

## ภาคผนวกที่ 4

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

ตรวจวัดคุณภาพสิ่งแวดล้อม

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง  
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
<b>คุณภาพอากาศในบรรยากาศ</b>		
Total Suspended Particulate (TSP)	High Volume Air Sampler No. B16, B24, B34	Digital Balance
Sulfur Dioxide (SO <sub>2</sub> )	Gas Sampler Box No. B03, B04, B10	Spectrophotometer
Nitrogen Dioxide (NO <sub>2</sub> )	NO <sub>2</sub> Analyzer No. B15, B16, B18	NO <sub>2</sub> Analyzer No. B15, B16, B18
Acetaldehyde	Flow Meter	GC/MS
1,4-Dioxane	Flow Meter	GC/MS
<b>คุณภาพอากาศจากปล่องระบาย</b>		
Particulate	Console No. B01, B05 Pitot Tube No. B04, B35	Digital Balance
Oxides of Nitrogen	Vacuum Gauge	Spectrophotometer
Carbon Monoxide	Personal Pump SKC No. B17, B74 Rotameter No. H-B08, B09	CO Analyzer No. B13
Sulfur Dioxide	Personal Pump SKC No. B05, B06 Rotameter No. H-B08, B09	Digital Balance
Total VOC	Personal Pump SKC No. B17, B74 Rotameter No. H-B08, B09	VOC Analyzer No. B02
Acetaldehyde	Personal Pump SKC No. B05, B06 Rotameter No. H-B08, B09	GC/FID
<b>ระดับเสียงในบรรยากาศ</b>		
L <sub>eq</sub> 24 hr, L <sub>max</sub> , L <sub>90</sub>	Acoustic Calibrator Sound Level Meter ACO No. B02, R17, R18, R19 CR-B02, B03	-
<b>คุณภาพน้ำผิวดิน</b>		
pH	-	pH Meter
Temperature	-	Liquid in Glass Thermometer
Total Suspended Solids	-	Digital Balance
BOD <sub>5</sub>	-	BOD Analyzer
COD	-	COD Reactor
Grease & Oil	-	Digital Balance

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง  
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
<b>คุณภาพน้ำทิ้ง</b>		
pH	-	pH Meter
Total Suspended Solids	-	Digital Balance
BOD <sub>5</sub>	-	BOD Analyzer
COD	-	COD Reactor
Grease & Oil	-	Digital Balance
<b>คุณภาพอากาศในสถานประกอบการ</b>		
ไอระเหย Ethylene Glycol (EG)	Personal Pump SKC No. B21, B48, Rotameter No. H-B06	GC/FID
ไอระเหย Acetaldehyde	Personal Pump SKC No. B44, B52, B54, B54, B68, B75, B84 Rotameter No. L- B06	GC/FID
<b>ระดับเสียงในสถานประกอบการ</b>		
Leq 8 hr	Acoustic Calibrator Sound Level Meter ACO No. B18, B29, B33, B36, B41, B43	-

คุณภาพอากาศในบรรยากาศ



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

### High Volume Air Sampler Calibration Report

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

#### Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft <sup>3</sup> /min)	R <sup>2</sup>
B01	B01	02/05/2025	$y = 1.180x - 4.939$	0.999
B02	B02	02/05/2025	$y = 1.156x - 3.058$	0.999
B03	B03	02/05/2025	$y = 1.139x - 4.505$	0.998
B04	B04	05/05/2025	$y = 1.168x - 4.342$	0.997
B05	B05	05/05/2025	$y = 1.181x - 7.813$	0.997
B06	B06	01/05/2025	$y = 1.185x - 4.081$	0.998
B07	B07	01/05/2025	$y = 1.173x - 5.069$	0.997
B08	B08	01/05/2025	$y = 1.141x - 3.533$	0.996
B09	B09	01/05/2025	$y = 1.163x - 3.805$	0.999
B10	B10	01/05/2025	$y = 1.079x - 2.229$	0.997
B11	B11	02/05/2025	$y = 1.169x - 3.130$	0.999
B12	B12	02/05/2025	$y = 1.173x - 3.515$	0.998
B13	B13	02/05/2025	$y = 1.187x - 4.231$	0.996
B14	B14	02/05/2025	$y = 1.157x - 4.001$	0.999
B15	B15	02/05/2025	$y = 1.093x - 2.530$	0.999
B16	B16	01/05/2025	$y = 1.168x - 5.027$	0.997
B17	B17	01/05/2025	$y = 1.149x - 3.125$	0.997
B18	B18	01/05/2025	$y = 1.120x - 1.685$	0.998
B19	B19	02/05/2025	$y = 1.166x - 4.175$	0.997
B20	B20	02/05/2025	$y = 1.107x - 0.981$	0.999
B21	B21	01/05/2025	$y = 1.184x - 6.199$	0.998
B22	B22	01/05/2025	$y = 1.162x - 2.993$	0.996
B23	B23	05/05/2025	$y = 1.155x - 2.556$	0.997
B24	B24	05/05/2025	$y = 1.158x - 4.429$	0.999
B25	B25	05/05/2025	$y = 1.127x - 1.558$	0.998
B26	B26	05/05/2025	$y = 1.137x - 3.875$	0.997
B27	B27	01/05/2025	$y = 1.185x - 6.360$	0.999
B28	B28	01/05/2025	$y = 1.180x - 6.028$	0.996
B29	B29	01/05/2025	$y = 1.148x - 2.869$	0.998
B30	B30	01/05/2025	$y = 1.125x - 0.258$	0.996
B31	B31	01/05/2025	$y = 1.154x - 4.528$	0.996
B32	B32	02/05/2025	$y = 1.179x - 4.299$	0.997
B33	B33	02/05/2025	$y = 1.144x - 1.976$	0.999
B34	B34	05/05/2025	$y = 1.135x - 0.204$	0.998

Calibrated by : [Redacted]



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### Gas Sampler Box Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Dry Cal DCL-ML

S/N : 136164

#### Calibration Data

Gas Sampler		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)	04/03/2025	200	199.6	199.4	200.3	200.2
B02	2 (A&B)	03/03/2025	200	199.8	199.7	200.4	200.3
B03	2 (A&B)	03/03/2025	200	200.3	200.2	200.6	200.5
B04	2 (A&B)	04/03/2025	200	199.9	199.8	200.5	200.4
B05	2 (A&B)	05/03/2025	200	199.8	199.7	200.4	200.3
B06	2 (A&B)	03/03/2025	200	200.5	200.4	200.3	200.2
B07	2 (A&B)	05/03/2025	200	200.3	200.2	199.9	199.8
B08	2 (A&B)	03/03/2025	200	200.4	200.3	200.7	200.6
B09	2 (A&B)	03/03/2025	200	199.9	199.8	200.4	200.3
B10	2 (A&B)	05/03/2025	200	199.7	199.6	200.5	200.4
B11	2 (A&B)	04/03/2025	200	200.4	200.2	200.7	200.6
B12	2 (A&B)	04/03/2025	200	200.2	200.1	200.4	200.3
B13	2 (A&B)	05/03/2025	200	199.9	199.8	200.7	200.6
B14	2 (A&B)	03/03/2025	200	200.8	200.7	200.2	200.1
B15	2 (A&B)	05/03/2025	200	200.3	200.2	199.7	199.6
B16	2 (A&B)	03/03/2025	200	200.2	200.1	199.9	199.8
B17	2 (A&B)	04/03/2025	200	199.7	199.6	200.5	200.4

Calibrated by : [Redacted]



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	25 May 2025	BRAND :	API	MODEL :	200A
NO.	NOX-B15	SERIAL NO.	213		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 05 August 2024		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: A007265V	
Certified Date	: 05 January 2023		Expired Date	: 05 January 2026	
			Cylinder Conc.	: 48.8 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
			% RH	50	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.9	-0.025	400.0	1.008
NO <sub>x</sub> Span	400	400.1	0.025	400.0	1.011
API Model 200A 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	506	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.3	mV	-20 - 150		
AZERO	94.0	mV	-20 - 150		
HVPS	674	V	420 - 900 constant		
RCELL TEMP	50.5	°C	50 ± 1		
BOX TEMP	29.1	°C	8 - 48		
PMT TEMP	7.3	°C	7 ± 2		
MOLY TEMP	314.8	°C	315 ± 5		
RCELL PRESS	8.2	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.4	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.008	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.011	-	1.0 ± 0.3		
NO Offset	1.5	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		



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	25 May 2025	BRAND :	API	MODEL :	200E
NO.	NOX-B16	SERIAL NO.	249		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 05 August 2024		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: A007265V	
Certified Date	: 05 January 2023		Expired Date	: 05 January 2026	
			Cylinder Conc.	: 48.8 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
			% RH	50	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.6	-0.100	400.0	1.004
NO <sub>x</sub> Span	400	399.9	-0.025	400.0	1.008
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	509	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.0	mV	-20 - 150		
AZERO	93.6	mV	-20 - 150		
HVPS	675	V	420 - 900 constant		
RCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.3	°C	8 - 48		
PMT TEMP	7.1	°C	7 ± 2		
MOLY TEMP	315.4	°C	315 ± 5		
RCELL PRESS	8.3	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.5	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.004	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.008	-	1.0 ± 0.3		
NO Offset	1.1	mV	-20 to +150		
NO <sub>x</sub> Offset	0.8	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		





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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	25 May 2025	BRAND :	API	MODEL :	TML-41M
NO.	NOX-B18	SERIAL NO.	N07543		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 05 August 2024		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: A00726SV	
Certified Date	: 05 January 2023		Expired Date	: 05 January 2026	
			Cylinder Conc.	: 48.8 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
			% RH	50	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
NO Span	400	399.8	-0.050	400.0	1.006
NO <sub>x</sub> Span	400	400.2	0.050	400.0	1.010
API Model TML-41M NO <sub>x</sub> Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	504	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.1	mV	-20 - 150		
AZERO	93.8	mV	-20 - 150		
HVPS	672	V	420 - 900 constant		
RCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	28.9	°C	8 ± 48		
PMT TEMP	7.2	°C	7 ± 2		
MOLY TEMP	314.9	°C	315 ± 5		
RCELL PRESS	8.4	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	1.006	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.010	-	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		



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## CALIBRATION CERTIFICATE

Page 1 of 4

Certificate No. : L202412119-0001

Date Issued : 13-Dec-24

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

**Equipment** : Mass Flow meter

**Manufacturer** : Dwyer

**Model** : GMF-2101

**Serial No.** : -

**ID No./Tag No.** : MF01/51

**Date Received** : 11-Dec-24

**Date Calibrated** : 12-Dec-24

**Calibrated by** : Saruth Srichutikul

### Calibration Method or Calibration Procedure Used

In-house method : CP-34 by comparison against mass flow calibrator.

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

### Result of Calibration

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

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App

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Certificate No. : L202412119-0001

**Ambient Temperature** :  $(25 \pm 2)^{\circ}\text{C}$

**Relative Humidity** :  $(50 \pm 15)\%\text{RH}$

**Capacity Range** : 17 ml/min

**Calibration Media** : Air

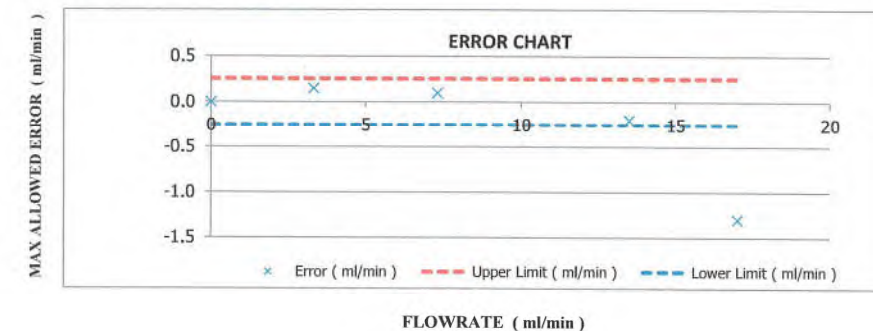
**Type** : Mass Flowmeter

**Unit Under Calibration Reference Condition** : Pressure 101.325 kPa(abs) ,  $21^{\circ}\text{C}$  , Nitrogen

### Before Adjustment

Temperature ( $^{\circ}\text{C}$ )	Pressure (kPa)	UUC Reading (ml/min)	STD Reading (ml/min)	Error (ml/min)	Uncertainty ( $\pm$ ml/min)
24.00	100.46	0.00	0.000 *	0.000	0.063
24.10	100.62	3.30	3.149	0.151	0.13
24.10	100.78	7.30	7.2	0.10	0.14
24.20	101.07	13.50	13.7	-0.20	0.15
24.20	101.30	17.00	18.3	-1.30	0.19

### Error = Unit Under Calibration - Standard





Certificate No. : L202412119-0001

Ambient Temperature : (25 ± 2)°C

Relative Humidity : (50 ± 15)%RH

Capacity Range : 17 ml/min

Calibration Media : Air

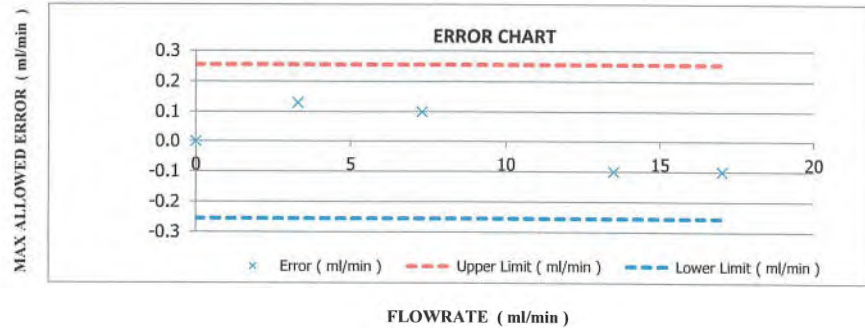
Type : Mass Flowmeter

Unit Under Calibration Reference Condition : Pressure 101.325 kPa(abs) , 21 °C , Nitrogen

## After Adjustment

Temperature ( ° C )	Pressure ( kPa )	UUC Reading ( ml/min )	STD Reading ( ml/min )	Error ( ml/min )	Uncertainty ( ± ml/min )
24.00	100.45	0.00	0.000 *	0.000	0.063
24.10	100.62	3.30	3.170	0.130	0.13
24.10	100.78	7.30	7.2	0.10	0.14
24.20	101.01	13.50	13.6	-0.10	0.15
24.00	101.19	17.00	17.1	-0.10	0.18

Error = Unit Under Calibration - Standard



Certificate No. : L202412119-0001

Note : The actual flow rate is determined by the equation :

$$Q_{Meas} = Q_{Ref} \times \frac{P_{Ref}}{P_{Meas}} \times \frac{T_{Meas}}{T_{Ref}}$$

; Q = Flow rate

; P = Absolute pressure

; T = Absolute temperature

; Subscript "Meas" = Measurement condition

; Subscript "Ref" = Reference condition

Condition As-Received : Used Item

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

## Traceability of Certificate :

The International System of Units (SI) through

NIMT Certificate No. MW-0047-24,MW-0048-24 for Gas Flow meter Serial No. M5209179B/M5209179A, Due 03-Jul-25

End of Certificate



CERTIFICATE No : 25M2254  
REFERENCE No : 76365-1

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE  
MANUFACTURER : METTLER TOLEDO  
MODEL : XS105DU  
SERIAL No : 1126422905  
ID No : BA05/50  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,  
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 07-Mar-25

APPROVED BY :

ISSUED DATE : 13-Mar-25

RECEIVED DATE : 07-Mar-25

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



CERTIFICATE No : 25M2254

PAGE : 2 OF 2

## Calibration Report

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

### CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.

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

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

- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

**RESULT OF CALIBRATION** :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 120 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.00	0.00000	0.00000	0.000065
0.02	0.01999	0.00001	0.000065
0.10	0.10001	-0.00001	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50002	-0.00002	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00002	-0.00002	0.000068
10.00	10.00000	0.00000	0.000070
20.00	20.00004	-0.00004	0.000078
50.00	50.00000	0.00000	0.00013
100.00	100.00001	-0.00001	0.00019
120.00	120.00002	-0.00002	0.00022

5. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT





Cert. No. : SP24020  
Pages 1 of 3

## Calibration Certificate

**Equipment :** UV-VIS SPECTROPHOTOMETER  
**Manufacturer :** PERKINELMER  
**Model :** LAMBDA 25  
**Serial No.:** 501S14123010  
**ID No.:** SP03/58  
**Calibration Mode :** WAVELENGTH ACCURACY  
PHOTOMETRIC ACCURACY

**Condition As Found :** GOOD

**Customer :** S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,  
CHOMPHON, CHATUCHAK,  
BANGKOK 10900, THAILAND.

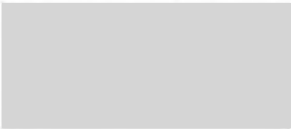
**Location :** WET CHEMISTRY LABORATORY IV

**Ambient Temperature :** ( 28.1 ± 5 ) °C  
**Relative Humidity :** ( 47.2 ± 25 ) %

**Received Date :** 27 AUGUST 2024  
**Calibration Date :** 27 AUGUST 2024  
**Date of Issue :** 27 AUGUST 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :



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.

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

### Calibration Method :

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

### Condition of this result of calibration :

1. Certified reference materials

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
Holmium liquid	RM-HL	29706	106864	01/11/2024
Didymium liquid	RM-DL	28912	106905	02/11/2024
Neutral density filter	RM-1N2N3N	13877	106918	03/11/2024
Potassium dichromate solutions	RM-0204060810	14204	106902	02/11/2024
Potassium Iodide solution	-	KI-0701-001	CI-0185-24	14/05/2026
2. This result of calibration was found accurate as shown on date and place of calibration only.
3. This certificate is traceable to the international system of unit maintained at :
  - 3.1 The UK National Physical Laboratory (NPL)
  - 3.2 The National Institute of Standards and Technology, NIST.

### Result of calibration : Wavelength Accuracy (Without adjustment)

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

UUC\* = Unit Under Calibration

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

451-451/h Sirinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand  
 Tel. +66 2433 8331 Email : calibration@sithiporn.com



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

**Result of calibration : Photometric Accuracy**

(Without adjustment)

Material	Wavelength (nm)	Filter S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0517	1.0550	0.0033	0.0029	2.00
		29914	0.7	0.7445	0.7460	0.0015	0.0029	2.00
		29381	0.5	0.5416	0.5431	0.0015	0.0030	2.00
	546.1	29360	1.0	0.9821	0.9820	-0.0001	0.0028	2.00
		29914	0.7	0.6961	0.6958	-0.0003	0.0028	2.00
		29381	0.5	0.5073	0.5080	0.0007	0.0029	2.00
	590.0	29360	1.0	1.0222	1.0210	-0.0012	0.0028	2.00
		29914	0.7	0.7237	0.7221	-0.0016	0.0029	2.00
		29381	0.5	0.5361	0.5361	0.0000	0.0031	2.00
	635.0	29360	1.0	0.9753	0.9745	-0.0008	0.0028	2.00
		29914	0.7	0.6910	0.6900	-0.0010	0.0029	2.00
		29381	0.5	0.5211	0.5210	-0.0001	0.0032	2.00
Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor	
RM-0204060810	235.0	20	0.2422		0.2418	-0.0004	0.0101	2.00
		40	0.4866		0.4852	-0.0014	0.0115	2.00
		60	0.7414		0.7389	-0.0025	0.0067	2.00
		80	0.9858		0.9842	-0.0016	0.0093	2.00
		100	1.2442		1.2414	-0.0028	0.0086	2.00

UUC\* = Unit Under Calibration

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

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

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

\*\*Specific Acceptance :

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

\*\*Stray light not TISI Accredited

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

End of Calibration Certificate



**GC Clarus 600/680 Preventive Maintenance (PM)**

Company Name:	S.P.S. Consulting Service Co.,Ltd		
Address (Instrument Location):	7 Soi Phaholyothin24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900.		
Serial Number:	680S14042502	Service Tag:	N68APSSFEMP
Customer Name (if applicable):	Ms.Naruecha	PM number :	1 of 2
Service Engineer Name:	Monchai Kitcharoenkeat	Service Order Number:	WO-
Date PM Performed: (DD-MMM-YYYY)	22-Feb-2025	Next PM Due Date: (DD-MMM-YYYY)	22-Aug-2025

Part Number	Release	Publication Date	PerkinElmer
TH09370070	C	August 2016	

**Scope**

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

**General Instructions:**

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

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## Component List

Component / Specific Model	Serial #	Software Version	Configuration Notes
Clarus680	680S14042502	Totalchrom6.3.2	PSS, PSS, FID,
Clarus SQ8T	648N4050804	Turbomass 6.4	
AtomX	US14113002	Tekma AtomX	

## Parts Lists

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

## Procedure Checklist

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

### 1. General:

☒ Review the instrument performance with the customer and document any recent problems.

☒ Check incoming AC line voltage for proper levels and grounding.  
 L-N 220 Volt  
 L-G 220 Volt  
 N-G 0.33 Volt

*\*Neutral to ground not more than 0.5 volts peak to peak*

☒ Inspect all gas line filters and traps; Replace if necessary with customer supplied spares.

Carrier gas ☒ Helium ☐ Nitrogen ☐ Hydrogen  
 Moisture level ☒ Good ☐ Need to replace ☐ Other \_\_\_\_\_

Detector gas ☒ Air Zero ☒ Hydrogen ☐ Nitrogen ☐ Helium  
 Moisture level ☒ Good ☐ Need to replace ☐ Other \_\_\_\_\_

☒ Inspect the customer log book and make any appropriate PM entries.

☒ Leak check all fittings from the gas source to instrument.  
 Gas leakage ☒ Pass ☐ Fail Comment \_\_\_\_\_

☒ Perform general inspection of system for cleanliness.

☒ Inspect for functional and clean electronic cooling and oven vent fans  
 Electronic cooling fan ☒ Yes ☐ No  
 Oven cooling fan ☒ Yes ☐ No

### 2. Electronic :

☒ Check oven temperature. Calibrate if necessary.  
 Oven temperature set point 150 °C ☒ Pass ☐ Fail

☐ Check sub-ambient option. (If installed).  
 Oven temperature set point 5 °C ☐ Pass ☐ Fail

☒ Perform routine maintenance on detector/injector. Replace parts as necessary with customer supplied spares.





- ☒ Check flows, including split flows if applicable. Calibrate if necessary.  
Carrier flow Pass  
Split flow Pass
- ☒ Check detector gas flows and adjust if necessary.  
Detector flow Pass
- ☒ Autosampler installed ☒ Yes ☐ No  
Check autosampler sensor for wear and replace if necessary.  
Vial sensor Pass  
Door sensor Pass  
Tower sensor Pass  
Plunger sensor Pass  
Elevator sensor Pass
- ☒ Remove syringe, manually flush. Replace with customer supplied spare if necessary.
- ☒ Check firmware version. Upgrade to current levels if necessary.  
Firmware version 6.5
- ☒ Measure all accessible power supply voltages.  
5 Volt Pass  
+15 Volt Pass  
-15 Volt Pass  
24 Volt Pass
- ☒ Record all detector voltage signal.  
Detector Channel A 1.12 mV.  
Detector Channel B NA mV.

### 3. Diagnostics Tests:

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

### 4. Review:

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



## Additional Comments

Additional Comments Regarding the PM

## Review

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

คุณภาพอากาศจากปล่องระบาย



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด  
S.P.S. CONSULTING SERVICE CO., LTD.  
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร 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

### Console Calibration Report

Calibration Method

Critical Orifices

#### Calibration Data

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

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

Accept Value of DH<sub>g</sub> (test) is  $46.7 \pm 6.4$  (mmH<sub>2</sub>O)

Calibrated by



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด  
S.P.S. CONSULTING SERVICE CO., LTD.  
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร 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

### Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

#### Calibration Data

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

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

Calibrated by :



# 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[64-220088-1]  
CLID. NO. : 212301419  
JOB CONTROL NO. : 240720076545  
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 20 July 2024

DATE OF ISSUED : 23 July 2024

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

Calibrated By : Sittipong Pimdee  
Calibration Engineer

Approved By :



Authorized Signatory  
23 July 2024



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. Q24076545

F3-011-05/12-23

page 1 of 3



@ckcalibration



# CALIBRATION LABORATORY Co.,LTD.

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



## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : VACUUM GAUGE  
MANUFACTURER : HI-LIGHT  
MODEL / TYPE : N/A  
SERIAL NO. : N/A[64-220088-1]  
DATE OF CALIBRATION : 22 July 2024  
DUE DATE OF CALIBRATION : 22 July 2025

#### ENVIRONMENT CONDITIONS :

Temperature : ( 23 ± 2 ) °C

Relative Humidity : ( 55 ± 10 ) %RH

#### PROCEDURE USED :

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

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

#### REFERENCE STANDARD USED :

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

#### TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).  
Certificate No. MP-0040-24, Due Date 08 February 2025.

#### 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. Q24076545

F3-011-05/12-23

page 2 of 3



@ckcalibration



# 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.cai-laboratory.com E-mail:sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment

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

## CALIBRATION DATA

### CORRECTION OF PRESSURE

DUC Test point ( inHg )	STD Reading ( kPa )		Conversion to inHg		Correction ( inHg )	
	Up	Down	Up	Down	Up	Down
0	0.00	0.00	0.0	0.0	0.0	0.0
-5	-15.58	-15.58	-4.6	-4.6	+0.4	+0.4
-10	-32.51	-32.84	-9.6	-9.7	+0.4	+0.3
-15	-49.44	-49.77	-14.6	-14.7	+0.4	+0.3
-20	-66.70	-66.70	-19.7	-19.7	+0.3	+0.3
-25	-83.63	-83.97	-24.7	-24.8	+0.3	+0.2
-30	-100.90	-100.90	-29.8	-29.8	+0.2	+0.2

Uncertainty of measurement  $\pm 0.2$  inHg

Transmitting fluid : Air.

Technical Note. Conversion factor 1 kPa ; 0.2953003 inHg

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 43 of 67

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

### End of Certificate ###

Certificate No. Q24076545

F3-011-05/12-23

page 3 of 3



@clccalibration





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

### Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

#### Environmental Conditions

Temperature 25 ± 3 °C  
Pressure 1010 ± 15 mmbar

#### Personal Pump Data

#### Calibration Data

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R <sup>2</sup>
B01	SKC	224-PCXR4	262101	01/04/2025	1,000	1,500	2,000	998	1,494	2,002	1.001x - 3.194	1.000
B02	SKC	224-PCXR4	626166	01/04/2025	1,000	1,500	2,000	995	1,508	2,003	1.008x - 12.605	1.000
B03	SKC	224-PCXR4	612968	03/04/2025	1,000	1,500	2,000	1,003	1,502	2,006	1.006x - 7.796	1.000
B04	SKC	224-PCXR4	602804	03/04/2025	1,000	1,500	2,000	1,001	1,499	2,013	1.004x - 7.060	0.999
B05	SKC	224-PCXR4	612693	03/04/2025	1,000	1,500	2,000	1,004	1,498	2,007	1.003x - 2.455	1.000
B06	SKC	224-PCXR4	262188	03/04/2025	1,000	1,500	2,000	1,003	1,512	2,004	1.000x + 0.696	1.000
B07	SKC	224-PCXR4	626263	03/04/2025	1,000	1,500	2,000	1,012	1,504	1,996	0.994x + 10.330	0.999
B08	SKC	224-PCXR4	626100	02/04/2025	1,000	1,500	2,000	996	1,511	2,007	1.010x - 14.048	1.000
B09	SKC	224-PCXR4	626479	03/04/2025	1,000	1,500	2,000	999	1,510	2,003	1.003x - 4.677	1.000
B10	SKC	224-PCXR4	091950	03/04/2025	1,000	1,500	2,000	1,002	1,498	2,004	1.004x - 6.544	1.000
B11	SKC	224-PCXR4	564315	04/04/2025	1,000	1,500	2,000	1,013	1,505	2,010	1.002x + 2.171	1.000
B12	SKC	224-PCXR4	034656	04/04/2025	1,000	1,500	2,000	1,004	1,506	2,009	1.008x - 9.391	1.000
B13	SKC	224-PCXR4	602073	03/04/2025	1,000	1,500	2,000	1,001	1,497	2,012	1.009x - 9.443	1.000
B14	SKC	224-PCXR4	626313	03/04/2025	1,000	1,500	2,000	1,004	1,515	1,997	1.002x - 1.273	0.999
B15	SKC	224-PCXR4	626474	03/04/2025	1,000	1,500	2,000	999	1,497	1,996	1.000x + 2.511	1.000
B16	SKC	224-PCXR4	626477	03/04/2025	1,000	1,500	2,000	1,012	1,504	2,007	0.997x + 8.160	1.000
B17	SKC	224-PCXR4	626860	01/04/2025	1,000	1,500	2,000	997	1,506	1,999	1.001x - 1.435	1.000
B18	SKC	224-PCXR4	692484	02/04/2025	1,000	1,500	2,000	1,007	1,493	2,005	0.996x + 4.350	1.000
B19	SKC	224-PCXR4	691599	03/04/2025	1,000	1,500	2,000	1,004	1,513	2,001	1.003x - 2.043	1.000
B20	SKC	224-PCXR4	691587	03/04/2025	1,000	1,500	2,000	999	1,504	1,998	0.995x + 0.556	1.000
B21	SKC	224-PCXR4	691531	03/04/2025	1,000	1,500	2,000	1,004	1,499	1,997	1.001x - 7.572	0.999
B22	SKC	224-PCXR4	691654	04/04/2025	1,000	1,500	2,000	1,008	1,504	2,006	1.005x - 4.941	1.000
B23	SKC	224-PCXR4	798393	04/04/2025	1,000	1,500	2,000	995	1,499	1,998	1.002x - 4.953	1.000
B24	SKC	224-PCXR4	626363	04/04/2025	1,000	1,500	2,000	1,002	1,501	1,996	0.999x - 1.539	1.000
B25	SKC	224-PCXR4	798489	04/04/2025	1,000	1,500	2,000	1,010	1,515	2,001	0.990x + 16.203	0.999
B26	SKC	224-PCXR4	798479	03/04/2025	1,000	1,500	2,000	999	1,492	1,999	0.998x - 0.596	1.000
B27	SKC	224-PCXR4	691673	03/04/2025	1,000	1,500	2,000	996	1,498	2,002	1.004x - 6.496	1.000
B28	SKC	224-PCXR4	691570	03/04/2025	1,000	1,500	2,000	1,004	1,499	1,994	0.993x + 8.068	1.000
B29	SKC	224-PCXR4	626472	03/04/2025	1,000	1,500	2,000	1,001	1,501	1,996	0.994x + 9.367	1.000
B30	SKC	224-PCXR4	691489	01/04/2025	1,000	1,500	2,000	994	1,507	2,003	1.005x - 12.489	1.000
B31	SKC	224-PCXR4	691509	02/04/2025	1,000	1,500	2,000	1,010	1,509	2,000	1.003x - 3.858	0.999
B32	SKC	224-PCXR4	091567	02/04/2025	1,000	1,500	2,000	996	1,497	1,997	0.998x - 0.764	1.000
B33	SKC	224-PCXR4	091756	03/04/2025	1,000	1,500	2,000	998	1,508	2,006	1.007x - 13.941	0.999
B34	SKC	224-PCXR4	612962	03/04/2025	1,000	1,500	2,000	1,004	1,494	1,995	0.993x + 8.471	1.000
B35	SKC	224-PCXR4	602682	03/04/2025	1,000	1,500	2,000	999	1,491	2,001	1.000x - 2.275	1.000
B36	SKC	224-PCXR4	626164	03/04/2025	1,000	1,500	2,000	1,004	1,499	1,997	0.993x + 5.109	1.000
B37	SKC	224-PCXR4	626256	03/04/2025	1,000	1,500	2,000	998	1,503	1,996	0.996x + 5.729	1.000
B38	SKC	224-PCXR4	626167	03/04/2025	1,000	1,500	2,000	996	1,509	2,004	1.008x - 15.248	0.999
B39	SKC	224-PCXR4	031653	02/04/2025	1,000	1,500	2,000	1,006	1,505	2,010	1.011x - 15.064	0.999
B40	SKC	224-PCXR4	262166	02/04/2025	1,000	1,500	2,000	1,006	1,505	2,010	1.011x - 15.064	0.999

Calibrated 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 ± 3 °C  
Pressure 1010 ± 15 mmbar

#### Personal Pump Data

#### Calibration Data

Personal Pump Data					Calibration Data							
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R <sup>2</sup>
B41	SKC	224-PCXR4	612669	03/04/2025	1,000	1,500	2,000	1,005	1,502	2,004	1.005x - 8.923	1.000
B42	SKC	224-PCXR4	626041	03/04/2025	1,000	1,500	2,000	1,004	1,501	2,008	1.006x - 13.856	1.000
B43	SKC	224-PCXR4	034656	01/04/2025	1,000	1,500	2,000	1,012	1,497	1,996	0.990x + 15.132	1.000
B44	SKC	224-PCXR8	329341	01/04/2025	1,000	1,500	2,000	1,011	1,511	2,008	1.002x - 0.860	0.999
B45	SKC	224-PCXR8	329594	04/04/2025	1,000	1,500	2,000	993	1,512	2,003	1.009x + 14.476	1.000
B46	SKC	224-PCXR8	566743	04/04/2025	1,000	1,500	2,000	1,008	1,508	2,008	1.000x - 0.100	0.999
B47	SKC	224-PCXR8	566747	04/04/2025	1,000	1,500	2,000	999	1,510	2,010	1.010x - 14.444	1.000
B48	SKC	224-PCXR8	566753	01/04/2025	1,000	1,500	2,000	1,010	1,506	2,006	0.999x + 2.782	1.000
B49	SKC	224-PCXR8	566780	04/04/2025	1,000	1,500	2,000	1,003	1,504	2,004	1.003x - 2.183	1.000
B50	SKC	224-PCXR8	500400	04/04/2025	1,000	1,500	2,000	1,002	1,493	1,995	0.994x + 5.841	1.000
B51	SKC	224-PCXR8	500363	04/04/2025	1,000	1,500	2,000	998	1,511	2,011	1.013x - 19.463	0.999
B52	SKC	224-PCXR8	093186	02/04/2025	1,000	1,500	2,000	997	1,505	2,006	1.008x - 12.641	1.000
B53	SKC	224-PCXR8	707670	02/04/2025	1,000	1,500	2,000	1,004	1,503	2,007	1.007x - 7.992	1.000
B54	SKC	224-PCXR3	509821	02/04/2025	1,000	1,500	2,000	1,005	1,504	2,008	1.010x - 15.060	0.999
B55	SKC	224-PCXR3	510710	02/04/2025	1,000	1,500	2,000	1,001	1,495	1,997	0.996x + 5.073	1.000
B56	SKC	224-PCXR3	511450	02/04/2025	1,000	1,500	2,000	1,005	1,494	1,996	0.991x + 13.385	1.000
B57	SKC	224-PCXR3	510798	03/04/2025	1,000	1,500	2,000	997	1,511	2,009	1.016x - 21.548	0.999
B58	SKC	224-PCXR3	509852	03/04/2025	1,000	1,500	2,000	1,006	1,493	2,002	1.007x - 4.694	1.000
B59	SKC	224-PCXR3	509866	03/04/2025	1,000	1,500	2,000	995	1,502	2,003	1.012x - 21.564	1.000
B60	SKC	224-PCXR3	512655	03/04/2025	1,000	1,500	2,000	998	1,507	2,004	1.010x - 18.510	0.999
B61	SKC	224-PCXR3	503915	03/04/2025	1,000	1,500	2,000	997	1,499	2,001	1.002x - 4.374	1.000
B62	SKC	224-PCXR3	505975	01/04/2025	1,000	1,500	2,000	1,002	1,503	2,005	1.008x - 11.138	1.000
B63	SKC	224-PCXR3	511432	04/04/2025	1,000	1,500	2,000	998	1,502	1,996	0.996x + 5.970	1.000
B64	SKC	224-PCXR3	508302	04/04/2025	1,000	1,500	2,000	1,005	1,509	2,008	1.009x - 10.402	1.000
B65	SKC	224-PCXR3	508310	04/04/2025	1,000	1,500	2,000	1,004	1,503	2,007	1.010x - 14.088	1.000
B66	SKC	224-PCXR3	509661	04/04/2025	1,000	1,500	2,000	1,003	1,504	2,010	1.008x - 12.369	1.000
B67	SKC	224-PCXR3	506295	04/04/2025	1,000	1,500	2,000	1,002	1,498	2,004	0.998x + 4.290	1.000
B68	SKC	224-PCXR3	505872	04/04/2025	1,000	1,500	2,000	999	1,504	1,998	1.000x + 0.436	1.000
B69	SKC	224-PCXR3	508375	02/04/2025	1,000	1,500	2,000	1,004	1,498	2,002	0.996x + 5.501	1.000
B70	SKC	224-PCXR3	510623	02/04/2025	1,000	1,500	2,000	998	1,497	2,005	1.005x - 8.735	1.000
B71	SKC	224-PCXR3	508367	02/04/2025	1,000	1,500	2,000	1,013	1,505	2,009	1.009x + 9.294	0.999
B72	SKC	224-PCXR3	505977	02/04/2025	1,000	1,500	2,000	997	1,494	2,001	1.006x - 11.330	1.000
B73	SKC	228-PCXR3	512606	01/04/2025	1,000	1,500	2,000	1,010	1,507	2,004	0.998x + 5.129	1.000
B74	SKC	224-PCXR3	505993	01/04/2025	1,000	1,500	2,000	998	1,499	2,010	1.009x - 11.942	1.000
B75	SKC	224-PCXR3	509820	01/04/2025	1,000	1,500	2,000	995	1,511	2,004	1.011x - 18.966	0.999
B76	SKC	224-PCXR3	509811	01/04/2025	1,000	1,500	2,000	999	1,504	2,010	1.012x - 20.893	0.999
B77	SKC	224-PCXR3	508301	03/04/2025	1,000	1,500	2,000	1,007	1,509	2,008	1.001x + 3.750	1.000
B78	SKC	224-PCXR3	510677	04/04/2025	1,000	1,500	2,000	998	1,508	2,001	1.003x - 3.276	1.000
B79	SKC	224-PCXR3	511433	04/04/2025	1,000	1,500	2,000	993	1,501	1,998	0.999x - 1.619	1.000



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Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R <sup>2</sup>
H-801	Dwyer	VFB-65	01/04/2025	500	1,000	2,000	499.1	997.5	1996.2	0.992x + 10.557	1.000
H-802	Dwyer	VFB-65	03/04/2025	500	1,000	2,000	501.5	996.9	2004.4	1.002x - 0.966	1.000
H-803	Dwyer	VFB-65	03/04/2025	500	1,000	2,000	498.9	997.4	1996.5	0.997x - 0.674	1.000
H-804	Dwyer	VFB-65	01/04/2025	500	1,000	2,000	498.0	996.5	2007.8	1.001x - 6.142	0.999
H-805	Dwyer	VFB-65	02/04/2025	500	1,000	2,000	501.2	998.6	1993.7	0.996x + 6.199	1.000
H-806	Dwyer	VFB-65	03/04/2025	500	1,000	2,000	499.7	995.3	1989.1	0.995x + 1.374	0.999
H-807	Dwyer	VFB-65	03/04/2025	500	1,000	2,000	500.1	999.7	2006.4	0.998x + 1.014	1.000
H-808	Dwyer	VFB-65	01/04/2025	500	1,000	2,000	499.8	997.4	1994.8	0.993x + 6.689	1.000
H-809	Dwyer	VFB-65	04/04/2025	500	1,000	2,000	498.2	997.1	2005.6	0.999x + 0.065	0.999
H-810	Dwyer	VFB-65									

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





CERTIFICATE No : 25M2254  
REFERENCE No : 76365-1

PAGE : 1 OF 2

### Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE  
MANUFACTURER : METTLER TOLEDO  
MODEL : XS105DU  
SERIAL No : 1126422905  
ID No : BA05/50  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,  
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 07-Mar-25

APPROVED BY :

ISSUED DATE : 13-Mar-25

RECEIVED DATE : 07-Mar-25

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



CERTIFICATE No : 25M2254

PAGE : 2 OF 2

### Calibration Report

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

#### CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.

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

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

- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

**RESULT OF CALIBRATION** :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 120 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.00	0.00000	0.00000	0.000065
0.02	0.01999	0.00001	0.000065
0.10	0.10001	-0.00001	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50002	-0.00002	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00002	-0.00002	0.000068
10.00	10.00000	0.00000	0.000070
20.00	20.00004	-0.00004	0.000078
50.00	50.00000	0.00000	0.00013
100.00	100.00001	-0.00001	0.00019
120.00	120.00002	-0.00002	0.00022

5. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT





Cert. No. : SP24020  
Pages 1 of 3

## Calibration Certificate

**Equipment :** UV-VIS SPECTROPHOTOMETER  
**Manufacturer :** PERKINELMER  
**Model :** LAMBDA 25  
**Serial No.:** 501S14123010  
**ID No.:** SP03/58  
**Calibration Mode :** WAVELENGTH ACCURACY  
PHOTOMETRIC ACCURACY

**Condition As Found :** GOOD

**Customer :** S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,  
CHOMPHON, CHATUCHAK,  
BANGKOK 10900, THAILAND.

**Location :** WET CHEMISTRY LABORATORY IV

**Ambient Temperature :** ( 28.1 ± 5 ) °C  
**Relative Humidity :** ( 47.2 ± 25 ) %

**Received Date :** 27 AUGUST 2024  
**Calibration Date :** 27 AUGUST 2024  
**Date of Issue :** 27 AUGUST 2024

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

This certificate is issued in accordance with the requirement  
other than in full, except with the prior written approval of the head of Calibration Laboratory.

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

### Calibration Method :

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

### Condition of this result of calibration :

1. Certified reference materials

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
Holmium liquid	RM-HL	29706	106864	01/11/2024
Didymium liquid	RM-DL	28912	106905	02/11/2024
Neutral density filter	RM-1N2N3N	13877	106918	03/11/2024
Potassium dichromate solutions	RM-0204060810	14204	106902	02/11/2024
Potassium Iodide solution	-	KI-0701-001	CI-0185-24	14/05/2026
2. This result of calibration was found accurate as shown on date and place of calibration only.
3. This certificate is traceable to the international system of unit maintained at :
  - 3.1 The UK National Physical Laboratory (NPL)
  - 3.2 The National Institute of Standards and Technology, NIST.

### Result of calibration : Wavelength Accuracy (Without adjustment)

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

UUC\* = Unit Under Calibration

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand  
 Tel. +66 2433 8331 Email : calibration@sithiporn.com

SITHIPORN  
 associates



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

**Result of calibration : Photometric Accuracy**

(Without adjustment)

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

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

UUC\* = Unit Under Calibration

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

Resolution of Wavelength Mode 0.1 nm

Resolution of Photometric Mode 0.0001 A

Parameter Setting

Measurement Mode Wavelength, Absorbance

Wavelength Scan 1100 nm-190 nm

Scanning Speed 7.5 nm/min

Data Pitch 0.1 nm

Band width(Wavelength) 1.0 nm

Band width(Vis) 1.0 nm

Band width(Uv) 1.0 nm

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

\*\*Specific Acceptance :

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

\*\*Stray light not TISI Accredited

The reported uncertainty is based on a standard uncertainty multiplied providing a level of confidence of approximately 95%

End of Calibration Certificate





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S.P.S. CONSULTING SERVICE CO., LTD.  
7 ซอยพหลโยธิน 24 แขวงพหลโยธิน เขตพญาไท กรุงเทพมหานคร 10600  
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompet, Chatuchak, Bangkok 10600  
Tel : (662) 939-4370-72, Fax : (662) 513-4321, E-mail : sales@spscn.com, www.spscn.com

Calibration Report			
Non-Dispersive Infrared CO Analyzer			
Date :	05 May 2025	Brand :	API
No. :	CO-813	Model :	300E
		Serial No. :	176
Calibrator (Dilution System)			
Brand :	Teledyne	Model :	700E
Last Cal. Date :	28 October 2024	Serial No. :	201-5
Reference Standard Gas			
Standard Gas :	Carbon Monoxide (CO)	Cylinder No. :	0711839
Certified Date :	14 March 2024	Expired Date :	14 March 2032
		Cylinder Conc. :	4.580 ppm
Calibrating Condition			
Pressure :	1011 mmbar	Temp. :	24.6 °C
		% RH :	50
Calibration Setting			
Span	Initial Reading (Before Adj.) PPM		Final Reading (After Adj.) PPM
Set Point	Expected Concentration	Analyzer Response	%Diff
Zero	0	-0.10	-
CO Span	40.00	39.95	-0.125
API Model 300E CO Analyzer Check List			
Parameter	Observed Value	Units	Nominal Range
Range	50	PPM	0-1000 ppm
Stability	0.10	PPM	± 1 ppm With Zero Air
CO Measure	4016.6	mV	2500-4800 mV
CO Reference	3948.5	mV	2500-4800 mV
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air
Sample Pressure	28.6	in-Hg-A	-2" ± Ambient Absolute Pressure
Sample Flow	812	CC/Min	800 ± 10%
Sample Temperature	48.3	°C	48 ± 4
Bench Temperature	48.0	°C	48 ± 2
Wheel Temperature	68.4	°C	48 ± 2
Box Temperature	30.8	°C	Ambient Temp ± 7 ± 10
Photo-Drive	3036.1	mV	250 mV to 4750 mV
Slope	1.017	-	1.0 ± 0.3
Offset	0.2	-	0 ± 0.3

Calibrated by :



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S.P.S. CONSULTING SERVICE CO., LTD.  
7 ซอยพหลโยธิน 24 แขวงพหลโยธิน เขตพญาไท กรุงเทพมหานคร 10600  
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompet, Chatuchak, Bangkok 10600  
Tel : (662) 939-4370-72, Fax : (662) 513-4321, E-mail : sales@spscn.com, www.spscn.com

Calibration Report			
Photo-Ionization Detector VOC Analyzer			
Date :	02 May 2025	Brand :	Mini RAE System
No. :	B02	Model :	Mini RAE 3000
		Serial No. :	592-917802
Reference Standard Gas			
Standard Gas :	Isobutylene (C <sub>4</sub> H <sub>8</sub> )	Cylinder No. :	1496584
Certified Date :	24 June 2021	Expired Date :	7 January 2026
		Cylinder Conc. :	100 ppm
Calibrating Condition			
Pressure :	1011 mmbar	Temp. :	24.6 °C
		% RH :	50
Calibration Setting			
Span Set Point	Initial Reading (Before Adj.) PPM		Final Reading (After Adj.) PPM
	Expected Concentration	Analyzer Response	%Diff
Zero (Fresh Air)	0	0.1	-
VOC Span (Isobutylene)	100	99.6	-0.40

Calibrated by :



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THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200  
80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

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

### GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0824/22063

Instrument Type : Gas Chromatography

Model : CP-3800

Serial Number : 00734

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

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

Date : 05/08/2024

#### ELECTRONIC TEST

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

#### RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector ( FID Channel Front)

INJECTOR : Capillary Injector Model 1079

#### GC CONDITION:

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

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

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

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



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

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

#### Detector Sensitivity ( FID )

Detector Response	Result	Specification
Baseline Noise (µV)	2.85	≤ 50
Baseline Drift (%)	0.09	≤ 1
Sensitivity ( S/N for C15)	16,400	≥ 1,024

#### Temperature Specification

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

#### Relative Standard Deviation % ( % RSD)

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

APPROVAL :

Signature:

Engineer : Suwarot Trikanut

Date : 05/08/2024



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

#### Results Integrated System Testing

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

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

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

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

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by		
Date		



Comments	
Reviewed by	



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

#### Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 RT 1	4.128
C15 RT 2	4.128
C15 RT 3	4.128
C15 RT 4	4.128
C15 RT 5	4.128
C15 RT Average	4.128
* % RSD ( < 0.5 % )	0

\* The precision specification should be less than 0.5 % RSD \*\* ( Relative Standard Deviation ) for an Auto sampler injection and less than 0.5 % for Manual injections. To calculate the %RSD, select the RT C15 peak for each of the five ( 5 ) samples.

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

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

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by		
Date		



Comments	
Reviewed by	



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1/1

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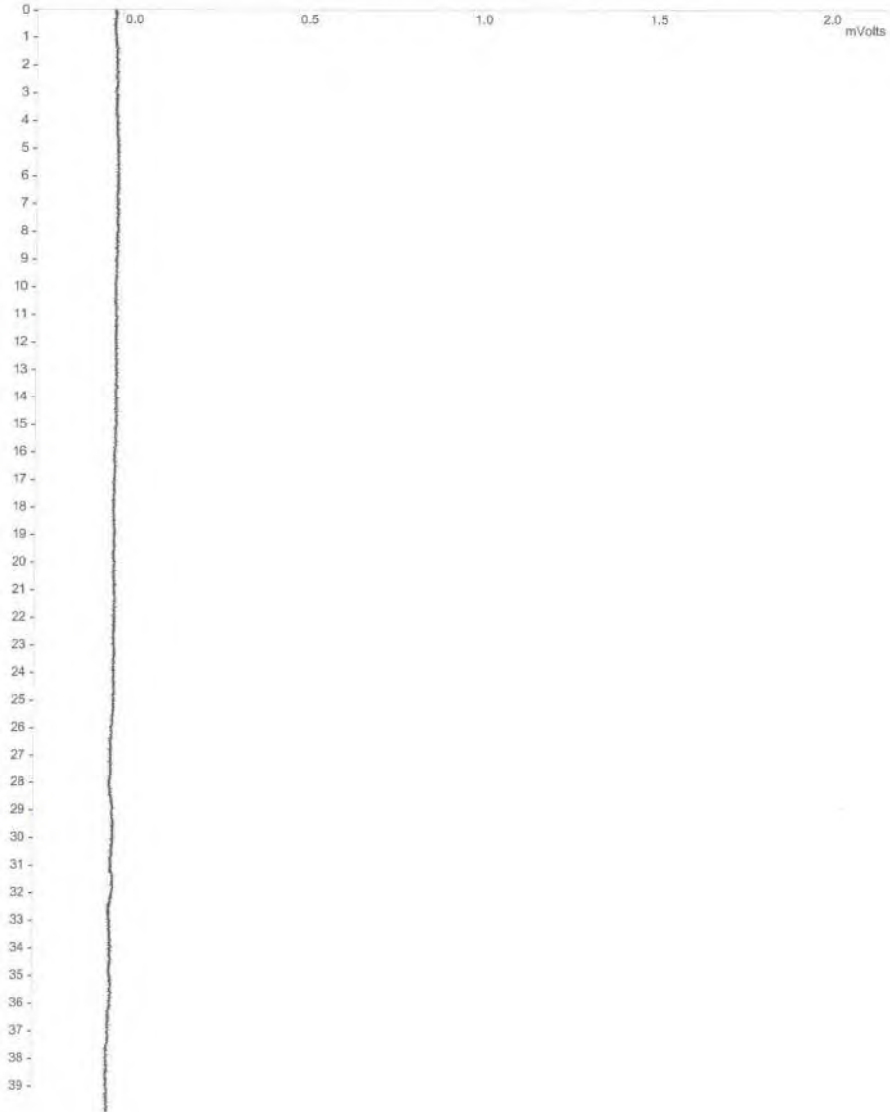
Title :  
Run File : f:\sps2024\cal2024\baseline2024002.run  
Method File : D:\Method-GC\star C\Star\TU\cal0203\baseline FID.mth  
Sample ID : Baseline2024

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

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

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

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



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

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

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

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

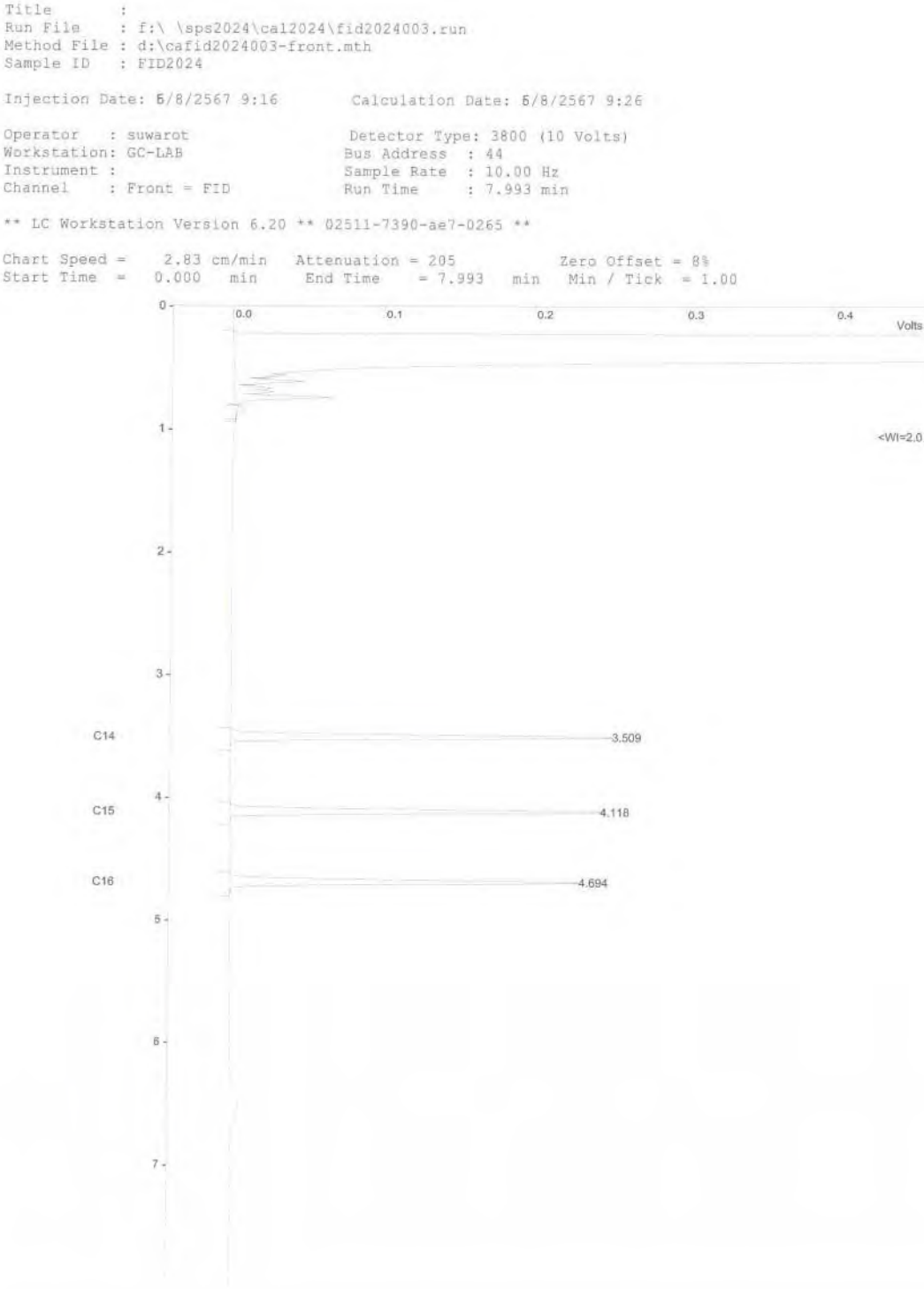
Run Mode : Analysis  
Peak Measurement: Peak Area  
Calculation Type: External Standard

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

Total Unidentified Counts : 0 counts  
Detected Peaks: 0      Rejected Peaks: 0      Identified Peaks: 0  
Multiplier: 1      Divisor: 1      Unidentified Peak Factor: 0  
Baseline Offset: -16 microVolts      LSB: 1 microVolts  
Noise (used): 22 microVolts - monitored before this run  
Manual injection  
Data Handling: No peaks

\*\*\*\*\*





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

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

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

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

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

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

Peak No.	Peak Name	Result ( )	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	C14	54.1202	3.509	-0.005	163565	BB	2.1	C
2	C15	53.5241	4.118	-0.005	157309	BB	2.2	C
3	C16	52.2361	4.694	0.001	146804	BB	2.3	C
Totals:		159.8804		-0.009	1704289			

Status Codes:  
C - Out of calibration range

Total Unidentified Counts : 69332200 counts

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

Multiplier: 1      Divisor: 1      Unidentified Peak Factor: 0

Baseline Offset: -29 microVolts      LSB: 1 microVolts

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

Manual injection

Calib. out of range; No Recovery Action Specified

\*\*\*\*\*



Sample ID: fid std

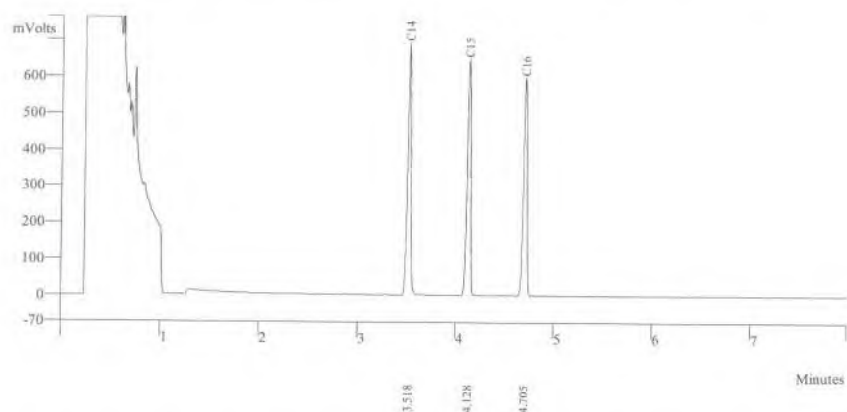
Operator (Inj): suwarot  
Injection Date: 05/08/2024  
Calc Date: 05/08/2024  
Run Time (min): 7.993  
Workstation: GC-LAB  
Instrument (Inj):



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

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

A = FID 10 V RESULTS



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



Sample ID: fid std

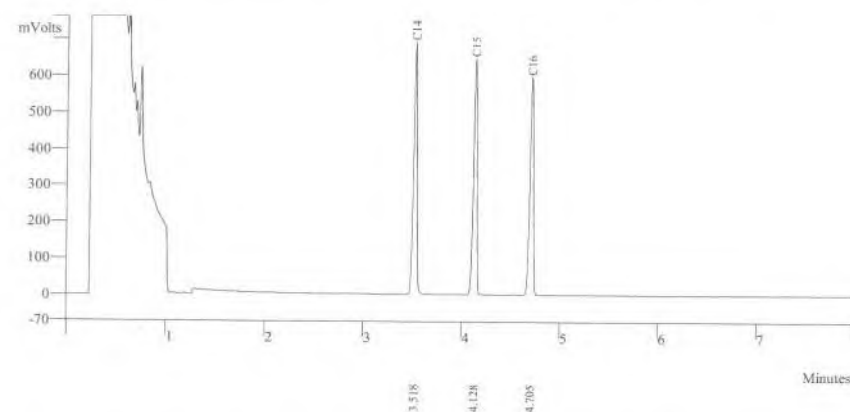
Operator (Inj): suwarot  
Injection Date: 05/08/2024  
Calc Date: 05/08/2024  
Run Time (min): 7.993  
Workstation: GC-LAB  
Instrument (Inj):



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

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

A = FID 10 V RESULTS



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



Sample ID: fid std

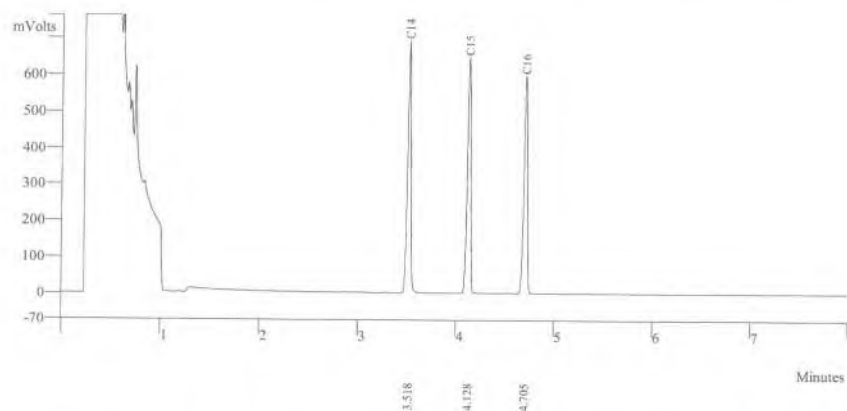
Operator (Inj): suwarot  
Injection Date: 05/08/2024  
Calc Date: 05/08/2024  
Run Time (min): 7.993  
Workstation: GC-LAB  
Instrument (Inj):



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

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

A = FID 10 V RESULTS



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



Sample ID: fid std

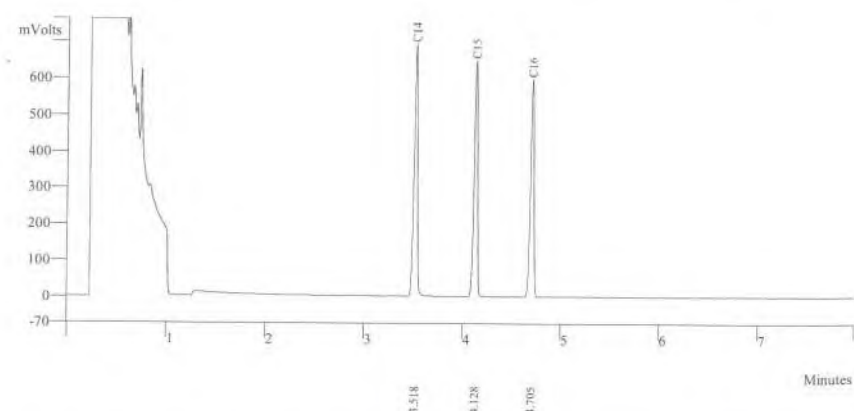
Operator (Inj): suwarot  
Injection Date: 05/08/2024  
Calc Date: 05/08/2024  
Run Time (min): 7.993  
Workstation: GC-LAB  
Instrument (Inj):



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

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

A = FID 10 V RESULTS



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



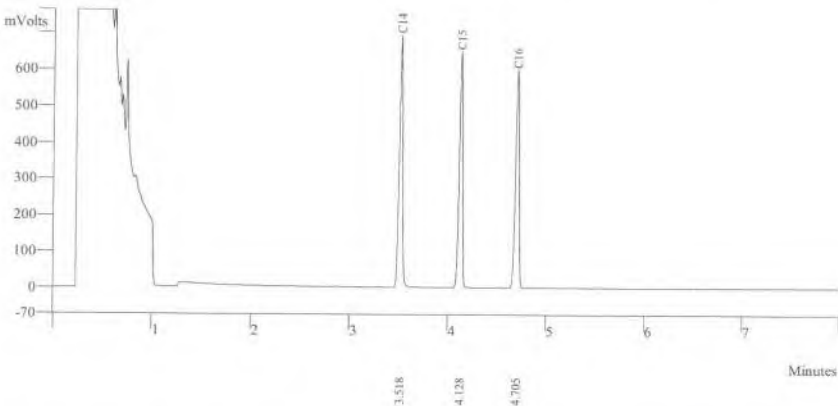
Sample ID: fid std

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

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

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

A = FID 10 V RESULTS



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



Agilent Technologies

Certificate of Analysis

FID-TCD Performance Evaluation Sample Kit

Agilent Part Number: 5080-8842, 18710-60170

Sample Lot Number: 0006750304

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

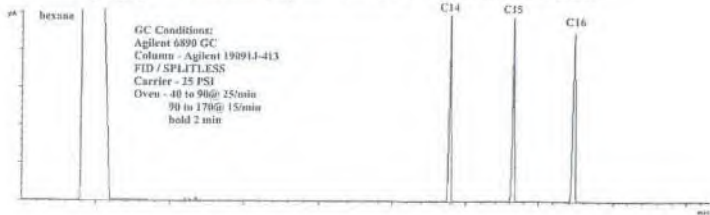
Concentrations:		
n-tetradecane	0.218 g/L (± 0.5%)	0.033 w/w %
n-pentadecane	0.218 g/L (± 0.5%)	0.033 w/w %
n-hexadecane	0.218 g/L (± 0.5%)	0.033 w/w %

Solvent: hexane

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

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

Typical Analytical Spectrum or Chromatography  
GC Chromatography – n-tetradecane, n-pentadecane, and n-hexadecane in hexane



Date of release: 30 June 2023  
Date of expiration: 31 July 2025



## Certificate of Calibration

Certificate No.: WK2312-031-1

Page 1 of 2

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

Instrument	: AMD Flow Meter	Ambient Temperature	: (23 ± 2) °C
Manufacturer	: Agilent Technologies	Humidity	: (50 ± 15) %RH
Model	: G6691A	Received Date	: 6-Dec-23
Serial No.	: MY16470347	Calibrated Date	: 7-Dec-23
Identity No.	: SV-DF-001	Issued Date	: 12-Dec-23
Range	: 0 ml/min to 750 ml/min	Calibrated Location	: In Lab
Resolution	: See to data		
Calibration Method	: CP-WK-M10		

Reference standard instruments :

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

MIT : Miracle International Technology Co.,Ltd.

This result calibrate was found accurate as shown on date place of calibrate only

This certificate is traceability to the International System of Unit (SI)

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

Calibrated by : Mr.Taywanat Hansuwankul

Approved by :

Authorized Signatory

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## Calibration Results

Certificate No. : WK2312-031-1

Page 2 of 2

Calibration Result of the Accuracy

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

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

(X) Without Adjustment ( ) After Adjustment

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\*\*\*\* End of Certificate\*\*\*\*





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



## Certificate of Calibration

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

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

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

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

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



Certificate No. : LF24-0278

Model : 51

Serial No. : 5910857

Page 1 of 3



Measuretronix Limited

## Calibration Report

UUC : Fluke 51 Thermometer

Certificate No. : LF24-0278

Serial No. : 5910857

Report data type : As-Found

Asset No. : 5910857

Date of Calibrate : 26-Jun-2024

Procedure : CP-LF-04:Rev.02

Date of Receive : 17-Jun-2024

Note : Refer to Fluke 51,52 Operator's Manual Rev 1 3/86, Oct 1985

Environment condition

Customer : Thai Unique Co., Ltd.

Temperature : 23 °C ± 3 °C

Address : 80-82 Prachathipatai Road,  
Bangkhunphrom, Pranakorn,  
Bangkok 10200

Humidity : 50 %RH ± 20 %RH

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

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

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

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

Remark : The units of uncertainty values in this report are referred to the below details :

"Volt" or "V" for voltage, "Ampere" or "A" for current, "Ohm" or "Ω" for resistance, "Farad" or "F" for capacitance, "Hertz" or "Hz" for frequency, "deg C" or "°C" for degree Celsius, "deg F" or "°F" for degree Fahrenheit, etc.

### Standard Used

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

Certificate No. : LF24-0278

Model : 51

Serial No. : 5910857

Page 2 of 3

### Test Data

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

End of Calibration Report

# Certificate

It is hereby certified that

**Suwarot Trikainut**

Has successfully completed the Application Training for

**Basic Gas Chromatography and Sampler**

Training Contents were:

**Hardware Operation, Software Operation, Data analysis and**

**Troubleshooting : Model**

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

At Thai Unique Co., Ltd, Bangkok, Thailand

On 15<sup>th</sup> March, 2019

Service Manager

ระดับเสียงในบรรยากาศ





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

## CALIBRATION CERTIFICATE

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

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

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

### Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

### Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Keithley 2015-P S/N4106495.

7. Condenser Microphone B&K 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 22 Feb. 2024

Date of Calibration : 4 Mar. 2024

1 / 2

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

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

FM.BLMTC.002 Rev.4

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

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

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



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

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

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

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

### 1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	93.85	-0.15	± 0.10	±0.75 dB

### 2. Frequency

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

### 3. Total Distortion

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

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

Approved by :

(Mr.Prawate Kluaypa)  
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 4 Mar. 2024

Date of Issue : 5 Mar. 2024

Ref : 2011267022200795001

End of Certificate

2 / 2

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

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FM.BLMTC.002 Rev.4

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



บริษัท 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

Noise B\_087/25

## Sound Level Meter Calibration Report

### Acoustic Calibrator Data

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

### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B18	ACO	6236	00172048	20 March 2025	93.7	93.9
ACO-B29	ACO	6236	00182011	20 March 2025	93.9	93.9
ACO-B33	ACO	6236	00182015	20 March 2025	93.8	93.9
ACO-B36	ACO	6236	00192027	20 March 2025	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.81 ± 0.10 dB	

Calibrated by :



คุณภาพน้ำผิวดิน





# CALIBRATION LABORATORY Co.,LTD.

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



## CERTIFICATE OF CALIBRATION

### FOR

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

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

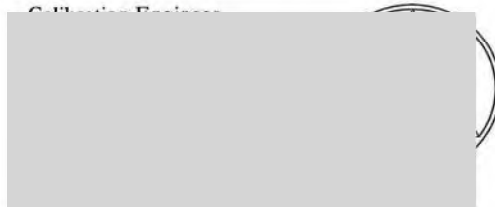
DATE OF RECEIVED : 17 June 2025

DATE OF ISSUED : 20 June 2025

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

Calibrated By : Sukgasem Seehanart  
Wenick Inchaisri

Approved By :



20 June 2025

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

Certificate No. Q25070523

F3-011-05/12-23

page 1 of 4



# CALIBRATION LABORATORY Co.,LTD.

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



## REPORT OF CALIBRATION

### FOR

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

#### ENVIRONMENT CONDITIONS :

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

#### PROCEDURE USED :

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

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

#### REFERENCE STANDARD USED :

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

Certificate No. Q25070523

F3-011-05/12-23

page 2 of 4





# CALIBRATION LABORATORY CO., LTD.

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



## TRACEABILITY :

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

## UNCERTAINTY :

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

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

Certificate No. Q25070523

F3-011-05/12-23

page 3 of 4



# CALIBRATION LABORATORY CO., LTD.

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



## CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

## MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment

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

### CALIBRATION DATA

#### 1. pH METER RESULT @ 25 °C

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

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

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

#### 2. TEMPERATURE RESULT

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

Technical Note. Type of sensor : Thermistor

Probe  $\varnothing$  3 mm

Materials : Metal Sheath.

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

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

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

### End of Certificate ###

Certificate No. Q25070523

F3-011-05/12-23

page 4 of 4



## Certificate of Calibration

Certificate No. : 68-400046-2

Page : 1 of 2

Submitted by : S. P. S Consulting Service Co., Ltd.  
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900

Equipment : Liquid in Glass Thermometer  
Manufacturer : SK Model : N/A  
Range : 0 °C to 100 °C Resolution : 1 °C  
Serial No. : N/A Immersion : Total  
ID No. : TM21/59

Environment : Ambient Temperature : (23 ± 2) °C  
Relative Humidity : (50 ± 15) %  
Line Voltage : (220 ± 22) VAC

Date of Received : 21 January 2025

Date of Calibration : 24 January 2025

Date of Issue : 24 January 2025

Calibrated by : Chortip Samchusri

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

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400001	TT-0023-24	16 Feb 2026	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)
400004	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)

Approved

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 68-400046-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC\* reading 0 °C Standard reading 0.4429 °C

Standard Reading ( °C )	UUC Reading ( °C )	Correction ( °C )	Uncertainty ( ± °C )
20.4801	20	0.5	0.31

### Remark

UUC : Unit Under Calibration

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

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

- o0o -

Handwritten signature





CERTIFICATE No : 25M2256  
REFERENCE No : 76365-3

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : SARTORIUS

MODEL : BSA224S-CW

SERIAL No : 36591843

ID No : BA09/61

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 07-Mar-25

APPROVED BY : [Signature]

ISSUED DATE : 13-Mar-25

RECEIVED DATE : 07-Mar-25

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

CERTIFICATE No : 25M2256

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW

MANUFACTURER : SARTORIUS S/N : 36591843

ID No : BA09/61 RECEIVED DATE : 07-Mar-25

AIR PRESSURE : 1009mbar  $\pm$  1mbar CALIBRATION DATE : 07-Mar-25

AMBIENT TEMPERATURE : 24° C  $\pm$  1° C RELATIVE HUMIDITY : 52 %RH  $\pm$  10 % RH

## CONDITION OF THIS RESULTS OF CALIBRATION

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

## 2. REFERENCE STANDARD INSTRUMENTS :-

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

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.

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

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

- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

## RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000071 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

## 5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	100.0000
2	100.0000
3	100.0000
4	100.0000
5	100.0000
OFF-CENTER LOADING	0.0000

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

END OF CALIBRATION REPORT





CERT.No.: HS-W015C

Harikul Science Co.,Ltd.

694 Soi Ratchadanivet 24, Pracharatbamphe,  
Samsaennok, Huaikhwang, Bangkok 10310

Tel: 0-2274-2456 Fax: 0-2274-2443

Email: info@harikul.com www.harikul.com

Certificate of Calibration

Calibration Date : 18 Mar 25

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

7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol,

Chatuchak, Bangkok, Thailand 10900

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 760.00 mmHg

Salinity : 0 ppt

Model : YSI 5000

S/N : 15B100751

Probe : YSI 5010

S/N : 22D100097

ID NO. : -

Air Temp ref : S/N. F8065C26

Barometric ref : S/N. F8065C26

Water Temp ref : -

ID NO. HS001

Technician : Kittipong M.

Calibration Details

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

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

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

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

Technician Signature

(Kittipong Maekwong)

Laboratory Manager

(Natanapha Pisatkunchon)



**QUALITY CALIBRATION CO., LTD.**

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

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

www.qcalibration.com

CERTIFICATE No : 25T0520

REFERENCE No : 75853-1

PAGE : 1 OF 2

**Certificate of Calibration**

**EQUIPMENT** : COD REACTOR

**MANUFACTURER** : HACH

**MODEL** : DRB 200

**SERIAL No** : 15110C0497

**ID No** : DRB 05/59

**CONDITION AS RECEIVED** : USED ITEM

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

**CALIBRATED BY** : CHAICHARN CH.

**CALIBRATION DATE** : 27-Jan-25

**APPROVED BY** : 

**ISSUED DATE** : 27-Jan-25

**RECEIVED DATE** : 15-Jan-25

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



F-G010 REV : 03

**QUALITY CALIBRATION CO., LTD.**

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

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

CERTIFICATE No : 25T0520

PAGE : 2 OF 2

**Calibration Report**

**EQUIPMENT** : COD REACTOR

**MANUFACTURER** : HACH

**ID NUMBER** : DRB 05/59

**RECEIVED DATE** : 15-Jan-25

**AMBIENT TEMPERATURE** : 23° C ± 1° C

**MODEL** : DRB 200

**SERIAL NUMBER** : 15110C0497

**CALIBRATION DATE** : 27-Jan-25

**RELATIVE HUMIDITY** : 53 %RH ± 10 % RH

**CONDITION OF THIS RESULTS OF CALIBRATION**

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

2. REFERENCE STANDARD INSTRUMENTS :-

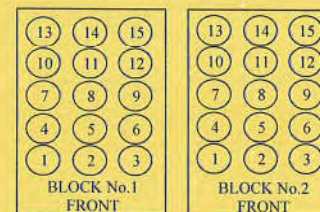
<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	6635300	24T6468	26-Jun-25

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.

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

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO., LTD.

**RESULT OF CALIBRATION** :- WITHOUT ADJUSTMENT



Block No.	1	2	
Calibration Point (°C)	150	150	
Controller temperature (°C)	144	144	
Indicating Temperature	144	144	
Measured Temperature (° C) at Spread Locations	1	150.01	149.57
	2	150.69	150.44
	3	150.40	149.46
	4	150.22	149.89
	5	150.27	149.75
	6	150.51	150.45
	7	150.24	150.03
	8	150.20	150.08
	9	150.14	150.14
	10	149.70	149.83
	11	149.58	149.89
	12	149.46	149.79
	13	148.77	149.03
	14	148.99	149.14
	15	149.02	149.62
Uncertainty of Measurement(± °C)		0.87	0.

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAM

NOTE 2 : LOCATION 10 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.  
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY  
COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



คุณภาพน้ำทิ้ง





# CALIBRATION LABORATORY CO., LTD.

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



## CERTIFICATE OF CALIBRATION

### FOR

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

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

DATE OF RECEIVED : 17 June 2025

DATE OF ISSUED : 20 June 2025

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

Calibrated By : Sukgasem Seehanart  
Wenick Inchaisri

Calibration Engineer

Approved By : Mongkol Yotsoontorn  
Authorized Signatory  
20 June 2025



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

Certificate No. Q25070523

F3-011-05/12-23

page 1 of 4



@clccalibration



# CALIBRATION LABORATORY CO., LTD.

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



## REPORT OF CALIBRATION

### FOR

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

#### ENVIRONMENT CONDITIONS :

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

#### PROCEDURE USED :

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

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

#### REFERENCE STANDARD USED :

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

Certificate No. Q25070523

F3-011-05/12-23

page 2 of 4



@clccalibration



# CALIBRATION LABORATORY CO., LTD.

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



## TRACEABILITY :

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

## UNCERTAINTY :

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

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

Certificate No. Q25070523

F3-011-05/12-23

page 3 of 4



# CALIBRATION LABORATORY CO., LTD.

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



## CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

## MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment

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

### CALIBRATION DATA

#### 1. pH METER RESULT @ 25 °C

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

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

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

#### 2. TEMPERATURE RESULT

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

Technical Note. Type of sensor : Thermistor

Probe  $\varnothing$  3 mm

Materials : Metal Sheath.

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

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

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

### End of Certificate ###

Certificate No. Q25070523

F3-011-05/12-23

page 4 of 4





CERTIFICATE No : 25M2256  
REFERENCE No : 76365-3

## Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : SARTORIUS

MODEL : BSA224S-CW

SERIAL No : 36591843

ID No : BA09/61

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 07-Mar-25

APPROVED BY : ISSUED DATE : 

RECEIVED DATE : 07-Mar-25

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

CERTIFICATE No : 25M2256

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW

MANUFACTURER : SARTORIUS S/N : 36591843

ID No : BA09/61 RECEIVED DATE : 07-Mar-25

AIR PRESSURE : 1009mbar  $\pm$  1mbar CALIBRATION DATE : 07-Mar-25

AMBIENT TEMPERATURE : 24° C  $\pm$  1° C RELATIVE HUMIDITY : 52 %RH  $\pm$  10 % RH

## CONDITION OF THIS RESULTS OF CALIBRATION

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

## 2. REFERENCE STANDARD INSTRUMENTS :-

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

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.

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

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

- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

## RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000071 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

## 5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	100.0000
2	100.0000
3	100.0000
4	100.0000
5	100.0000
OFF-CENTER LOADING	0.0000

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

END OF CALIBRATION REPORT





CERT.No.: HS-W015C

Harikul Science Co.,Ltd.

694 Soi Ratchadanivet 24, Pracharatbamphen,  
Samsaennok, Huaikhwang, Bangkok 10310

Tel: 0-2274-2456 Fax: 0-2274-2443

Email: info@harikul.com www.harikul.com

Certificate of Calibration

Calibration Date : 18 Mar 25

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

7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol,

Chatuchak, Bangkok, Thailand 10900

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 760.00 mmHg

Salinity : 0 ppt

Model : YSI 5000

S/N : 15B100751

Probe : YSI 5010

S/N : 22D100097

ID NO. : -

Air Temp ref : S/N. F8065C26

Barometric ref : S/N. F8065C26

Water Temp ref : -

ID NO. HS001

Technician : Kittipong M.

Calibration Details

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

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

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

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

Technician Signature

(Kittipong Maekwong)

Laboratory Manager

(Natanapha Pisatkunchon)



**QUALITY CALIBRATION CO., LTD.**

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

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

www.qcalibration.com

CERTIFICATE No : 25T0520

REFERENCE No : 75853-1

PAGE : 1 OF 2

**Certificate of Calibration**

EQUIPMENT : COD REACTOR

MANUFACTURER : HACH

MODEL : DRB 200

SERIAL No : 15110C0497

ID No : DRB 05/59

CONDITION AS RECEIVED : USED ITEM

SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,  
JOMPOL, CHATUCHAK, BANGKOK 10900CALIBRATED BY : CHAICHARN CH.CALIBRATION DATE : 27-Jan-25APPROVED BY : ISSUED DATE : 15-Jan-25RECEIVED DATE : 15-Jan-25THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF  
QUALITY CALIBRATION CO., LTD.

F-G010 REV : 03

**QUALITY CALIBRATION CO., LTD.**

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

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

CERTIFICATE No : 25T0520

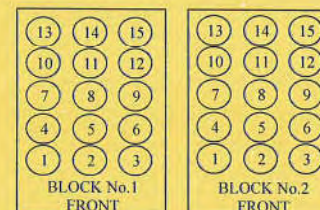
PAGE : 2 OF 2

**Calibration Report**EQUIPMENT : COD REACTOR  
MANUFACTURER : HACH  
ID NUMBER : DRB 05/59  
RECEIVED DATE : 15-Jan-25  
AMBIENT TEMPERATURE : 23° C ± 1° CMODEL : DRB 200  
SERIAL NUMBER : 15110C0497  
CALIBRATION DATE : 27-Jan-25  
RELATIVE HUMIDITY : 53 %RH ± 10 % RH**CONDITION OF THIS RESULTS OF CALIBRATION**1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD WITH CALIBRATED THERMOCOUPLE TYPE K  
UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON POINTS AND LOCATED AS THE PICTURE.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	6635300	24T6468	26-Jun-25

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

**RESULT OF CALIBRATION :-** WITHOUT ADJUSTMENT

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

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE  
NOTE 2 : LOCATION 10 WAS REFERENCE LOCATION.NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY A  
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY  
COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



คุณภาพอากาศในสถานประกอบการ





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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R <sup>2</sup>
B01	SKC	224-PCXR4	262101	03/01/2025	1,000	1,500	2,000	996	1,503	1,999	1.003x - 5.913	1.000
B02	SKC	224-PCXR4	626165	03/01/2025	1,000	1,500	2,000	997	1,499	1,996	0.999x - 0.140	1.000
B03	SKC	224-PCXR4	612968	06/01/2025	1,000	1,500	2,000	1,008	1,504	1,998	0.999x + 1.131	0.999
B04	SKC	224-PCXR4	402804	06/01/2025	1,000	1,500	2,000	994	1,505	2,004	1.010x - 17.826	1.000
B05	SKC	224-PCXR4	612693	07/01/2025	1,000	1,500	2,000	997	1,508	1,997	1.009x - 14.660	0.999
B06	SKC	224-PCXR4	262188	07/01/2025	1,000	1,500	2,000	1,005	1,493	2,002	0.995x + 7.108	1.000
B07	SKC	224-PCXR4	626262	07/01/2025	1,000	1,500	2,000	994	1,498	2,004	1.006x - 10.636	1.000
B08	SKC	224-PCXR4	626100	08/01/2025	1,000	1,500	2,000	1,014	1,505	2,010	1.006x - 2.859	0.999
B09	SKC	224-PCXR4	626479	06/01/2025	1,000	1,500	2,000	998	1,491	2,006	1.012x - 22.408	1.000
B10	SKC	224-PCXR4	091950	06/01/2025	1,000	1,500	2,000	999	1,507	2,007	1.010x - 15.236	1.000
B11	SKC	224-PCXR8	564315	06/01/2025	1,000	1,500	2,000	997	1,496	1,996	1.001x - 3.394	1.000
B12	SKC	224-PCXR4	034656	07/01/2025	1,000	1,500	2,000	1,005	1,503	2,004	1.011x - 19.282	0.999
B13	SKC	224-PCXR4	602073	07/01/2025	1,000	1,500	2,000	995	1,505	1,998	1.006x - 12.605	1.000
B14	SKC	224-PCXR4	626313	03/01/2025	1,000	1,500	2,000	1,003	1,506	2,007	1.007x - 8.152	1.000
B15	SKC	224-PCXR4	626474	06/01/2025	1,000	1,500	2,000	1,010	1,498	2,001	0.994x + 9.807	1.000
B16	SKC	224-PCXR4	626477	06/01/2025	1,000	1,500	2,000	998	1,507	2,002	1.013x - 22.572	0.999
B17	SKC	224-PCXR4	626860	06/01/2025	1,000	1,500	2,000	1,005	1,499	2,001	0.995x + 7.368	1.000
B18	SKC	224-PCXR4	691484	06/01/2025	1,000	1,500	2,000	1,008	1,494	2,002	0.993x + 10.346	1.000
B19	SKC	224-PCXR4	591599	06/01/2025	1,000	1,500	2,000	1,010	1,505	2,010	1.006x + 6.532	1.000
B20	SKC	224-PCXR4	691587	07/01/2025	1,000	1,500	2,000	1,006	1,512	2,009	1.002x - 1.671	0.999
B21	SKC	224-PCXR4	691531	07/01/2025	1,000	1,500	2,000	1,001	1,510	2,007	1.007x - 10.035	1.000
B22	SKC	224-PCXR4	691654	07/01/2025	1,000	1,500	2,000	1,015	1,513	2,012	0.999x + 8.423	0.999
B23	SKC	224-PCXR4	798393	07/01/2025	1,000	1,500	2,000	999	1,498	2,001	1.001x - 0.856	1.000
B24	SKC	224-PCXR4	626363	06/01/2025	1,000	1,500	2,000	1,001	1,506	2,004	1.007x - 12.177	0.999
B25	SKC	224-PCXR6	798489	06/01/2025	1,000	1,500	2,000	996	1,514	2,005	1.011x + 13.301	1.000
B26	SKC	224-PCXR6	798479	03/01/2025	1,000	1,500	2,000	998	1,509	2,002	1.005x - 9.187	1.000
B27	SKC	224-PCXR4	691673	03/01/2025	1,000	1,500	2,000	1,001	1,511	1,995	0.998x - 0.790	0.999
B28	SKC	224-PCXR4	691570	03/01/2025	1,000	1,500	2,000	1,004	1,513	2,006	1.001x + 1.779	1.000
B29	SKC	224-PCXR4	626472	03/01/2025	1,000	1,500	2,000	998	1,508	2,007	1.009x - 13.557	1.000
B30	SKC	224-PCXR4	691489	03/01/2025	1,000	1,500	2,000	1,003	1,503	2,012	1.008x - 10.099	1.000
B31	SKC	224-PCXR4	691509	06/01/2025	1,000	1,500	2,000	997	1,510	2,009	1.012x - 18.638	1.000
B32	SKC	224-PCXR4	091567	06/01/2025	1,000	1,500	2,000	1,014	1,517	2,007	0.995x + 11.854	0.999
B33	SKC	224-PCXR8	091756	06/01/2025	1,000	1,500	2,000	999	1,510	2,003	1.003x - 4.801	1.000
B34	SKC	224-PCXR4	612962	07/01/2025	1,000	1,500	2,000	1,001	1,511	2,008	1.008x - 11.354	0.999
B35	SKC	224-PCXR4	602682	07/01/2025	1,000	1,500	2,000	1,008	1,514	1,996	0.993x + 11.338	0.999
B36	SKC	224-PCXR4	626164	07/01/2025	1,000	1,500	2,000	1,005	1,506	2,007	1.003x - 2.339	1.000
B37	SKC	224-PCXR4	626256	07/01/2025	1,000	1,500	2,000	1,003	1,503	2,005	1.011x - 16.311	0.999
B38	SKC	224-PCXR4	626167	03/01/2025	1,000	1,500	2,000	1,006	1,514	2,007	1.006x + 6.712	0.999
B39	SKC	224-PCXR4	034637	06/01/2025	1,000	1,500	2,000	1,013	1,515	2,013	1.002x + 3.638	0.999
B40	SKC											

Cal



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data					Calibration Data							
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R <sup>2</sup>
B41	SKC	224-PCXR4	612669	07/01/2025	1,000	1,500	2,000	996	1,512	2,005	1.008x - 10.246	1.000
B42	SKC	224-PCXR4	626041	07/01/2025	1,000	1,500	2,000	995	1,499	2,002	1.002x - 2.343	1.000
B43	SKC	224-PCXR4	034636	03/01/2025	1,000	1,500	2,000	999	1,493	1,997	0.996x + 2.703	1.000
B44	SKC	224-PCXR8	529341	03/01/2025	1,000	1,500	2,000	998	1,510	2,003	1.009x - 16.871	0.999
B45	SKC	224-PCXR8	529594	03/01/2025	1,000	1,500	2,000	997	1,506	2,004	1.012x - 21.113	0.999
B46	SKC	224-PCXR8	566743	03/01/2025	1,000	1,500	2,000	996	1,497	2,003	1.010x - 16.955	1.000
B47	SKC	224-PCXR8	566747	03/01/2025	1,000	1,500	2,000	1,002	1,504	2,001	1.005x - 2.758	1.000
B48	SKC	224-PCXR8	566753	03/01/2025	1,000	1,500	2,000	998	1,512	2,002	1.008x - 13.876	0.999
B49	SKC	224-PCXR8	566780	03/01/2025	1,000	1,500	2,000	997	1,497	1,997	1.002x - 5.465	1.000
B50	SKC	224-PCXR8	509400	03/01/2025	1,000	1,500	2,000	996	1,503	1,999	1.003x - 7.316	1.000
B51	SKC	224-PCXR8	509363	06/01/2025	1,000	1,500	2,000	1,003	1,503	1,998	0.995x + 8.579	1.000
B52	SKC	224-PCXR8	093186	06/01/2025	1,000	1,500	2,000	1,002	1,496	1,999	0.999x - 0.396	1.000
B53	SKC	224-PCXR8	707670	07/01/2025	1,000	1,500	2,000	997	1,505	2,005	1.010x - 19.569	0.999
B54	SKC	224-PCXR3	509821	07/01/2025	1,000	1,500	2,000	1,004	1,506	2,002	1.002x - 0.736	1.000
B55	SKC	224-PCXR3	510710	07/01/2025	1,000	1,500	2,000	998	1,501	2,001	1.003x - 5.629	1.000
B56	SKC	224-PCXR3	511450	07/01/2025	1,000	1,500	2,000	995	1,509	2,007	1.013x - 22.400	0.999
B57	SKC	224-PCXR3	510798	07/01/2025	1,000	1,500	2,000	999	1,498	1,996	0.996x + 4.985	1.000
B58	SKC	224-PCXR3	509852	06/01/2025	1,000	1,500	2,000	1,002	1,503	2,005	1.009x - 13.249	1.000
B59	SKC	224-PCXR3	509862	06/01/2025	1,000	1,500	2,000	996	1,506	2,007	1.015x - 25.718	0.999
B60	SKC	224-PCXR3	512655	06/01/2025	1,000	1,500	2,000	1,012	1,504	2,001	0.995x + 10.338	1.000
B61	SKC	224-PCXR3	503915	03/01/2025	1,000	1,500	2,000	1,003	1,507	2,010	1.010x - 13.768	1.000
B62	SKC	224-PCXR3	509973	03/01/2025	1,000	1,500	2,000	1,004	1,505	2,008	1.012x - 17.586	0.999
B63	SKC	224-PCXR3	511432	03/01/2025	1,000	1,500	2,000	999	1,503	2,003	1.013x - 21.586	0.999
B64	SKC	224-PCXR3	508302	06/01/2025	1,000	1,500	2,000	996	1,506	2,006	1.010x - 15.623	1.000
B65	SKC	224-PCXR3	508310	06/01/2025	1,000	1,500	2,000	1,003	1,502	2,002	1.001x + 1.279	1.000
B66	SKC	224-PCXR3	509861	06/01/2025	1,000	1,500	2,000	1,004	1,505	2,008	1.004x + 7.200	1.000
B67	SKC	224-PCXR3	506295	06/01/2025	1,000	1,500	2,000	997	1,497	2,007	1.011x - 22.995	0.999
B68	SKC	224-PCXR3	505872	07/01/2025	1,000	1,500	2,000	1,001	1,493	1,999	0.998x + 1.515	1.000
B69	SKC	224-PCXR3	508975	07/01/2025	1,000	1,500	2,000	995	1,506	2,005	1.013x - 23.639	0.999
B70	SKC	224-PCXR3	510623	07/01/2025	1,000	1,500	2,000	1,004	1,502	2,007	1.011x - 17.470	0.999
B71	SKC	224-PCXR3	508167	06/01/2025	1,000	1,500	2,000	1,003	1,504	2,006	1.016x - 24.787	0.999
B72	SKC	224-PCXR3	505977	06/01/2025	1,000	1,500	2,000	1,008	1,496	2,007	1.001x + 0.906	1.000
B73	SKC	224-PCXR3	512686	06/01/2025	1,000	1,500	2,000	1,003	1,502	2,003	1.007x - 15.456	0.999
B74	SKC	224-PCXR3	503993	06/01/2025	1,000	1,500	2,000	1,004	1,501	1,999	1.000x - 0.624	1.000
B75	SKC	224-PCXR3	509820	06/01/2025	1,000	1,500	2,000	996	1,510	2,003	1.010x - 17.886	0.999
B76	SKC	224-PCXR3	509811	07/01/2025	1,000	1,500	2,000	994	1,509	2,008	1.013x - 21.300	1.000
B77	SKC	224-PCXR3	508301	07/01/2025	1,000	1,500	2,000	1,002	1,491	2,006	1.006x - 10.302	1.000
B78	SKC	224-PCXR3	510677	07/01/2025	1,000	1,500	2,000	1,005	1,504	2,007	1.012x - 19.937	0.999
B79	SKC	224-PCXR3	510920	06/01/2025	1,000	1,500	2,000	1,003	1,503	2,006	1.015x - 30.223	0.999





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### Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

#### Environmental Conditions

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

#### Personal Pump Data

#### Calibration Data

No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R <sup>2</sup>
B80	SKC	224-PCXR3	504569	06/01/2025	1,000	1,500	2,000	999	1,497	2,011	1.009x - 11.282	1.000
B81	SKC	224-PCXR3	503480	03/01/2025	1,000	1,500	2,000	1,004	1,505	2,008	1.010x - 16.107	0.999
B82	SKC	224-PCXR3	505673	03/01/2025	1,000	1,500	2,000	995	1,509	2,005	1.014x - 24.323	0.999
B83	SKC	224-PCXR3	510785	07/01/2025	1,000	1,500	2,000	999	1,504	1,998	0.998x + 5.669	1.000
B84	SKC	224-PCXR3	508353	07/01/2025	1,000	1,500	2,000	993	1,492	2,004	1.009x - 21.129	1.000
B85	SKC	224-PCXR3	505757	07/01/2025	1,000	1,500	2,000	1,005	1,503	2,008	1.007x - 9.639	1.000
B86	SKC	224-PCXR3	512625	06/01/2025	1,000	1,500	2,000	996	1,495	2,001	1.005x - 11.406	1.000
B87	SKC	224-PCXR3	504324	06/01/2025	1,000	1,500	2,000	997	1,498	1,999	1.004x - 12.097	1.000
B88	SKC	224-PCXR3	508307	06/01/2025	1,000	1,500	2,000	994	1,502	1,994	0.999x - 1.619	1.000
B89	SKC	224-PCXR3	509860	06/01/2025	1,000	1,500	2,000	995	1,507	2,003	1.008x - 14.844	1.000
B90	SKC	224-PCXR3	508366	07/01/2025	1,000	1,500	2,000	997	1,496	1,995	0.999x - 1.143	1.000
B91	SKC	224-PCXR3	510919	07/01/2025	1,000	1,500	2,000	1,005	1,503	2,012	1.008x - 11.670	0.999
B92	SKC	224-PCXR3	510987	03/01/2025	1,000	1,500	2,000	999	1,494	2,010	1.013x - 24.882	0.999
B93	SKC	224-PCXR3	509845	03/01/2025	1,000	1,500	2,000	997	1,507	1,998	1.002x - 9.103	1.000

Calibrated by



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### Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

#### Calibration Data

#### Rotameter Data

#### Calibration Data

Non-Recal 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-801	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	498.1	999.3	2001.2	0.991x + 4.404	1.000
H-802	Dwyer	VFB-65	06/01/2025	500	1,000	2,000	499.2	998.1	2012.5	1.003x - 8.556	0.999
H-803	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	502.4	1002.9	2008.6	1.000x - 2.203	1.000
H-804	Dwyer	VFB-65	07/01/2025	500	1,000	2,000	501.7	997.4	1993.2	0.996x + 5.850	1.000
H-805	Dwyer	VFB-65	07/01/2025	500	1,000	2,000	500.9	994.7	1984.4	0.985x + 17.991	0.999
H-806	Dwyer	VFB-65	06/01/2025	500	1,000	2,000	502.5	997.1	1993.6	0.993x + 7.901	1.000
H-807	Dwyer	VFB-65	06/01/2025	500	1,000	2,000	501.4	998.8	2009.5	1.001x + 0.428	1.000
H-808	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	500.9	999.4	1993.8	0.997x + 2.266	0.999
H-809	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	502.3	1004.1	2009.7	0.996x + 11.111	1.000
H-810	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	498.6	999.5	2010.3	1.001x - 0.553	0.999



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, Chusabak, Bangkok 10900  
Tel : (662) 939-0370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R <sup>2</sup>
L-801	Dwyer	VFA-21	03/01/2025	50	100	200	50.2	100.1	199.4	0.997x + 0.962	0.999
L-802	Dwyer	VFA-21	06/01/2025	50	100	200	49.3	99.2	201.5	0.994x + 0.653	1.000
L-803	Dwyer	VFA-21	03/01/2025	50	100	200	49.6	99.8	199.7	0.996x + 0.107	1.000
L-804	Dwyer	VFA-21	07/01/2025	50	100	200	50.5	100.6	200.4	0.995x + 1.286	1.000
L-805	Dwyer	VFA-21	07/01/2025	50	100	200	50.4	101.1	202.5	0.994x + 1.572	1.000
L-806	Dwyer	VFA-21	06/01/2025	50	100	200	50.9	99.2	198.7	1.000x + 0.411	0.999
L-807	Dwyer	VFA-21	06/01/2025	50	100	200	49.7	99.1	201.4	0.997x + 0.176	1.000
L-808	Dwyer	VFA-21	03/01/2025	50	100	200	50.6	99.8	200.2	0.998x + 1.116	0.999
L-809	Dwyer	VFA-21	03/01/2025	50	100	200	49.8	101.9	198.3	1.000x + 0.229	1.000



บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200  
80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

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

### GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0824/22063

Instrument Type : Gas Chromatography

Model : CP-3800

Serial Number : 00734

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

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

Date : 05/08/2024

#### ELECTRONIC TEST

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

#### RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector ( FID Channel Front)

INJECTOR : Capillary Injector Model 1079

#### GC CONDITION:

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

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

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

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



บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200  
80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

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

#### Detector Sensitivity ( FID )

Detector Response	Result	Specification
Baseline Noise (µV)	2.85	≤ 50
Baseline Drift (%)	0.09	≤ 1
Sensitivity ( S/N for C15)	16,400	≥ 1,024

#### Temperature Specification

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

#### Relative Standard Deviation % ( % RSD)

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

APPROV.

Signature:

Engineer : Suwarot Trikanut

Date : 05/08/2024



VARIAN

1/2

SERVICE DEPARTMENT  
FR-SV-029 Rev. 04



VARIAN

2/2

SERVICE DEPARTMENT  
FR-SV-029 Rev. 04





#### Results Integrated System Testing

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

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

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

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



#### Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 RT 1	4.128
C15 RT 2	4.128
C15 RT 3	4.128
C15 RT 4	4.128
C15 RT 5	4.128
C15 RT Average	4.128
* % RSD ( < 0.5 % )	0

\* The precision specification should be less than 0.5 % RSD \*\* ( Relative Standard Deviation ) for an Auto sampler injection and less than 0.5 % for Manual injections. To calculate the %RSD, select the RT C15 peak for each of the five ( 5 ) samples.

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

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

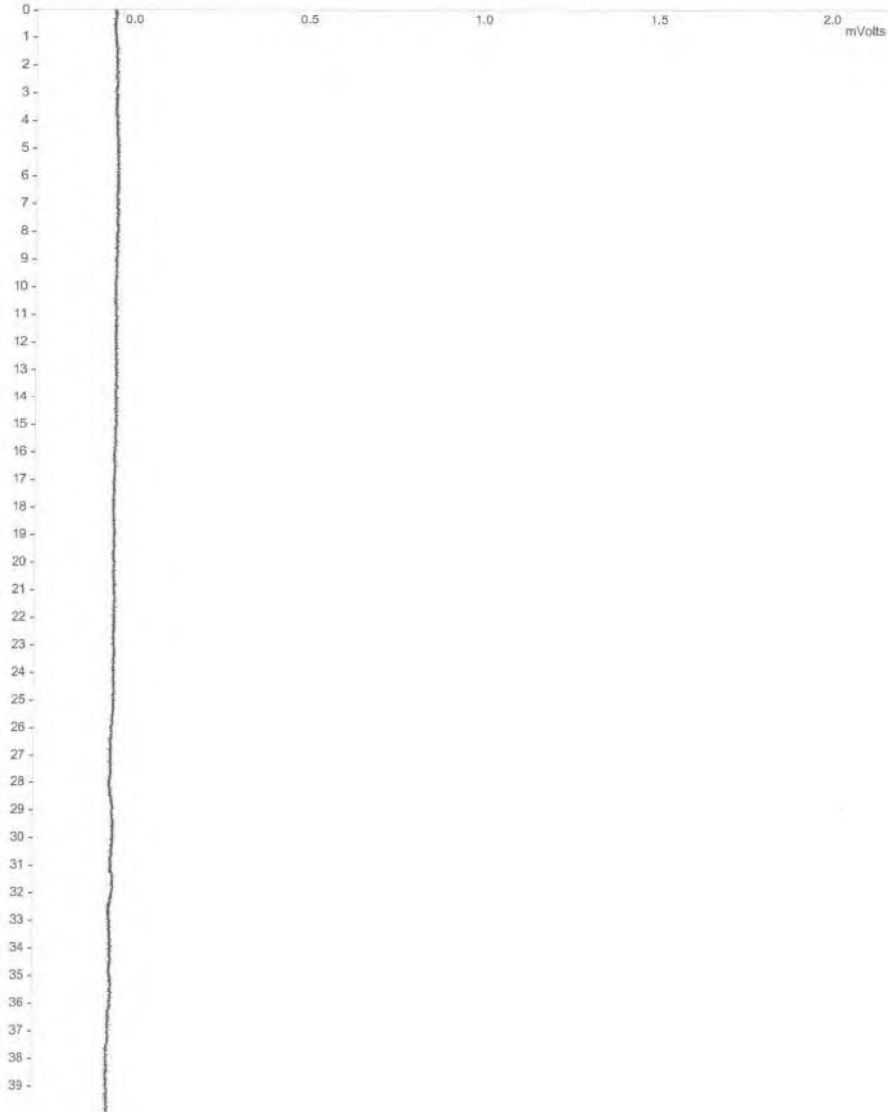
Title :  
Run File : f:\sps2024\cal2024\baseline2024002.run  
Method File : D:\Method-GC\star C\Star\TU\cal0203\baseline FID.mth  
Sample ID : Baseline2024

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

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

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

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



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

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

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

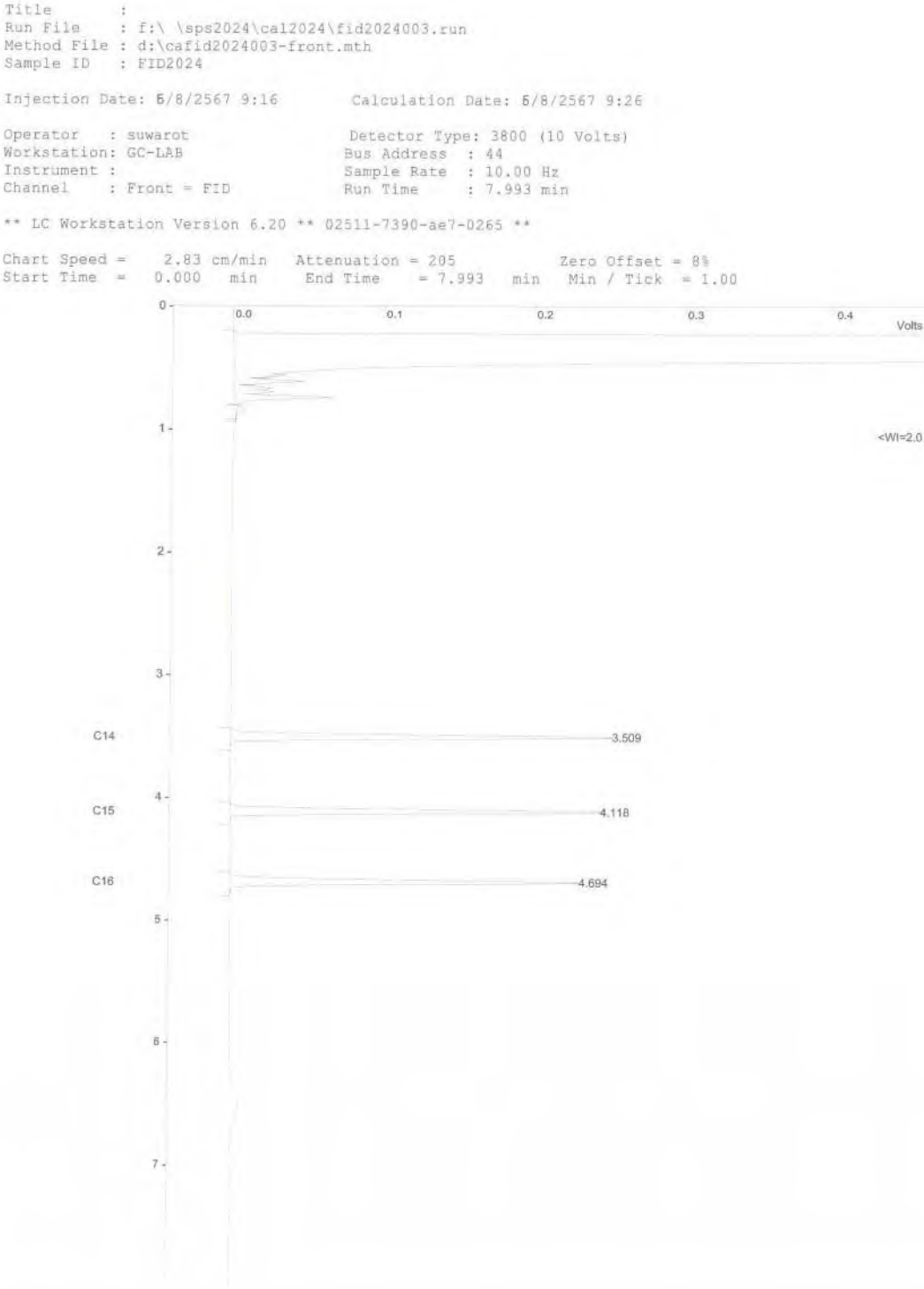
\*\* LC Workstation Version 6.20 \*\* 02511-7390-ae7-0265 \*\*

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

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

Total Unidentified Counts : 0 counts  
Detected Peaks: 0      Rejected Peaks: 0      Identified Peaks: 0  
Multiplier: 1      Divisor: 1      Unidentified Peak Factor: 0  
Baseline Offset: -16 microVolts      LSB: 1 microVolts  
Noise (used): 22 microVolts - monitored before this run  
Manual injection  
Data Handling: No peaks

\*\*\*\*\*



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

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

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

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

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

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

Peak No.	Peak Name	Result ( )	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	C14	54.1202	3.509	-0.005	163565	BB	2.1	C
2	C15	53.5241	4.118	-0.005	157309	BB	2.2	C
3	C16	52.2361	4.694	0.001	146804	BB	2.3	C
Totals:		159.8804		-0.009	1704289			

Status Codes:  
C - Out of calibration range

Total Unidentified Counts : 69332200 counts

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

Multiplier: 1      Divisor: 1      Unidentified Peak Factor: 0

Baseline Offset: -29 microVolts      LSB: 1 microVolts

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

Manual injection

Calib. out of range; No Recovery Action Specified

\*\*\*\*\*



Sample ID: fid std

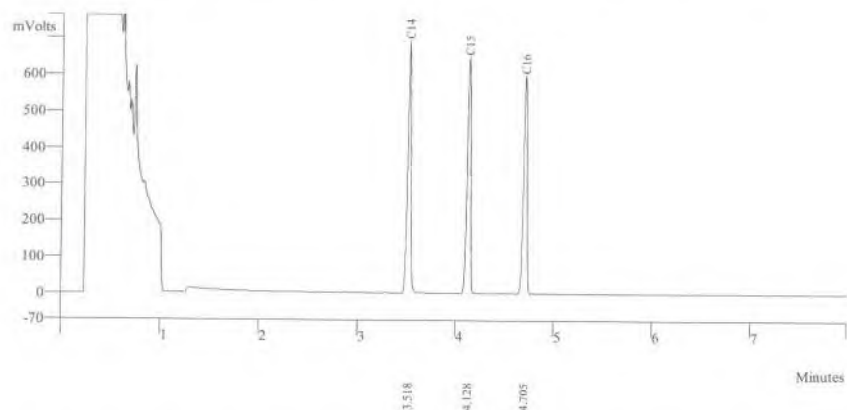
Operator (Inj): suwarot  
Injection Date: 05/08/2024  
Calc Date: 05/08/2024  
Run Time (min): 7.993  
Workstation: GC-LAB  
Instrument (Inj):



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

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

A = FID 10 V RESULTS



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



Sample ID: fid std

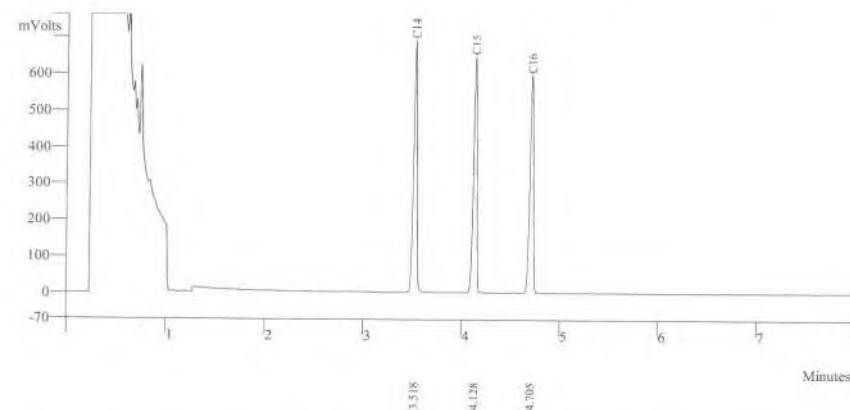
Operator (Inj): suwarot  
Injection Date: 05/08/2024  
Calc Date: 05/08/2024  
Run Time (min): 7.993  
Workstation: GC-LAB  
Instrument (Inj):



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

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

A = FID 10 V RESULTS



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



Sample ID: fid std

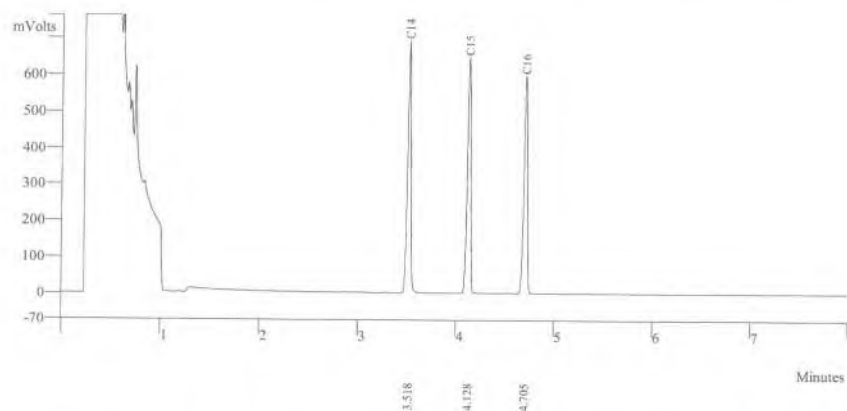
Operator (Inj): suwarot  
Injection Date: 05/08/2024  
Calc Date: 05/08/2024  
Run Time (min): 7.993  
Workstation: GC-LAB  
Instrument (Inj):



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

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

A = FID 10 V RESULTS



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



Sample ID: fid std

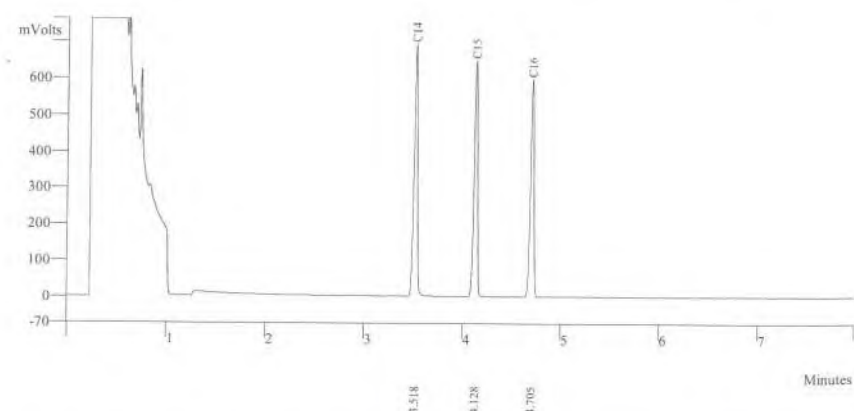
Operator (Inj): suwarot  
Injection Date: 05/08/2024  
Calc Date: 05/08/2024  
Run Time (min): 7.993  
Workstation: GC-LAB  
Instrument (Inj):



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

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

A = FID 10 V RESULTS



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



Sample ID: fid std

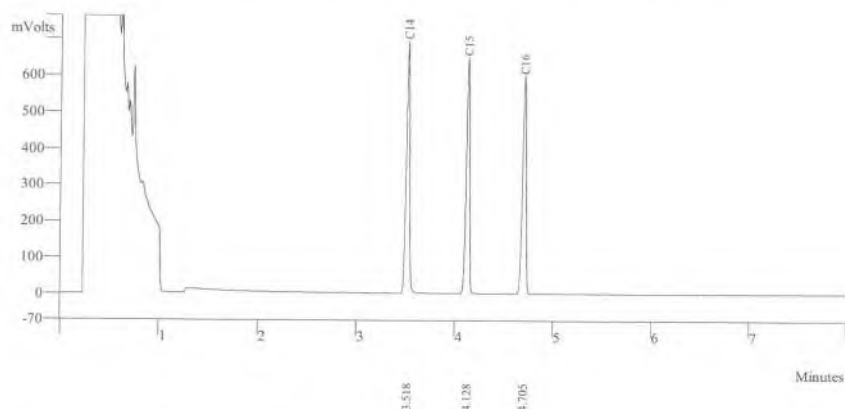
Operator (Inj): suwarot  
 Injection Date: 05/08/2024  
 Calc Date: 05/08/2024  
 Run Time (min): 7.993  
 Workstation: GC-LAB  
 Instrument (Inj):



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

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

A = FID 10 V RESULTS



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



THAI UNIQUE CO.,LTD.

1 Of 1



Agilent Technologies

## Certificate of Analysis

## FID-TCD Performance Evaluation Sample Kit

Agilent Part Number: 5080-8842, 18710-60170

Sample Lot Number: 0006750304

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

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

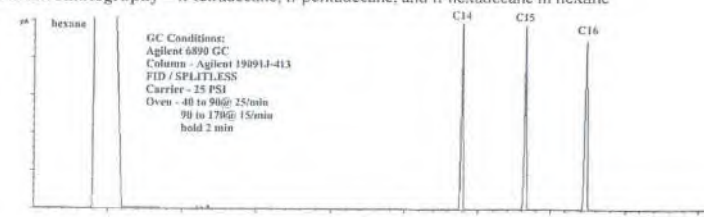
Solvent: hexane

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

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

## Typical Analytical Spectrum or Chromatography

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



Date of release: 30 June 2023

Date of expiration: 31 July 2025

*Monica Bourgeois*  
 Monica Bourgeois  
 QMS Representative



## Certificate of Calibration

Certificate No.: WK2312-031-1

Page 1 of 2

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

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

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

Reference standard instruments :

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

MIT : Miracle International Technology Co.,Ltd.

This result calibrate was found accurate as shown on date place of calibrate only  
This certificate is traceability to the International System of Unit (SI)

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

Calibrated by : Mr.Taywanat Hansuwankul

Approved by :

Ms. Budsagorn Patcha

Authorized Signatory

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

## Calibration Results

Certificate No. : WK2312-031-1

Page 2 of 2

Calibration Result of the Accuracy

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

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

(X) Without Adjustment ( ) After Adjustment

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

\*\*\*\* End of Certificate\*\*\*\*



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



## Certificate of Calibration

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

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

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

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

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

Certificate No. : LF24-0278

Model : 51

Serial No. : 5910857

Page 1 of 3

Measuretronix Cal-Lab

Form 421 Rev.07 Date : 05-Jun-2024



Measuretronix Limited

## Calibration Report

UUC : Fluke 51 Thermometer

Serial No. : 5910857

Asset No. : 5910857

Procedure : CP-LF-04:Rev.02

Note : Refer to Fluke 51,52 Operator's Manual Rev 1 3/86, Oct 1985

Customer : Thai Unique Co., Ltd.

Address : 80-82 Prachathipatai Road,  
Bangkhunphrom, Pranakorn,  
Bangkok 10200

Certificate No. : LF24-0278

Report data type : As-Found

Date of Calibrate : 26-Jun-2024

Date of Receive : 17-Jun-2024

Environment condition

Temperature : 23 °C ± 3 °C

Humidity : 50 %RH ± 20 %RH

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

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

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

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

Remark : The units of uncertainty values in this report are referred to the below details :

"Volt" or "V" for voltage, "Ampere" or "A" for current, "Ohm" or "Ω" for resistance, "Farad" or "F" for capacitance, "Hertz" or "Hz" for frequency, "deg C" or "°C" for degree Celsius, "deg F" or "°F" for degree Fahrenheit, etc.

### Standard Used

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

Certificate No. : LF24-0278

Model : 51

Serial No. : 5910857

Page 2 of 3

### Test Data

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

End of Calibration Report

# Certificate

It is hereby certified that

**Suwarot Trikainut**

Has successfully completed the Application Training for

**Basic Gas Chromatography and Sampler**

Training Contents were:

**Hardware Operation, Software Operation, Data analysis and**

**Troubleshooting : Model**

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

At Thai Unique Co., Ltd, Bangkok, Thailand

On 15<sup>th</sup> March, 2019

Service manager



ระดับเสียงในสถานประกอบการ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

## CALIBRATION CERTIFICATE

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

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

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

### Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

### Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Keithley 2015-P S/N4106495.

7. Condenser Microphone B&K 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 22 Feb. 2024

Date of Calibration : 4 Mar. 2024

1 / 2

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

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

FM.BLMTC.002 Rev.4

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

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

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

### 1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	93.85	-0.15	± 0.10	±0.75 dB

### 2. Frequency

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

### 3. Total Distortion

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

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

Calibrator

Date of Calibration : 4 Mar. 2024

Date of Issue : 5 Mar. 2024

Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Ref : 2011267022200795001

End of Certificate

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FM.BLMTC.002 Rev.4

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7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900  
7 Sol 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

Noise B\_209/25

## Sound Level Meter Calibration Report

### Acoustic Calibrator Data

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

### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B02	ACO	6236	00222306	25 May 2025	93.8	93.9
ACO-R17	ACO	6236	00172064	25 May 2025	93.8	93.9
ACO-R18	ACO	6236	00172065	25 May 2025	93.7	93.9
ACO-R19	ACO	6236	00182001	25 May 2025	93.9	93.9
ACO-C1-B02	ACO	6238	00223039	25 May 2025	93.9	93.9
ACO-C1-B03	ACO	6238	00223040	25 May 2025	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.81 ± 0.10 dB	

Calibrated by :

