

ภาคผนวก ง

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ใบรับรองการสอบเทียบเครื่องมือ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0517

MTC No. EEL. BP. 14/0767

## CALIBRATION CERTIFICATE

Submitted by : Smile Laboratory Co.,Ltd

Address : 563/1, Thoet Thai Rd., Bangwa, Phasicharoen, Bangkok, 10160, Thailand.

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

### Instrument Calibrated :

Description : Acoustic Calibrator

Manufacturer : Quest Technologies

Model : QC-20

Serial No. : QF4090085

### Ambient Environment

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

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

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

Standards used :

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Keithley 2015-P S/N 4106495.
7. Condenser Microphone Bruel&Kjaer 4180 S/N 2633526.

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

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

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

Date of Receipt : 8 Jul. 2024

Date of Calibration : 12 Jul. 2024

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✓

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

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

FM.BL.MTC.002 Rev.4

#### Head Office

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Tel. (66) 0 2577 9000  
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#### Office/Laboratory

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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 20 $\mu$ Pa at 1000 Hz

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.80	-0.20	$\pm 0.10$	$\pm 0.40$ dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1000.6	0.6	$\pm 1.5$	$\pm 1.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	2.50	$\pm 0.60$	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Date of Calibration : 12 Jul. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0517

MTC No. EEL. BP. 14/0767

Nominal Output of Unit Under Test = 114 dB re 20 $\mu$ Pa at 1000 Hz

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

### 1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	113.74	-0.26	$\pm 0.10$	$\pm 0.40$ dB

### 2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1000.6	0.6	$\pm 1.5$	$\pm 1.0\%$

### 3. Total Distortion

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

Note : 1. No adjustment.

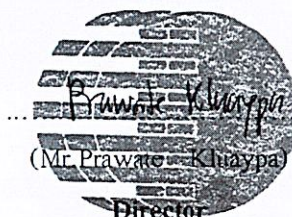
2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :



Approved by :



(Mr. Prawate Khuyapa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 12 Jul. 2024

Date of Issue : 15 Jul. 2024

Ref : 2011267070802505001

End of Certificate

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FM.BL.MTC.002 Rev.4

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E-mail : sumalee@tistr.or.th





# CERTIFICATE OF CALIBRATION

NO. 20240113130

Name of Product:	Sound Level Meter
Model:	ST-11D
Serial Number:	820890
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2024-01-31
Due Date:	2025-01-29



- I. This report certifies that all calibration equipment used in the test is traceable with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass then, and applies only to the unit identified above.
- II. This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
- III. This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlet Tech Co Ltd Taiwan.

1. Preliminary inspection: OK

2. Type & serial No. of Microphone: AWA14425-57144

3. Adjustments to indicated sound levels:

Type of Calibrator B&K 4231 Sound

Pressure Level 94.0 dB

4. Measuring up limit: 140 dBA

5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests.)

Equivalent Free-field Sound Level (reference environment conditions) 93.8 dB

Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
10	-71.1	-14.2	-0.4	1000	0.0	0.0	-0.1
20	-50.1	-6.3	-0.1	2000	1.3	-0.1	-0.1
31.5	-39.1	-2.6	-0.1	4000	1.1	-0.9	-0.1
63	-26.1	-0.4	-0.1	8000	-1.0	-3.1	0.0
125	-16.2	-0.1	0.1	12500	-11.5	-13.5	0.1
250	-8.7	0.1	-0.1	16000	-11.5	-13.4	0.1
500	-3.1	0.1	-0.2	20000	-23.8	-25.8	-0.1

## 6. Self-generated noise

Microphone replaced by electrical input signal device

7.5 dB(A)	10.9 dB(C)	10.9 dB(Z)
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## 7. F&S Weighting

Rate of the F weighting decrease (dB/s)	35.1
Rate of the S weighting decrease (dB/s)	4.4
Deviation of F&S	-0.1

## 8. Level Linearity (A-weighting at frequency 1 kHz)

Reference sound level 90.0 dB

Max error at 10dB steps upper reference sound level 0.1 dB

Max error at 1dB steps within 5dB of the upper limit linear operating range 0.0 dB

Max error at 10dB steps below reference sound level 0.1 dB

Max error at 1dB steps within 5dB upper the lower limit linear operating range 0.1 dB

## 9. Tone burst response (A Weighting) :

Single Toneburst duration /ms	Toneburst response /dB			
	LAFmax-LA	LASmax-LA	LAE-LA	LAeqT-LA
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-7.4	-6.9	-7.0
2	-18.1	-26.9	-26.9	-7.0
0.25	-27.2	/	-36.0	-7.0

## 10. Peak C sound level (500Hz) :

Cycle	One cycle	nominal value	Positive half	nominal value	Negative half	nominal value
LCpeak-LC(dB)	3.5	3.5	2.4	2.4	2.3	2.4

## 11. Overload indication: Pass

## 12. Statistical analysis function

Sweep signal maximum indicated sound level: 112.8 dB

Sweep amplitude: 40 dB

Scan cycle time: 60 S; Measurement period: 180 S.



Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
LAeq,T	103.2	103.2	0.0
L5	110.8	110.8	0.0
L10	108.8	108.8	0.0
L50	92.9	92.8	0.1
L90	76.9	76.8	0.1
L95	75.0	74.9	0.1

Uncertainty of measurement results: 0.4 dB (k=2)

Environment conditions:

Air temperature: 20 °C

Relative humidity: 50 %

Static pressure: 101.8 kPa

Reference equipment used in the calibration:

Description:	Model	Serial No.	Expiry Date	Traceable To
Microphone	B&K 4191	2929405	2024-12-15	NML
Multi function sound calibrator	B&K 4226	2288444	2024-10-15	CIGISMEC
Signal generator	DS 360	33873	2024-10-15	CEPREI

Test specifications:

1. All Scalet's Sound level Meter has been calibrated in accordance with the requirements as specified in ISO17025 and the lab calibration procedure SMTP004-CA-152.
2. The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.
3. The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responses of the Sound Level Meter.

References:

IEC 61672-3 Sound Level Meters Part 3: Periodic tests

## CERTIFICATE OF CALIBRATION

NO. 20240113131

Name of Product:	Sound Level Meter
Model:	ST-11D
Serial Number:	820891
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2024-01-31
Due Date:	2025-01-29

Calibrated by:



- This report certifies that all calibration equipment used in the test is traceable with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass then, and applies only to the unit identified above.
- This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
- This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlet Tech Co Ltd Taiwan.

1. Preliminary inspection: OK

2. Type & serial No. of Microphone: AWA14425-57258

3. Adjustments to indicated sound levels:

Type of Calibrator B&K 4231 Sound

Pressure Level 94.0 dB

4. Measuring up limit: 140 dBA

5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests.)

Equivalent Free-field Sound Level (reference environment conditions) 93.8 dB

Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
10	-71.3	-14.5	-0.3	1000	0.0	0.0	-0.1
20	-50.1	-6.2	-0.1	2000	1.3	-0.1	-0.1
31.5	-39.2	-2.6	-0.1	4000	1.1	-0.9	-0.1
63	-26.1	-0.4	-0.2	8000	-1.0	-3.1	0.0
125	-16.2	-0.1	0.1	12500	-11.5	-13.5	0.1
250	-8.7	0.1	-0.1	16000	-11.5	-13.3	0.1
500	-3.1	0.2	-0.2	20000	-23.9	-25.9	-0.1



#### 6. Self-generated noise

Microphone replaced by electrical input signal device

6.9 dB(A)	8.4 dB(C)	14.8 dB(Z)
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#### 7. F&S Weighting

Rate of the F weighting decrease (dB/s)	35.1
Rate of the S weighting decrease (dB/s)	4.3
Deviation of F&S	-0.1

#### 8. Level Linearity (A-weighting at frequency 1 kHz)

Reference sound level 90.0 dB

Max error at 10dB steps upper reference sound level 0.1 dB

Max error at 1dB steps within 5dB of the upper limit linear operating range 0.0 dB

Max error at 10dB steps below reference sound level 0.1 dB

Max error at 1dB steps within 5dB upper the lower limit linear operating range 0.1 dB

#### 9. Tone burst response (A Weighting) :

Single Toneburst duration /ms	Toneburst response /dB			
	LAFmax-LA	LASmax-LA	LAE-LA	LAeqT-LA
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-7.4	-6.9	-7.0
2	-18.1	-26.9	-26.9	-7.0
0.25	-27.2	/	-36.0	-7.0

#### 10. Peak C sound level (500Hz) :

Cycle	One cycle	nominal value	Positive half	nominal value	Negative half	nominal value
LCpeak-LC(dB)	3.5	3.5	2.4	2.4	2.3	2.4

#### 11. Overload indication: Pass

#### 12. Statistical analysis function

Sweep signal maximum indicated sound level: 112.8 dB

Sweep amplitude: 40 dB

Scan cycle time: 60 S; Measurement period: 180 S.

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
L <sub>Aeq,T</sub>	103.2	103.2	0.0
L <sub>5</sub>	110.8	110.8	0.0
L <sub>10</sub>	108.8	108.8	0.0
L <sub>50</sub>	92.9	92.8	0.1
L <sub>90</sub>	76.9	76.8	0.1
L <sub>95</sub>	75.0	74.9	0.1

Uncertainty of measurement results: 0.4 dB (k=2)

Environment conditions:

Air temperature: 20 °C

Relative humidity: 50 %

Static pressure: 101.8 kPa

Reference equipment used in the calibration:

Description:	Model	Serial No.	Expiry Date	Traceable To
Microphone	B&K 4191	2929405	2024-12-15	NML
Multi function sound calibrator	B&K 4226	2288444	2024-10-15	CIGISMEC
Signal generator	DS 360	33873	2024-10-15	CEPREI

Test specifications:

1. All Scarlet's Sound level Meter has been calibrated in accordance with the requirements as specified in ISO17025 and the lab calibration procedure SMTP004-CA-152.
2. The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.
3. The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responses of the Sound Level Meter.

References:

IEC 61672-3 Sound Level Meters Part 3: Periodic tests





# CERTIFICATE OF CALIBRATION

NO. 20240113132

Name of Product:	Sound Level Meter
Model:	ST-11D
Serial Number:	820892
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2024-01-31
Due Date:	2025-01-29



- I. This report certifies that all calibration equipment used in the test is traceable with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass then, and applies only to the unit identified above.
- II. This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
- III. This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlet Tech Co Ltd Taiwan.

1. Preliminary inspection: OK

2. Type & serial No. of Microphone: AWA14425-55133

3. Adjustments to indicated sound levels:

Type of Calibrator B&K 4231 Sound

Pressure Level 94.0 dB

4. Measuring up limit: 140 dBA

5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests.)

Equivalent Free-field Sound Level (reference environment conditions) 93.8 dB

Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
10	-71.3	-14.4	-0.2	1000	0.0	0.0	-0.1
20	-50.1	-6.2	-0.2	2000	1.3	-0.1	-0.1
31.5	-39.2	-2.6	-0.1	4000	1.1	-0.8	-0.1
63	-26.1	-0.3	-0.2	8000	-1.0	-3.2	0.0
125	-16.2	-0.1	0.1	12500	-11.5	-13.5	0.1
250	-8.7	0.1	-0.1	16000	-11.5	-13.3	0.1
500	-3.2	0.2	-0.2	20000	-23.9	-25.8	-0.1

## 6. Self-generated noise

Microphone replaced by electrical input signal device

9.2 dB(A)	9.9 dB(C)	15.0 dB(Z)
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## 7. F&S Weighting

Rate of the F weighting decrease (dB/s)	35.1
Rate of the S weighting decrease (dB/s)	4.4
Deviation of F&S	-0.1

## 8. Level Linearity (A-weighting at frequency 1 kHz)

Reference sound level 90.0 dB

Max error at 10dB steps upper reference sound level 0.1 dB

Max error at 1dB steps within 5dB of the upper limit linear operating range 0.0 dB

Max error at 10dB steps below reference sound level 0.1 dB

Max error at 1dB steps within 5dB upper the lower limit linear operating range 0.1 dB

## 9. Tone burst response (A Weighting) :

Single Toneburst duration /ms	Toneburst response /dB			
	LAFmax-LA	LASmax-LA	LAE-LA	LAeqT-LA
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-7.4	-6.9	-7.0
2	-18.1	-26.9	-26.9	-7.0
0.25	-27.2	/	-36.0	-7.0

## 10. Peak C sound level (500Hz) :

Cycle	One cycle	nominal value	Positive half	nominal value	Negative half	nominal value
LCpeak-LC(dB)	3.5	3.5	2.4	2.4	2.3	2.4

## 11. Overload indication: Pass

## 12. Statistical analysis function

Sweep signal maximum indicated sound level: 112.8 dB

Sweep amplitude: 40 dB

Scan cycle time: 60 S; Measurement period: 180 S.



Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
LAeq,T	103.2	103.2	0.0
L5	110.8	110.8	0.0
L10	108.8	108.8	0.0
L50	92.9	92.8	0.1
L90	76.9	76.8	0.1
L95	75.0	74.9	0.1

Uncertainty of measurement results: 0.4 dB (k=2)

Environment conditions:

Air temperature: 20 °C

Relative humidity: 50 %

Static pressure: 101.8 kPa

Reference equipment used in the calibration:

Description:	Model	Serial No.	Expiry Date	Traceable To
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Multi function sound calibrator	B&K 4226	2288444	2024-10-15	CIGISMEC
Signal generator	DS 360	33873	2024-10-15	CEPREI

Test specifications:

1. All Scarlet's Sound level Meter has been calibrated in accordance with the requirements as specified in ISO17025 and the lab calibration procedure SMTP004-CA-152.
2. The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of  $\pm 20\%$ .
3. The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responses of the Sound Level Meter.

References:

IEC 61672-3 Sound Level Meters Part 3: Periodic tests



บริษัท สไมล์ แล็บอราทอรี จำกัด

Smile Laboratory Co., Ltd.

563/1 ถนนทองเอก แขวงบางกาวัว เขตภาษีเจริญ กรุงเทพฯ 10160 โทรศัพท์ 02-227-0265 โทรสาร 02-454-0317  
563/1 Thoei Thai Rd., Bangwa, Phasicharoen, Bangkok 10160 Tel. 02-227-0265 Fax. 02-454-0317

## TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

### Site Information

Sampler Location	โครงการ SML-2248-10-67	Date	17 October 2024
Project Site	บริเวณชุมชน หมู่ 4 บ้านสันป่าฝ้าย	Person	Mr. Sirichai Tanseesang

### Calibration Orifice

Transfer Standard Type	Orifice	$Q_{std}$ Slope (m)	2.10372
Calibrator Model	TE-5025A	$Q_{std}$ Intercept (b)	-0.03890
Calibrator Serial Number	3092		

### Calibration Information

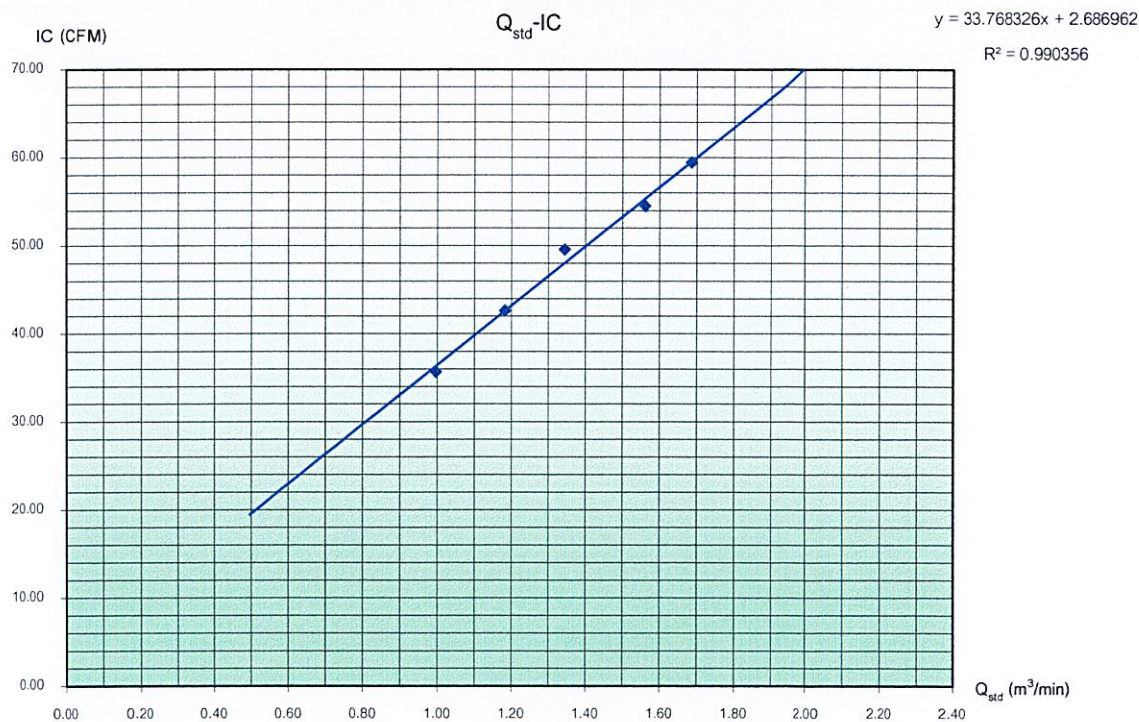
Sampler Number	TSP No.01	Motor Serial Number	1203-415	Recorder Serial Number	607
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Test No.	Pressure Drop Across Orifice ( $\Delta H_2O$ ) (inH <sub>2</sub> O)			(A)	(X)	(I)	(Y)	Temperature ( $^{\circ}K = ^{\circ}C + 273$ )	Barometric Pressure (mmHg)
	Positive	Negative	$\Delta H_2O$	$[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m <sup>3</sup> /min)	Sample Flow Rate Indication (ft <sup>3</sup> /min)	$IC = I[(P_a/P_{std})(T_{std}/T_a)]^{1/2}$ (ft <sup>3</sup> /min)		
1	2.2	2.1	4.30	2.05646	0.99603	36.0	35.70	303.0	760.0
2	3.2	2.9	6.10	2.44936	1.18279	43.0	42.64	303.0	760.0
3	4.1	3.8	7.90	2.78741	1.34348	50.0	49.59	303.0	760.0
4	5.4	5.3	10.70	3.24398	1.56051	55.0	54.54	303.0	760.0
5	6.3	6.2	12.50	3.50624	1.68518	60.0	59.50	303.0	760.0
Average								303.0	760.0

Linear Regression :  $y = mX + b$

Slope (m)	33.768326
Intercept (b)	2.686962
R-Square ( $R^2$ )	0.990356
Correlation Coefficient (r)	0.995166

Andersen Instruments, Inc.



Calibrated By

SMILE  
Laboratory Co., Ltd.





บริษัท สไมล์ แล็บอราทอรี จำกัด

Smile Laboratory Co., Ltd.

563/1 ถนนทองหล่อ แขวงบางกะปิ เขตปทุมธานี กรุงเทพฯ 10160 โทรศัพท์ 02-227-0265 โทรสาร 02-454-0317  
563/1 Thoei Thai Rd., Bangwa, Phasicharoen, Bangkok 10160 Tel. 02-227-0265 Fax. 02-454-0317

## PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

### Site Information

Sampler Location	โครงการ SML-2248-10-67	Date	17 October 2024
Project Site	บริเวณชุมชน หมู่ 4 บ้านสันป่าฝ้าย	Person	Mr. Sirichai Tanseesang

### Calibration Orifice

Transfer Standard Type	Orifice	$Q_{std}$ Slope (m)	2.10372
Calibrator Model	TE-5025A	$Q_{std}$ Intercept (b)	-0.03890
Calibrator Serial Number	3092		

### Calibration Information

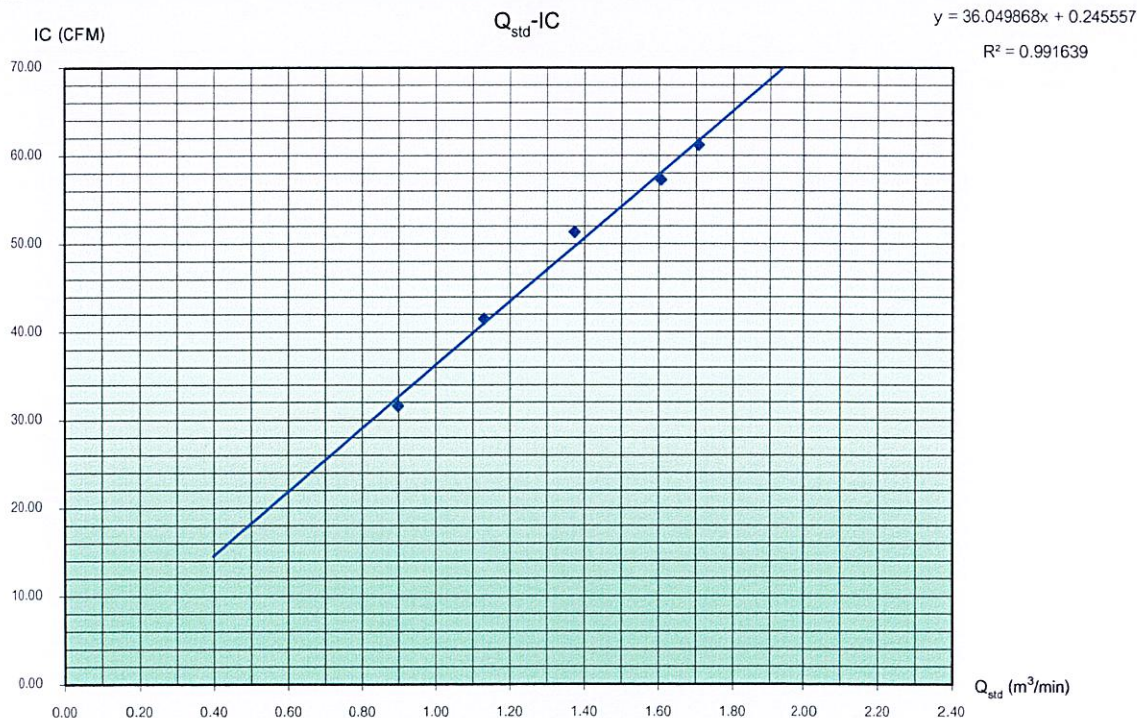
Sampler Number	PM10 No.01	Motor Serial Number	1203-449	Recorder Serial Number	624
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Test No.	Pressure Drop Across Orifice ( $\Delta H_2O$ ) (inH <sub>2</sub> O)			(A)	(X)	(I)	(Y)	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
	Positive	Negative	$\Delta H_2O$	$[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m <sup>3</sup> /min)	Sample Flow Rate Indication (ft <sup>3</sup> /min)	$IC = I[(P_a/P_{std})(T_{std}/T_a)]^{1/2}$ (ft <sup>3</sup> /min)		
1	1.8	1.7	3.50	1.84924	0.89752	32.0	31.63	305.0	760.0
2	2.9	2.7	5.60	2.33912	1.13039	42.0	41.52	305.0	760.0
3	4.2	4.1	8.30	2.84772	1.37215	52.0	51.40	305.0	760.0
4	5.8	5.6	11.40	3.33742	1.60493	58.0	57.33	305.0	760.0
5	6.5	6.4	12.90	3.55020	1.70607	62.0	61.28	305.0	760.0
Average								305.0	760.0

Linear Regression :  $y = mX + b$

Slope (m)	36.049868
Intercept (b)	0.245557
R-Square ( $R^2$ )	0.991639
Correlation Coefficient (r)	0.995811

Andersen Instruments, Inc.



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## TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

### Site Information

Sampler Location	โครงการ SML-2248-10-67	Date	17 October 2024
Project Site	โรงเรียนบ้านช่องกอม่วง	Person	Mr. Sirichai Tanseesang

### Calibration Orifice

Transfer Standard Type	Orifice	$Q_{std}$ Slope (m)	2.10372
Calibrator Model	TE-5025A	$Q_{std}$ Intercept (b)	-0.03890
Calibrator Serial Number	3092		

### Calibration Information

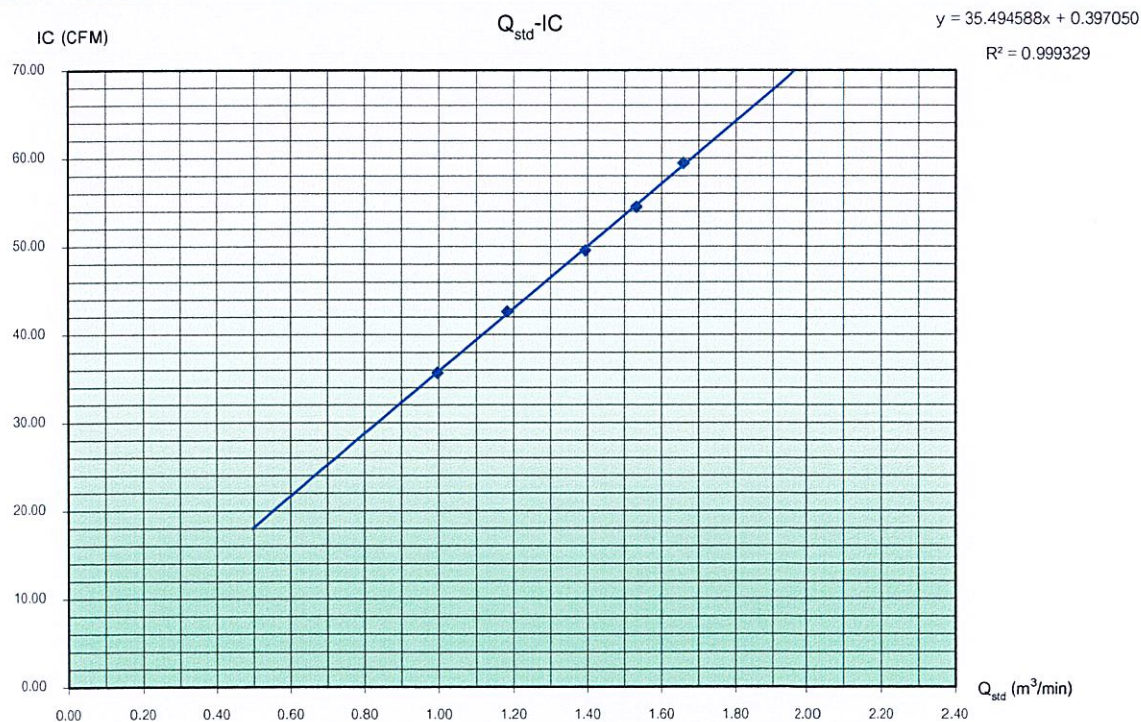
Sampler Number	TSP No.02	Motor Serial Number	1203-421	Recorder Serial Number	608
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Test No.	Pressure Drop Across Orifice ( $\Delta H_2O$ ) (inH <sub>2</sub> O)			(A)	(X)	(I)	(Y)	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
	Positive	Negative	$\Delta H_2O$	$[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m <sup>3</sup> /min)	Sample Flow Rate Indication (ft <sup>3</sup> /min)	$IC = I[(P_a/P_{std})(T_{std}/T_a)]^{1/2}$ (ft <sup>3</sup> /min)		
1	2.2	2.1	4.30	2.05646	0.99603	36.0	35.70	303.0	760.0
2	3.1	3.0	6.10	2.44936	1.18279	43.0	42.64	303.0	760.0
3	4.3	4.2	8.50	2.89132	1.39288	50.0	49.59	303.0	760.0
4	5.2	5.1	10.30	3.18277	1.53142	55.0	54.54	303.0	760.0
5	6.1	6.0	12.10	3.44969	1.65829	60.0	59.50	303.0	760.0
Average								303.0	760.0

Linear Regression :  $y = mX + b$

Slope (m)	35.494588
Intercept (b)	0.397050
R-Square ( $R^2$ )	0.999329
Correlation Coefficient (r)	0.999664

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563/1 Thoei Thai Rd., Bangwa, Phasicharoen, Bangkok 10160 Tel. 02-227-0265 Fax. 02-454-0317

## PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

### Site Information

Sampler Location	โครงการ SML-0155-02-67	Date	17 October 2024
Project Site	โรงเรียนบ้านช่องจอม่วง	Person	Mr. Sirichai Tanseesang

### Calibration Orifice

Transfer Standard Type	Orifice	$Q_{std}$ Slope (m)	2.10372
Calibrator Model	TE-5025A	$Q_{std}$ Intercept (b)	-0.03890
Calibrator Serial Number	3092		

### Calibration Information

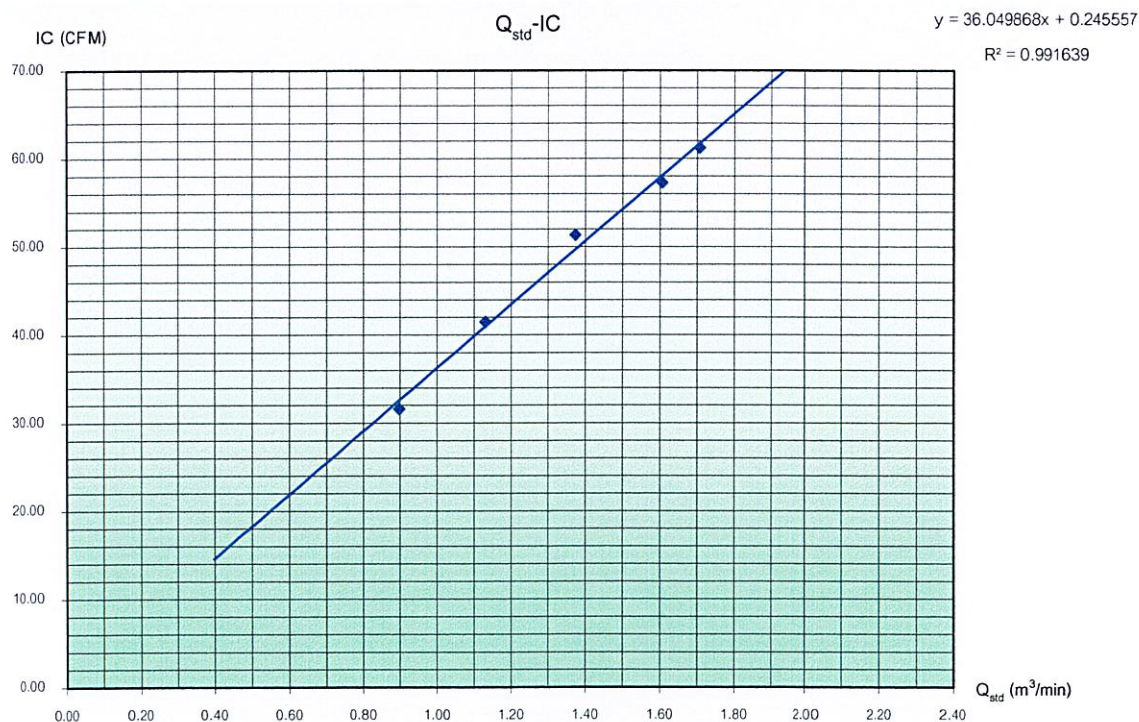
Sampler Number	PM10 No.02	Motor Serial Number	1203-452	Recorder Serial Number	625
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Test No.	Pressure Drop Across Orifice ( $\Delta H_2O$ ) (inH <sub>2</sub> O)			(A)	(X)	(I)	(Y)	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
	Positive	Negative	$\Delta H_2O$	$[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m <sup>3</sup> /min)	Sample Flow Rate Indication (ft <sup>3</sup> /min)	$IC = I[(P_a/P_{std})(T_{std}/T_a)]^{1/2}$ (ft <sup>3</sup> /min)		
1	1.8	1.7	3.50	1.84924	0.89752	32.0	31.63	305.0	760.0
2	2.9	2.7	5.60	2.33912	1.13039	42.0	41.52	305.0	760.0
3	4.2	4.1	8.30	2.84772	1.37215	52.0	51.40	305.0	760.0
4	5.8	5.6	11.40	3.33742	1.60493	58.0	57.33	305.0	760.0
5	6.5	6.4	12.90	3.55020	1.70607	62.0	61.28	305.0	760.0
Average								305.0	760.0

Linear Regression :  $y = mX + b$

Slope (m)	36.049868
Intercept (b)	0.245557
R-Square ( $R^2$ )	0.991639
Correlation Coefficient (r)	0.995811

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563/1 Thoei Thai Rd., Bangwa, Phasicharoen, Bangkok 10160 Tel. 02-227-0265 Fax. 02-454-0317

## TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

### Site Information

Sampler Location	โครงการ SML-2248-10-67	Date	17 October 2024
Project Site	วัดวังทอง	Person	Mr. Sirichai Tanseesang

### Calibration Orifice

Transfer Standard Type	Orifice	Q <sub>std</sub> Slope (m)	2.10372
Calibrator Model	TE-5025A	Q <sub>std</sub> Intercept (b)	-0.03890
Calibrator Serial Number	3092		

### Calibration Information

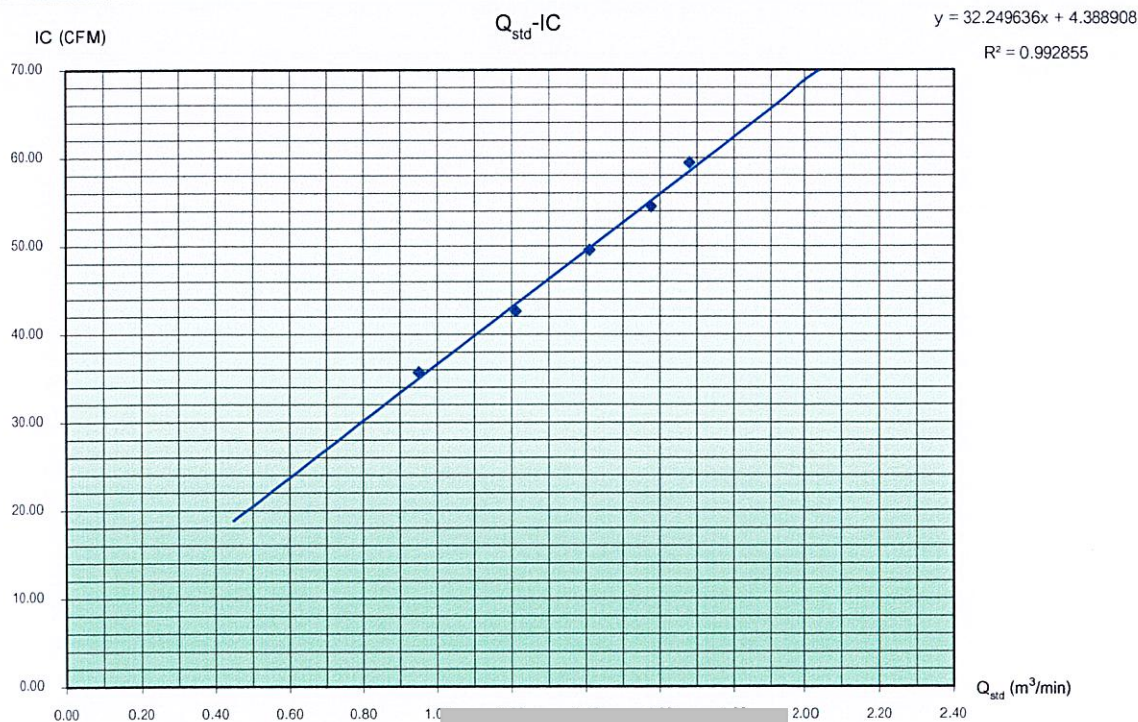
Sampler Number	TSP No.03	Motor Serial Number	1203-426	Recorder Serial Number	609
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Test No.	Pressure Drop Across Orifice ( $\Delta H_2O$ ) (inH <sub>2</sub> O)			(A)	(X)	(I)	(Y)	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
	Positive	Negative	$\Delta H_2O$	$[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	Q <sub>std</sub> = (1/m)[(A-b)] (m <sup>3</sup> /min)	Sample Flow Rate Indication (ft <sup>3</sup> /min)	IC = I[(P <sub>a</sub> /P <sub>std</sub> )(T <sub>std</sub> /T <sub>a</sub> )] <sup>1/2</sup> (ft <sup>3</sup> /min)		
1	2.0	1.9	3.90	1.95848	0.94945	36.0	35.70	303.0	760.0
2	3.3	3.1	6.40	2.50886	1.21107	43.0	42.64	303.0	760.0
3	4.4	4.3	8.70	2.92514	1.40895	50.0	49.59	303.0	760.0
4	5.5	5.4	10.90	3.27416	1.57486	55.0	54.54	303.0	760.0
5	6.3	6.1	12.40	3.49219	1.67850	60.0	59.50	303.0	760.0
Average								303.0	760.0

Linear Regression : y= mX + b

Slope (m)	32.249636
Intercept (b)	4.388908
R-Square (R <sup>2</sup> )	0.992855
Correlation Coefficient (r)	0.996421

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## PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

### Site Information

Sampler Location	โครงการ SML-2248-10-67	Date	17 October 2024
Project Site	วัดวังทอง	Person	Mr. Sirichai Tanseesang

### Calibration Orifice

Transfer Standard Type	Orifice	$Q_{std}$ Slope (m)	2.10372
Calibrator Model	TE-5025A	$Q_{std}$ Intercept (b)	-0.03890
Calibrator Serial Number	3092		

### Calibration Information

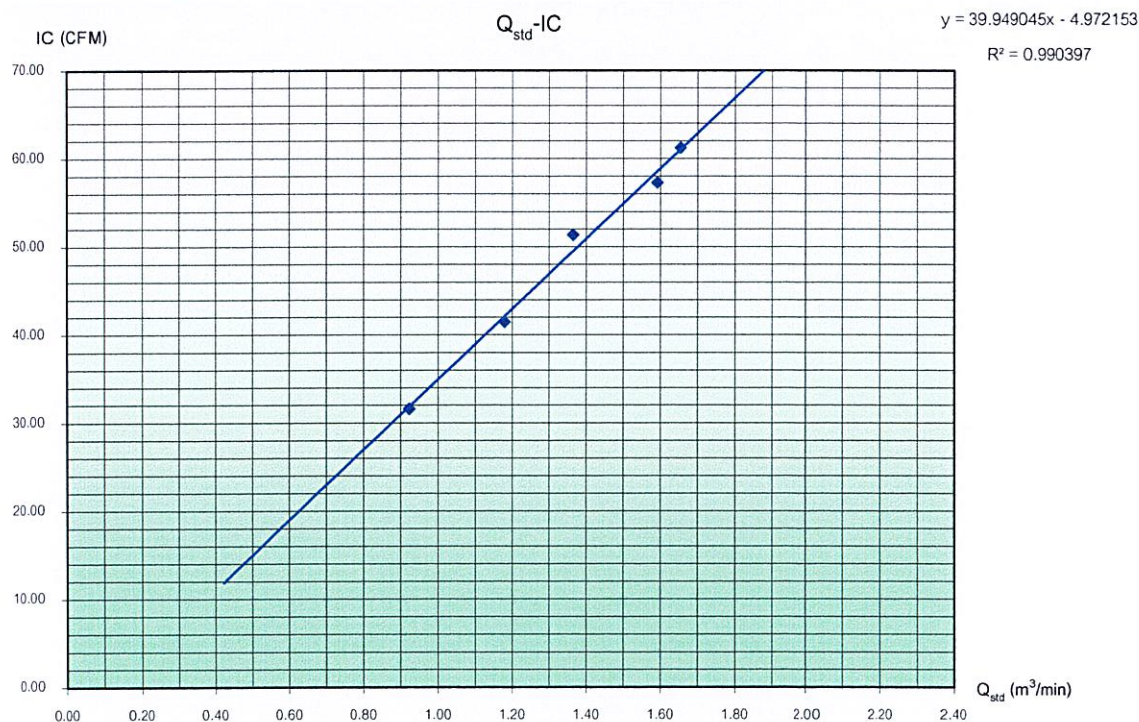
Sampler Number	PM10 No.03	Motor Serial Number	1203-445	Recorder Serial Number	626
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Test No.	Pressure Drop Across Orifice ( $\Delta H_2O$ ) (inH <sub>2</sub> O)			(A)	(X)	(I)	(Y)	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
	Positive	Negative	$\Delta H_2O$	$[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m <sup>3</sup> /min)	Sample Flow Rate Indication (ft <sup>3</sup> /min)	$IC = I[(P_a/P_{std})(T_{std}/T_a)]^{1/2}$ (ft <sup>3</sup> /min)		
1	1.9	1.8	3.70	1.90134	0.92229	32.0	31.63	305.0	760.0
2	3.1	3.0	6.10	2.44131	1.17896	42.0	41.52	305.0	760.0
3	4.2	4.0	8.20	2.83051	1.36397	52.0	51.40	305.0	760.0
4	5.7	5.5	11.20	3.30801	1.59095	58.0	57.33	305.0	760.0
5	6.1	6.0	12.10	3.43836	1.65291	62.0	61.28	305.0	760.0
Average								305.0	760.0

Linear Regression :  $y = mX + b$

Slope (m)	39.949045
Intercept (b)	4.972153
R-Square ( $R^2$ )	0.990397
Correlation Coefficient (r)	0.995187

Andersen Instruments, Inc.



Calibrated By

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## Analyzer Performance Test

Calibrated Date: 17 October 2024

### Instruments Information

Analyzer Type: SO <sub>2</sub> Analyzer	Manufacturer: Thermo Environmental
Model: 43C	S/N: 250818

### Calibration System

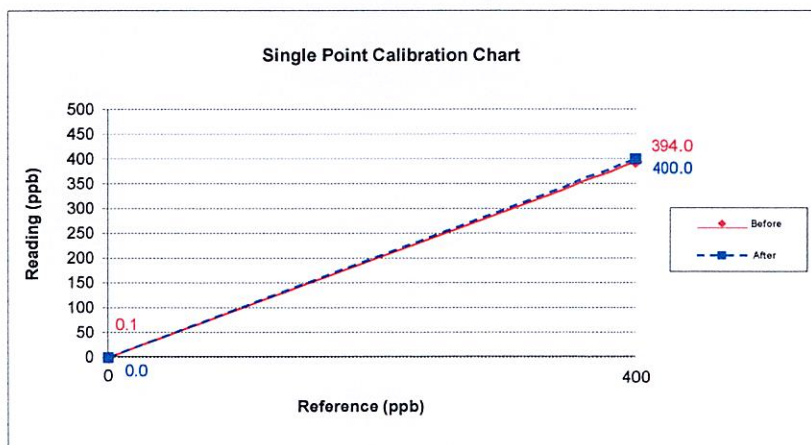
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008	NO Conc 46.05 ppm
S/N: 705	SO <sub>2</sub> Conc 46.01 ppm
ZERO AIR Generator API MODEL 701	CO Conc 4,487 ppm
S/N: 1924	Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

### Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	0.1	0.1	400.0	394.0	-1.5
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :







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ENVIR SERVICE CO., LTD.

## บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201  
42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

### Analyzer Performance Test

Calibrated Date: 17 October 2024

#### Instruments Information

Analyzer Type: NO/NO <sub>2</sub> /NO <sub>x</sub> Analyzer Model: APNA-360	Manufacturer: Horiba Environmental S/N: 8517870112
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#### Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 46.05 ppm SO <sub>2</sub> Conc 46.01 ppm CO Conc 4,487 ppm Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

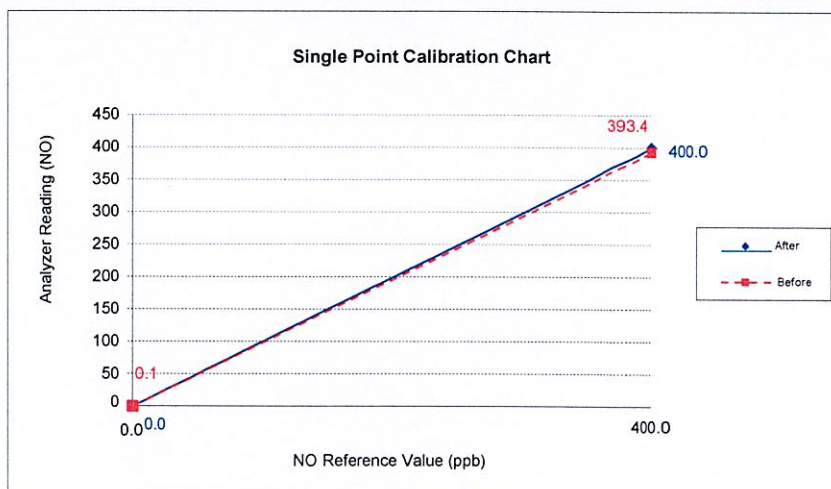
Humidity: 51 %RH

#### Calibration Check ( Before adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.4	400.0	-1.7
NO <sub>x</sub>	0.1	0.0	0.1	400.0	400.0	0.0

#### Calibration Check ( After adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NO <sub>x</sub>	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By

## Analyzer Performance Test

Calibrated Date: 17 October 2024

### Instruments Information

Analyzer Type: SO <sub>2</sub> Analyzer	Manufacturer: API Environmental
Model: 100A	S/N: 1618

### Calibration System

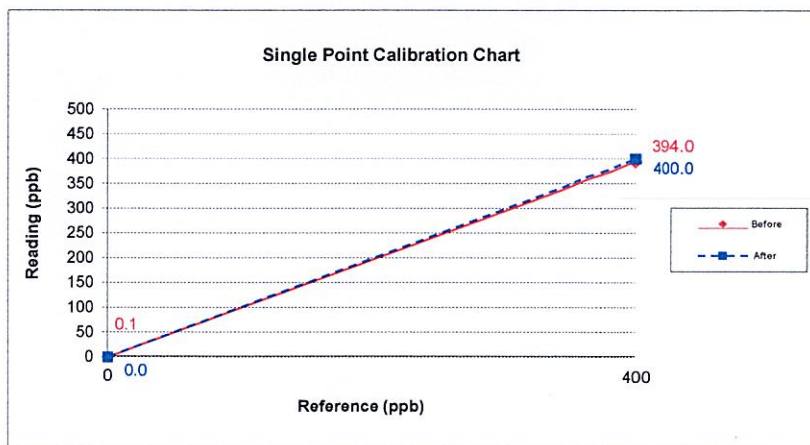
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008	NO Conc 46.05 ppm
S/N: 705	SO <sub>2</sub> Conc 46.01 ppm
ZERO AIR Generator API MODEL 701	CO Conc 4,487 ppm
S/N: 1924	Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

### Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	0.1	0.1	400.0	394.0	-1.5
After	0.0	0.0	0.0	400.0	400.0	0.0



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ENVIR SERVICE CO., LTD.

## บริษัท เอ็นไวร์ เซอร์วิส จำกัด

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42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

### Analyzer Performance Test

Calibrated Date: 17 October 2024

#### Instruments Information

Analyzer Type: NO/NO <sub>2</sub> /NO <sub>x</sub> Analyzer	Manufacturer: API Environmental
Model: 200A	S/N: 612

#### Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008	NO Conc 46.05 ppm
S/N: 705	SO <sub>2</sub> Conc 46.01 ppm
ZERO AIR Generator API Model 701	CO Conc 4,487 ppm
S/N: 1924	Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

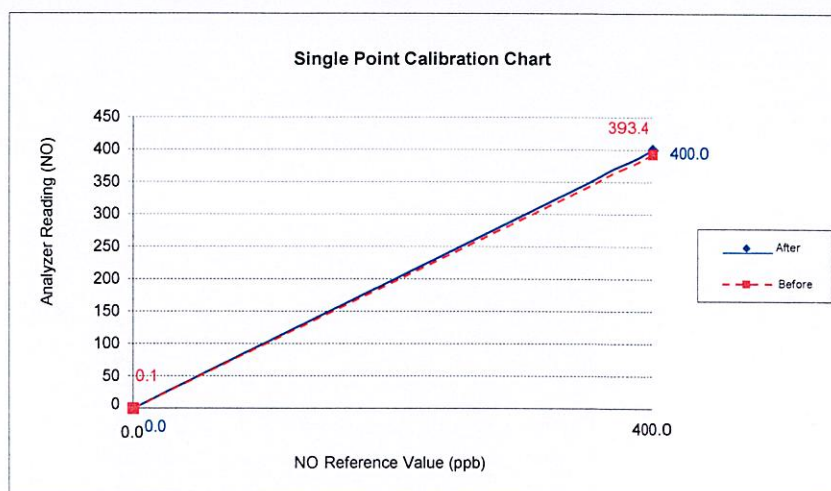
Humidity: 51 %RH

#### Calibration Check ( Before adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.4	400.0	-1.7
NO <sub>x</sub>	0.1	0.0	0.1	400.0	400.0	0.0

#### Calibration Check ( After adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NO <sub>x</sub>	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By

## Analyzer Performance Test

Calibrated Date: 17 October 2024

### Instruments Information

Analyzer Type: SO <sub>2</sub> Analyzer	Manufacturer: API Environmental
Model: 100A	S/N: 1810

### Calibration System

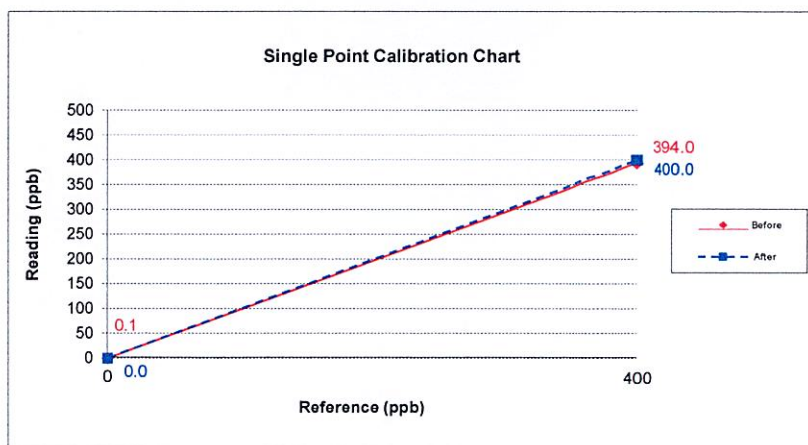
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008	NO Conc 46.05 ppm
S/N: 705	SO <sub>2</sub> Conc 46.01 ppm
ZERO AIR Generator API MODEL 701	CO Conc 4,487 ppm
S/N: 1924	Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

### Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	0.1	0.1	400.0	394.0	-1.5
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate





บริษัท เอ็นไวร์ เซอร์วิส จำกัด  
ENVIR SERVICE CO., LTD.

## บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201  
42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

### Analyzer Performance Test

Calibrated Date: 17 October 2024

#### Instruments Information

Analyzer Type: NO/NO <sub>2</sub> /NO <sub>x</sub> Analyzer	Manufacturer: TELEDYNE INSTRUMENTS
Model: 200A	S/N: 2609

#### Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008	NO Conc 46.05 ppm
S/N: 705	SO <sub>2</sub> Conc 46.01 ppm
ZERO AIR Generator API Model 701	CO Conc 4,487 ppm
S/N: 1924	Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

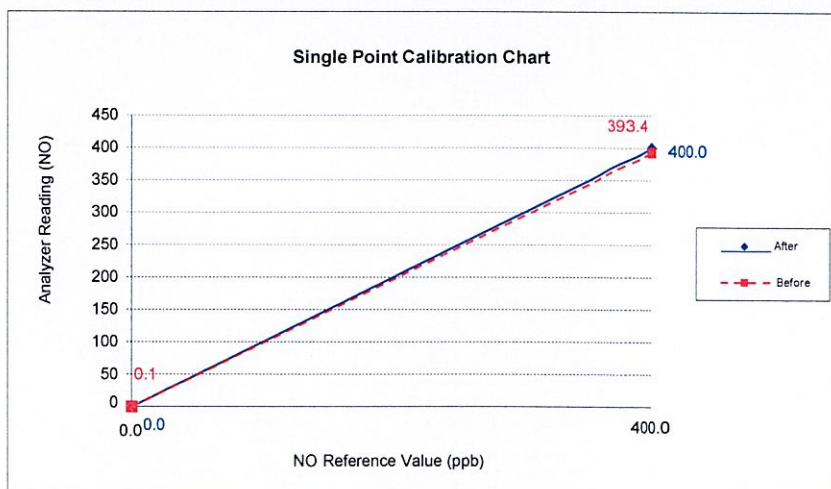
Humidity: 51 %RH

#### Calibration Check ( Before adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.4	400.0	-1.7
NO <sub>x</sub>	0.1	0.0	0.1	400.0	400.0	0.0

#### Calibration Check ( After adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NO <sub>x</sub>	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By



## Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 17 October 2024

Certificate No. 114/21

Page : 1 of 2

Manufacture Yong Instruments

Type four blade helicoid propeller

Model No. 05103

Mfg Code Logger 30908794

Transmitter -

Customer ENVIR SERVICE CO., LTD.

42 Raminthra 14 yeak 9, Tha Raeng,

Bangkhen, Bangkok 10230

Calibration Condition : Temperature

25.2 °C

Barometric Pressure

1012.8 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425

: Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV

(sensor TR-90AH)

Serial Number 110730029

(sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER

: Theodor Friedrich : Dry No. 8390/94 Wet No. 8389/94

: Thermoschneider No. 918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type RTB220 No. V1220015

Calibrated by :





## The Result of Calibration

Date of Issue 17 October 2024

Certificate No. 114/21

Page : 2 of 2

Standard	HOOK GAGE NO 1425			TESTED ANEMOMETER			
	Pressure	Vacuum	Pressure	Pressure	Correction	Velocity	Correction
Ultrasonic Anemometer m/sec	inches	inches	hPa	hPa	hPa	m/sec	m/sec
1.00	-	-	-	-	-	0.7	0.30
3.02	-	-	-	-	-	2.7	0.32
5.04	-	-	-	-	-	4.8	0.24
7.03	-	-	-	-	-	6.7	0.33
9.01	-	-	-	-	-	8.7	0.31
11.03	-	-	-	-	-	10.7	0.33
13.01	-	-	-	-	-	12.4	0.61
15.03	-	-	-	-	-	14.1	0.93
17.05	-	-	-	-	-	16.4	0.65
20.02	-	-	-	-	-	19.1	0.92

Wind Aloft Plotting Board.	
US. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :



## Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 17 October 2024

Certificate No. 114/21

Page : 1 of 2

Manufacture Yong Instruments

Type four blade helicoid propeller

Model No. 05103

Mfg Code Logger 30908233

Transmitter -

Customer ENVIR SERVICE CO., LTD.

42 Raminthra 14 yeak 9, Tha Raeng,

Bangkhen, Bangkok 10230

Calibration Condition : Temperature 25.2 °C Barometric Pressure 1012.8 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER : Theodor Friedrich : Dry No. 8390/94 Wet No. 8389/94

: Thermoschneider No. 918802

STANDARD BAROMETER : Digital Barometer Vaisala Type RTB220 No. V1220015

Calibrated by :





## The Result of Calibration

Date of Issue 17 October 2024

Certificate No. 114/21

Page : 2 of 2

Standard	HOOK GAGE NO 1425			TESTED ANEMOMETER			
	Pressure	Vacuum	Pressure	Pressure	Correction	Velocity	Correction
Ultrasonic Anemometer m/sec	inches	inches	hPa	hPa	hPa	m/sec	m/sec
1.00	-	-	-	-	-	0.7	0.30
3.02	-	-	-	-	-	2.7	0.32
5.04	-	-	-	-	-	4.8	0.24
7.03	-	-	-	-	-	6.7	0.33
9.01	-	-	-	-	-	8.7	0.31
11.03	-	-	-	-	-	10.7	0.33
13.01	-	-	-	-	-	12.4	0.61
15.03	-	-	-	-	-	14.1	0.93
17.05	-	-	-	-	-	16.4	0.65
20.02	-	-	-	-	-	19.1	0.92

Wind Aloft Plotting Board.	
US. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by



## Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 17 October 2024

Certificate No. 114/21

Page : 1 of 2

Manufacture Yong Instruments

Type four blade helicoid propeller

Model No. 05103

Mfg Code Logger 30908695

Transmitter -

Customer ENVIR SERVICE CO., LTD.

42 Raminthra 14 yeak 9, Tha Raeng,

Bangkhen, Bangkok 10230

Calibration Condition : Temperature

25.2 °C

Barometric Pressure

1012.8 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425

: Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV

(sensor TR-90AH)

Serial Number 110730029

(sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER

: Theodor Friedrich : Dry No. 8390/94 Wet No. 8389/94

: Thermoschneider No. 918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type RTB220 No. V1220015

Calibrated by :





## The Result of Calibration

Date of Issue 17 October 2024

Certificate No. 114/21

Page : 2 of 2

Standard	HOOK GAGE NO 1425			TESTED ANEMOMETER			
	Pressure	Vacuum	Pressure	Pressure	Correction	Velocity	Correction
Ultrasonic Anemometer m/sec	inches	inches	hPa	hPa	hPa	m/sec	m/sec
1.00	-	-	-	-	-	0.7	0.30
3.02	-	-	-	-	-	2.7	0.32
5.04	-	-	-	-	-	4.8	0.24
7.03	-	-	-	-	-	6.7	0.33
9.01	-	-	-	-	-	8.7	0.31
11.03	-	-	-	-	-	10.7	0.33
13.01	-	-	-	-	-	12.4	0.61
15.03	-	-	-	-	-	14.1	0.93
17.05	-	-	-	-	-	16.4	0.65
20.02	-	-	-	-	-	19.1	0.92

Wind Aloft Plotting Board.	
US. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :



## MAINTENANCE REPORT AND IPV TEST CERTIFICATE

### OPTIMA 8000

<b>Customer :</b> ECO Consultant <b>Address :</b> 13 32/13 หมู่ 4 ตำบล ท้ายเกาะ อำเภอสามโคก ปทุมธานี <b>User Name:</b> Koofa <b>Phone:</b> <b>Fax:</b>	<b>Date Tested:</b> September 17, 2024 <b>Recommendation Recertification Period</b> 6 <b>Recertification Due:</b> September 2, 2025 <b>Date Last Certified:</b> NA <b>Visit Number:</b> 1 of 2 <b>PerkinElmer Phone:</b> 02-719-6420 ext 206 <b>PerkinElmer Fax:</b> 02-318-5597
--	--

#### CONFIGURATION TESTED

<b>MODEL</b>	<b>SERIAL NUMBER</b>
OPTIMA 8000	078N1408041C

#### TESTED EQUIPMENT

IPV Methods

#### TEST STANDARD USED

Mixed standard 1/10  
Mixed standard 1/100

#### CUSTOMER SUPPLIED

2 % HNO3  
10 % HNO3

#### CALIBRATION NUMBER

#### PART NUMBER

N069-1579  
N930-0221

#### COMMENTS

#### ACCESSORIES/COMPONENT NOT INCLUDED

WinLab32 Version 5.5.0.0714

#### EXPIRATION

#### EXPIRATION DATE

JUN 30, 2025  
NOV 30, 2024

#### CUSTOMER INITIALS



## MAINTENANCE REPORT AND IPV TEST CERTIFICATE

### OPTIMA 8000

SERIAL NUMBER : 078N1408041CDATE TESTED : September 17, 2024**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

B. Inspect and replace as necessary, all torch components including the RF coil.

☐ OK

C. Inspect all tubing for sign of clacking or leaking.

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purge filters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every six months.

☐ OK**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK

## MAINTENANCE REPORT AND IPV TEST CERTIFICATE

### OPTIMA 8000

**SERIAL NUMBER :** 078N1408041C
**DATE TESTED :** September 17, 2024

PARAMETER	SPECIFICATION		FINAL VALUE
<b>Spectral Resolution : UV</b>	<b>As</b> 193.696 nm	$\leq 0.009$	<u>0.00776</u>
	<b>Ni</b> 231.604 nm	$\leq 0.011$	<u>0.00878</u>
	<b>Ni</b> 341.476 nm	$\leq 0.015$	<u>0.01360</u>
<b>Spectral Resolution : VIS</b>	<b>Ba</b> 455.403 nm	$\leq 0.020$	<u>0.01614</u>
<b>Precision</b>			
	<b>Zn</b> 206.200 nm	% RSD $\leq 1.0$	<u>0.83</u>
	<b>Mg</b> 280.271 nm	% RSD $\leq 1.0$	<u>0.79</u>
	<b>Mg</b> 285.213 nm	% RSD $\leq 1.0$	<u>0.71</u>
	<b>Ba</b> 455.403 nm	% RSD $\leq 1.0$	<u>0.67</u>
<b>Detection Limits : Axial</b>	<b>As</b> 193.696 nm	3(SD) ppb	<u>5.96</u>
	<b>Se</b> 196.026 nm	3(SD) ppb	<u>7.01</u>
	<b>Tl</b> 190.801 nm	3(SD) ppb	<u>7.45</u>
	<b>Pb</b> 220.353 nm	3(SD) ppb	<u>0.77</u>
<b>Detection Limits : Radial</b>	<b>As</b> 193.696 nm	3(SD) ppb	<u>40.81</u>
	<b>Zn</b> 213.857 nm	3(SD) ppb	<u>0.71</u>
	<b>Mn</b> 257.610 nm	3(SD) ppb	<u>0.05</u>
	<b>La</b> 379.478 nm	3(SD) ppb	<u>0.45</u>
	<b>Ba</b> 455.403 nm	3(SD) ppb	<u>0.05</u>
	<b>Ba</b> 493.408 nm	3(SD) ppb	<u>0.05</u>
<b>BEC : Axial (IB X 1000)/(IS-IB)</b>	<b>Mn</b> 257.610 nm	$\leq 30$ ppb	<u>4.86</u>
<b>BEC : Radial (IB X 1000)/(IS-IB)</b>	<b>Mn</b> 257.610 nm	$\leq 30$ ppb	<u>12.32</u>





**MAINTENANCE REPORT AND IPV TEST CERTIFICATE**  
**OPTIMA 8000**

**SERIAL NUMBER :** 078N1408041C

**DATE TESTED :** September 17, 2024

**Remarks :**

Commissioning follow as commissioning performance sheets.

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

**Service Department PerkinElmer Ltd.**

**Authorized Representative :**

(  )

Customer Support Engineer



# Certificate of Completion

*This certifies that*

**Khwanchai Siangwong**

*Has successfully completed*

**ICP Optima 8000 & Optima 2000/4000/7000 DV**

Completed on 4/17/2021 02:54 PM Eastern/New York

**Certified By: Fred Rubino**

**Global Training Leader**

Print Date May 24, 2021, 10:44 AM

*This Certificate has been generated electronically from PerkinElmer Learning Management System, LMS ES-009-000, 0-05-55-11.*



# PerkinElmer TruQ

Atomic Spectroscopy Standard



## Certificate of Analysis

**PerkinElmer Number:** N9300221

**Description:** Instrument Calibration Standard 4

**Matrix:** 5% HNO<sub>3</sub>

**Lot Number:** 59-091CRY1

**Certification Date:** MAY -- 2023

**Expiration Date:** NOV 30 2024

### \* Instrumental Analysis using ICP Spectrometer:

Analyte	Labeled	Measured	SRM	Analyte	Labeled	Measured	SRM
As	100 µg/mL	100 µg/mL	3103a <sup>†</sup>	Pb	50.0 µg/mL	49.8 µg/mL	3128*
Tl	100 µg/mL	100 µg/mL	3158*	Se	50.0 µg/mL	50.1 µg/mL	3149*
Cd	50.0 µg/mL	50.0 µg/mL	3108*				

\* - indicates NIST SRM

† - indicates CRM (when NIST SRM is not available)

Reference Multi: Lot# 54-134CR, 57-156CR, 58-169CR

Refer to side 2 for details of certification.

Balances are calibrated with weight sets traceable to NIST.

We guarantee that our PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to  $\pm 0.5\%$  of certified concentration until the expiration date, provided the standards are kept tightly capped and stored under normal laboratory conditions. This value is the sum of cumulative errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions we use high purity acids, ASTM Type I water (18 megohm double deionized), and leached, triple-rinsed bottles. All glassware used is class A.



Certifying Officer: 

PerkinElmer

PerkinElmer, Inc.

U.S.A. Tel: 1-203-925-4600

U.S.A. Toll Free: 1-800-762-4000

Visit [www.perkinelmer.com/lasoffices](http://www.perkinelmer.com/lasoffices) for a complete listing of our global offices.

# PerkinElmer TruQ

Atomic Spectroscopy Standard



## Certificate of Analysis

**PerkinElmer Number:** N0691579  
**Description:** Multi-Element Standard  
**Matrix:** 2% HNO<sub>3</sub>  
**Lot Number:** 61-176CRX1

**Certification Date:** DEC -- 2023  
**Expiration Date:** JUN 30 2025

### \* Instrumental Analysis using ICP Spectrometer:

Analyte	Labeled	Measured	SRM	Analyte	Labeled	Measured	SRM
As	50.0 µg/mL	50.3 µg/mL	3103a*	Ni	10.0 µg/mL	10.1 µg/mL	3136*
K	50.0 µg/mL	49.6 µg/mL	3141a*	Sr	10.0 µg/mL	10.0 µg/mL	3153a*
La	10.0 µg/mL	9.92 µg/mL	3127a*	Zn	10.0 µg/mL	10.0 µg/mL	3168a*
Li	10.0 µg/mL	10.1 µg/mL	3129a*	Ba	1.00 µg/mL	1.01 µg/mL	3104a*
Mn	10.0 µg/mL	10.1 µg/mL	3132*	Mg	1.00 µg/mL	1.01 µg/mL	3131a*

\* - indicates NIST SRM

† - indicates CRM (when NIST SRM is not available)

Reference Multi: Lot# 60-210CR, 60-053CR

Refer to side 2 for details of certification.

Balances are calibrated with weight sets traceable to NIST.

We guarantee that our PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to  $\pm 0.5\%$  of certified concentration until the expiration date, provided the standards are kept tightly capped and stored under normal laboratory conditions. This value is the sum of cumulative errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions we use high purity acids, ASTM Type I water (18 megohm double deionized), and leached, triple-rinsed bottles. All glassware used is class A.



**PerkinElmer®**

Certifying Officer: 

**PerkinElmer, Inc.**

U.S.A. Tel: 1-203-925-4600  
U.S.A. Toll Free: 1-800-762-4000

Visit [www.perkinelmer.com/lasoffices](http://www.perkinelmer.com/lasoffices) for a complete listing of our global offices.



## Service Report

Work Order Number	Activity Code	Billing Type	Requested Start Date	Model	Serial Number
WO-02905676	Planned Maintenance	Contract	11/07/2567 9:09 น.	ICPN0780011	078S1408041C
Service Representative Name	Contract Number	Expiry Date	Equipment ID	System ID	
Siangwong, Khwanchai	SC-0035629322	06/08/2026	N/A	N/A	
UDI Number					
N/A					
Equipment Location			Bill To Name		
บริษัท ฮีโด้ คอนซัลแทนท์ จำกัด อำเภอสามโคก จังหวัดปทุมธานี 37 12160 TH			บริษัท ฮีโด้ คอนซัลแทนท์ จำกัด อำเภอสามโคก จังหวัดปทุมธานี 37 12160 TH		
Customer Contact	Phone Number	Fax Number	Email	Purchase Order	
Koofa Premjompattana	080 6285118	N/A	koofa@foresee-corp.com	ECO350/66	

Work Description		
<ul style="list-style-type: none"> <li>- Clean sample introduction, mirror, lens, instrument exterior</li> <li>- Check Gas System in pneumatic gas control - work normally</li> <li>- Perform instrument test - pass</li> </ul>		
Start Date	End Date	Work Description
17/09/2024	17/09/2024	
17/09/2024	17/09/2024	

Tools Used					
Quantity	Calibrated Tool	Description	Serial Number	Last Calibration Date	Next Calibration Date
*** No Calibrated Tools Used ***					

Material Used				
Part Number	Part Description	Note	Lot/Serial Number	Quantity
*** No Parts Used ***				

Labour Details				
Part Number	Part Description	Start Date	Quantity	
SV000013	Preventative maintenance	17/09/2024	4	
SV000004	Service F.O.C. Travel	17/09/2024	2	

Work Complete Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> PM/OQ/IPV Left with Customer Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Customer Signature  17/9/2567 Koofa Premjompattana	Technician Signature  17/9/2567 Siangwong, Khwanchai
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#### Terms & Conditions

Customer Acknowledgment of receipt of the above repair / replacement.

Special Terms and Conditions: This is not an invoice.

Taxes will be applied to your invoice if applicable.



# MAINTENANCE AND IPV TEST CERTIFICATE MODEL

## Avio 220

<b>Customer :</b>	<u>SP Pattana Environment</u>	<b>Date Tested:</b>	<u>September 13, 2022</u>
		<b>Recommendation Recertification</b>	
<b>Address :</b>	<u>69 moo1 Bo kwang thong</u>	<b>Period</b>	<u>6</u> <b>Months</b>
	<u>Bothong Chonburi</u>	<b>Recertification Due:</b>	<u>March 13, 2023</u>
	<u>20270</u>	<b>Date Last Certified:</b>	<u>March 9, 2022</u>
<b>User Name:</b>	<u>Tharawut</u>	<b>Visit Number:</b>	<u>1 of 2</u>
<b>Phone:</b>	<u>085-205-8787</u>	<b>PerkinElmer Phone:</b>	<u>02-719-6420 ext 206</u>
<b>E - Mail :</b>		<b>PerkinElmer Fax:</b>	<u>02-318-5597</u>

CONFIGURATION TESTED		
<b>MODEL</b>	<b>SERIAL NUMBER</b>	<b>SOFTWARE</b>
<u>Avio 220Max</u>	<u>M79S2103081</u>	
<b>TESTED EQUIPMENT</b>	<b>CALIBRATION NUMBER</b>	<b>EXPIRATION</b>
<u>IPV Method</u>		
<b>TEST STANDARD USED</b>	<b>PART NUMBER</b>	<b>EXPIRATION DATE</b>
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>Jun 30,2023</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>Nov 30, 2023</u>
<b>CUSTOMER SUPPLIED</b>	<b>COMMENTS</b>	<b>CUSTOMER INITIALS</b>
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		

**MAINTENANCE AND IPV TEST CERTIFICATE MODEL****Avio 220****SERIAL NUMBER:** M79S2103081**DATE TESTED:** September 13, 2022**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

B. Inspect and replace as necessary, all torch components including the RF coil.

☐ OK

C. Inspect all tubing for sign of clacking or leaking.

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgebfilters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ OK**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK

# MAINTENANCE AND IPV TEST CERTIFICATE MODEL

## Avio 220

SERIAL NUMBER: M79S2103081		DATE TESTED: September 13, 2022	
PARAMETER	SPECIFICATION		FINAL VALUE
Spectral Resolution : UV			
As	193.696 nm	≤ 0.009 nm	0.00789 nm
Ni	231.604 nm	≤ 0.011 nm	0.00880 nm
Ni	341.476 nm	≤ 0.015 nm	0.01333 nm
Spectral Resolution : VIS			
Ba	455.403 nm	≤ 0.020 nm	0.01846 nm
Precision			
Zn	206.200 nm	% RSD ≤ 1.0 %	0.15 %
Mg	280.271 nm	% RSD ≤ 1.0 %	0.13 %
Mg	285.213 nm	% RSD ≤ 1.0 %	0.41 %
Ba	455.403 nm	% RSD ≤ 1.0 %	0.27 %
Detection Limits : Axial			
Tl	190.801 nm	3(sd)	0.32 ppb
As	193.696 nm	3(sd)	1.33 ppb
Se	196.026 nm	3(sd)	3.81
Pb	220.353 nm	3(sd)	0.32 ppb
Detection Limits : Radial			
As	193.696 nm	3(sd)	5.48 ppb
Zn	213.857 nm	3(sd)	0.32 ppb
Mn	257.610 nm	3(sd)	0.04 ppb
La	379.478 nm	3(sd)	0.17 ppb
Ba	455.403 nm	3(sd)	0.03 ppb
Ba	493.408 nm	3(sd)	0.04 ppb
BEC : Axial (IB X 1000)/(IS-IB)			
Mn	257.610 nm	≤ 30 ppb	1.54 ppb
BEC : Radial (IB X 1000)/(IS-IB)			
Mn	257.610 nm	≤ 30 ppb	5.41 ppb



**MAINTENANCE AND IPV TEST CERTIFICATE MODEL****Avio 220****SERIAL NUMBER:** M79S2103081**DATE TESTED:** September 13, 2022**Remarks :**

Commissioning follow as commissioning performance sheets.

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

**Service Department PerkinElmer Ltd.**

Customer Service Engineer:

(

Duang Hiransuk

)

Service Engineer







N0691579/10

N0691579/10

N9300221/100

N0691579/10

N0691579/10

	IB	IS	BEC
Axial	16576.2	10757679.3	1.54
Radial	12630.3	2346624.7	5.41





ID LINE : IEC17025



## Certificate of Calibration

Certificate Number : SPR24040264-1

Page : 1 of 4

Customer : SP Environmental Development Co., Ltd

69/1 Moo 1 , Boh Kwang Thong, Boh Thong District, Chon Buri  
20270, Thailand

Equipment Name : Thermoreactor

Manufacturer : Lovibond

Model : RD125

Serial Number : 0117/001634

ID. Number : N/A

### Environmental Conditions

Ambient Temperature :  $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$

Relative Humidity :  $60\% \pm 20\%$

Location of Calibration : On-Site

Calibration Procedure : SP-CPT-04-01

Received Date : 23 Apr 2024

Calibration Date : 26 Apr 2024

Recommend Due Date : N/A

Date of Issue : 27 Apr 2024

### Method of Calibration

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

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

Calibrated by : Mr.Kijja Visitsilp

Calibration Officer

Approved by



Authorized Signatory





ID LINE : IEC17025



## Calibration Report

Certificate Number : SPR24040264-1

Page : 2 of 4

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Data Acquisition/Switch Unit	34970A	MY44074688	SPR24010142-25	11 Jan 2025

### Traceability

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



ID LINE : IEC17025



## Result of Calibration

Certificate No. : SPR24040264-1

Page : 3 of 4

Temperature Measurement

Unit : °C

Pole No.	UUC Setting	Standard Reading	Error	Uncertainty ( ± )
1	150	150.78	-0.78	0.26
2	150	150.57	-0.57	0.26
3	150	151.86	-1.86	0.26
4	150	150.79	-0.79	0.26
5	150	151.21	-1.21	0.26
6	150	151.31	-1.31	0.26
7	150	152.03	-2.03	0.26
8	150	150.76	-0.76	0.26
9	150	150.54	-0.54	0.26
10	150	151.86	-1.86	0.26
11	150	149.32	0.68	0.26
12	150	151.60	-1.60	0.26
13	150	149.28	0.72	0.26
14	150	151.43	-1.43	0.26
15	150	149.70	0.30	0.26
16	150	149.65	0.35	0.26
17	150	149.82	0.18	0.26
18	150	150.50	-0.50	0.26
19	150	149.76	0.24	0.26
20	150	149.56	0.44	0.26
21	150	149.76	0.24	0.26
22	150	149.84	0.16	0.26
23	150	149.67	0.33	0.26
24	150	150.10	-0.10	0.26



ID LINE : IEC17025



## Result of Calibration

Certificate No. : SPR24040264-1

Page : 4 of 4

Figure 1. Position is Poles

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24

### Note:

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

### Measurement Uncertainty

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

- End of Certificate -





ID LINE : IEC17025



## Certificate of Calibration

Certificate Number : SPR24040264-2

Page : 1 of 3

Customer : SP Environmental Development Co., Ltd

69/1 Moo 1 , Boh Kwang Thong, Boh Thong District, Chon Buri  
20270, Thailand

Equipment Name : BOD Incubator

Manufacturer : Accuplus

Model : I250

Serial Number : 0410-1022-0029

ID. Number : N/A

### Environmental Conditions

Ambient Temperature : 25 °C  $\pm$  10 °C

Received Date : 23 Apr 2024

Relative Humidity : 60 %  $\pm$  20 %

Calibration Date : 26 Apr 2024

Location of Calibration : On-Site

Recommend Due Date : N/A

Calibration Procedure : SP-CPT-04-01

Date of Issue : 27 Apr 2024

### Method of Calibration

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

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

Calibrated by : Mr.Kijja Visitsilp

Approved by

Calibration Officer

Authorized Signatory



ID LINE : IEC17025



## Calibration Report

Certificate Number : SPR24040264-2

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Data Acquisition/Switch Unit	34970A	MY44074688	SPR24010142-25	11 Jan 2025

### Traceability

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



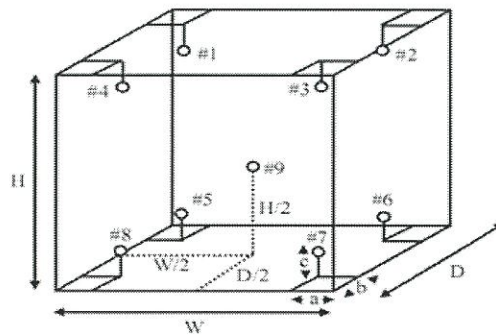
ID LINE : IEC17025



## Result of Calibration

Certificate Number : SPR24040264-2

Page : 3 of 3



Temperature Accuracy in the Measurement Zone.

Unit : °C

UUC Setting	Measured Temperature (°C) @ Probe No. (Probe No. 9 is REF.)									Uncertainty ( ± )
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
20.0	19.82	19.84	19.70	19.63	19.59	19.69	19.64	19.66	19.84	0.19

Temperature Uniformity, Stability, Overall Variation

Unit : °C

UUC Setting	UUC Reading	Temperature Stability	Temperature Uniformity	Overall Variation
20.0	20.0	0.09	0.40	0.45

### Note :

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

### Measurement Uncertainty

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

- End of Certificate -





ID LINE : IEC17025



## Certificate of Calibration

Certificate Number : SPR24040264-3

Page : 1 of 3

Customer : SP Environmental Development Co., Ltd

69/1 Moo 1 , Boh Kwang Thong, Boh Thong District, Chon Buri  
20270, Thailand

Equipment Name : Electronic Balance

Manufacturer : Bel Engineering

Model : MA214A

Serial Number : CHA2000931

ID. Number : N/A

### Environmental Conditions

Ambient Temperature :  $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$

Received Date : 23 Apr 2024

Relative Humidity :  $60\% \pm 20\%$

Calibration Date : 26 Apr 2024

Location of Calibration : On-Site

Recommend Due Date : N/A

Calibration Procedure : SP-CPM-04-01

Date of Issue : 27 Apr 2024

### Method of Calibration

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

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

Calibrated by : Mr.Kijja Visitsilp

Approved by :

Calibration Officer

Authorized Signatory



ID LINE : IEC17025



## Calibration Report

Certificate Number : SPR24040264-3

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Standard Weight Set	Class E2	B746971965	C02221902	16 Sep 2024

### Traceability

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

SPC - SPC Calibration Center Co;Ltd.



ID LINE : IEC17025



## Result of Calibration

Certificate No. : SPR24040264-3

Page : 3 of 3

Range capacity : 0 to 220 g

Resolution: 0.0001 g

Repeatability ( n = 10 number of measurement )

Standard Weight (g)	Standard Deviation
200	0.0000

Departure of indication from nominal Value

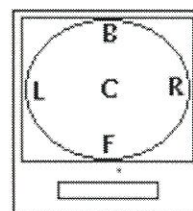
Unit : g

Nominal Value	UUC Reading	Error	Uncertainty ( ± )
No Load	0.0000	0.0000	0.000058
20.0	20.0001	0.0001	0.000064
40.0	40.0000	0.0000	0.000080
60.0	59.9999	-0.0001	0.00011
80.0	79.9999	-0.0001	0.00016
100.0	100.0001	0.0001	0.00016
120.0	119.9999	-0.0001	0.00020
140.0	140.0001	0.0001	0.00020
160.0	160.0001	0.0001	0.00030
180.0	180.0000	0.0000	0.00030
200.0	200.0001	0.0001	0.00030

Off - Center Loading

Center	50.0000 g
Front	50.0002 g
Back	49.9998 g
Left	49.9997 g
Right	50.0002 g
Maximum difference	0.0003 g

A mass of 50 g was placed to various positions on the pan. The weighing machine reading error obtained is given in table.



### Note:

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

### Measurement Uncertainty

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

- End of Certificate -

SP-FM-04-15 REV.0





ID LINE : IEC17025



## Certificate of Calibration

Certificate Number : SPR24040264-4

Page : 1 of 3

Customer : SP Environmental Development Co., Ltd

69/1 Moo 1 , Boh Kwang Thong, Boh Thong District, Chon Buri  
20270, Thailand

Equipment Name : pH Meter

Manufacturer : Eutech

Model : pH150

Serial Number : 3119958

ID. Number : N/A

### Environmental Conditions

Ambient Temperature : 25 °C ± 10 °C

Received Date : 23 Apr 2024

Relative Humidity : 60 % ± 20 %

Calibration Date : 26 Apr 2024

Location of Calibration : On-Site

Recommend Due Date : N/A

Calibration Procedure : SP-CPC-04-01,

Date of Issue : 27 Apr 2024

SP-CPT-04-05

### Method of Calibration

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

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

Calibrated by : Mr. Keerati Bunyawat

Approved by :

Calibration Officer

Authorized Signatory



ID LINE : IEC17025



## Calibration Report

Certificate Number : SPR24040264-4

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Standard pH Solution	PH016.L5	Lot No.970880	61278486	25 Apr 2025
Standard pH Solution	PH107.L5	Lot No.970881	61281486	25 Apr 2025
Standard pH Solution	PH020.L5	Lot No.970882	61297722	25 Apr 2025
Super Thermometer with PRT	1575/3850-40-392	58087/100288	PSL-T 0377/67	15 Feb 2025

### Traceability

This certification is traceable to the International System of Unit maintained at :  
C.P.A. Chem - ANAB#AT-1836 (ISO/IEC 17025:2017) and ANAB#AR-1835 (ISO/IEC 17034:2016)  
TISTR - Thailand Institute of Scientific and Technological Research



ID LINE : IEC17025



## Result of Calibration

Certificate No. : SPR24040264-4

Page : 3 of 3

pH Measurement @ 25 °C

Unit : pH

Standard Solution	UUC Reading	Error	Uncertainty ( ± )
4.008	4.01	0.002	0.012
6.984	7.02	0.036	0.012
10.011	10.01	-0.001	0.013

Temperature Measurement

Unit : °C

Standard Value	UUC Reading	Error	Uncertainty ( ± )
20.0	20.1	0.1	0.070
25.0	25.1	0.1	0.070
30.0	30.1	0.1	0.070

### Note:

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

### Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2.00$ , providing a level of confidence approximately 95%.

- End of Certificate -





ID LINE : IEC17025



## Certificate of Calibration

Certificate Number : SPR24040264-5

Page : 1 of 3

Customer : SP Environmental Development Co., Ltd

69/1 Moo 1 , Boh Kwang Thong, Boh Thong District, Chon Buri  
20270, Thailand

Equipment Name : pH Meter

Manufacturer : Eutech

Model : pH700

Serial Number : 2828878

ID. Number : N/A

### Environmental Conditions

Ambient Temperature : 25 °C  $\pm$  10 °C

Received Date : 23 Apr 2024

Relative Humidity : 60 %  $\pm$  20 %

Calibration Date : 26 Apr 2024

Location of Calibration : On-Site

Recommend Due Date : N/A

Calibration Procedure : SP-CPC-04-01,  
SP-CPT-04-05

Date of Issue : 27 Apr 2024

### Method of Calibration

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

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

Calibrated by : Mr. Keerati Bunyawat

Approved by :

Calibration Officer

Authorized Signatory



ID LINE : IEC17025



## Calibration Report

Certificate Number : SPR24040264-5

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Standard pH Solution	PH016.L5	Lot No.970880	61278486	25 Apr 2025
Standard pH Solution	PH107.L5	Lot No.970881	61281486	25 Apr 2025
Standard pH Solution	PH020.L5	Lot No.970882	61297722	25 Apr 2025
Super Thermometer with PRT	1575/3850-40-392	58087/100288	PSL-T 0377/67	15 Feb 2025

### Traceability

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

C.P.A. Chem - ANAB#AT-1836 (ISO/IEC 17025:2017) and ANAB#AR-1835 (ISO/IEC 17034:2016)

TISTR - Thailand Institute of Scientific and Technological Research



ID LINE : IEC17025



## Result of Calibration

Certificate No. : SPR24040264-5

Page : 3 of 3

pH Measurement @ 25 °C

Unit : pH

Standard Solution	UUC Reading	Error	Uncertainty ( ± )
4.008	4.01	0.002	0.012
6.984	7.01	0.026	0.012
10.011	10.01	-0.001	0.013

Temperature Measurement

Unit : °C

Standard Value	UUC Reading	Error	Uncertainty ( ± )
20.0	20.0	0.0	0.070
25.0	25.0	0.0	0.070
30.0	30.0	0.0	0.070

### Note:

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

### Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2.00$ , providing a level of confidence approximately 95%.

– End of Certificate –





ID LINE : IEC17025



## Certificate of Calibration

Certificate Number : SPR24040264-6

Page : 1 of 3

Customer : SP Environmental Development Co., Ltd

69/1 Moo 1 , Boh Kwang Thong, Boh Thong District, Chon Buri  
20270, Thailand

Equipment Name : Refrigerator

Manufacturer : Koldtech

Model : MR600L-1D-R

Serial Number : 01771

ID. Number : N/A

### Environmental Conditions

Ambient Temperature : 25 °C  $\pm$  10 °C

Received Date : 23 Apr 2024

Relative Humidity : 60 %  $\pm$  20 %

Calibration Date : 26 Apr 2024

Location of Calibration : On-Site

Recommend Due Date : N/A

Calibration Procedure : SP-CPT-04-01

Date of Issue : 27 Apr 2024

### Method of Calibration

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

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

Calibrated by : Mr. Keerati Bunyawat

Approved by :

Calibration Officer

Authorized Signatory



ID LINE : IEC17025



## Calibration Report

Certificate Number : SPR24040264-6

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Data Acquisition/Switch Unit	34970A	MY44074688	SPR24010142-25	11 Jan 2025

### Traceability

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



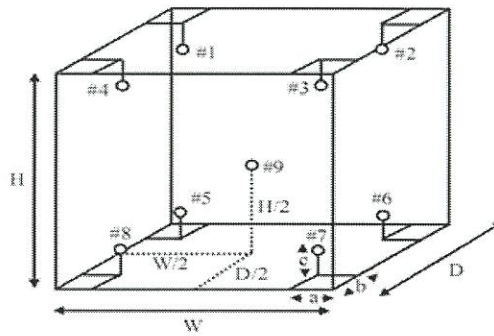
ID LINE : IEC17025



## Result of Calibration

Certificate Number : SPR24040264-6

Page : 3 of 3



Temperature Accuracy in the Measurement Zone.

Unit : °C

UUC Setting	Measured Temperature (°C) @ Probe No. (Probe No. 9 is REF.)									Uncertainty ( ± )
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
4.0	3.82	3.98	3.37	4.23	4.28	4.16	4.41	4.25	4.24	0.19

Temperature Uniformity, Stability, Overall Variation

Unit : °C

UUC Setting	UUC Reading	Temperature Stability	Temperature Uniformity	Overall Variation
4.0	4.0	0.09	1.03	1.21

### Note :

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

### Measurement Uncertainty

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

- End of Certificate -





ID LINE : IEC17025



## Certificate of Calibration

Certificate Number : SPR24040264-7

Page : 1 of 3

Customer : SP Environmental Development Co., Ltd

69/1 Moo 1 , Boh Kwang Thong, Boh Thong District, Chon Buri  
20270, Thailand

Equipment Name : Drying Oven

Manufacturer : Beijing Sci-Tech Development

Model : SOV 70B

Serial Number : KWF2018011001

ID. Number : N/A

### Environmental Conditions

Ambient Temperature :  $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$

Received Date : 23 Apr 2024

Relative Humidity :  $60\% \pm 20\%$

Calibration Date : 26 Apr 2024

Location of Calibration : On-Site

Recommend Due Date : N/A

Calibration Procedure : SP-CPT-04-01

Date of Issue : 27 Apr 2024

### Method of Calibration

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

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

Calibrated by : Mr. Keerati Bunyawat

Approved by :

Calibration Officer

Authorized Signatory



ID LINE : IEC17025



## Calibration Report

Certificate Number : SPR24040264-7

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Data Acquisition/Switch Unit	34970A	MY44074688	SPR24010142-25	11 Jan 2025

### Traceability

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



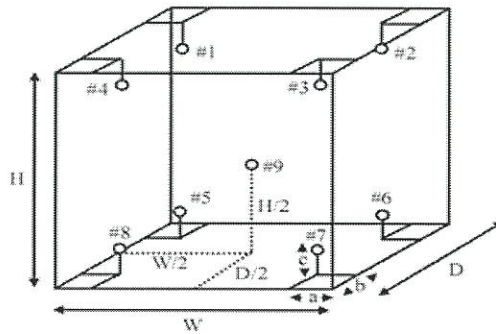
ID LINE : IEC17025



## Result of Calibration

Certificate Number : SPR24040264-7

Page : 3 of 3



Temperature Accuracy in the Measurement Zone.

Unit : °C

UUC Setting	Measured Temperature (°C) @ Probe No. (Probe No. 9 is REF.)									Uncertainty ( ± )
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
104.0	103.53	103.76	104.33	103.22	104.39	104.45	104.51	103.37	103.49	0.26
150.0	149.88	150.37	150.82	149.35	150.94	150.56	150.63	149.22	149.72	0.27
180.0	179.26	180.66	180.32	180.65	180.51	180.76	180.63	180.79	180.44	0.26

Temperature Uniformity, Stability, Overall Variation

Unit : °C

UUC Setting	UUC Reading	Temperature Stability	Temperature Uniformity	Overall Variation
104.0	104.0	0.09	1.18	1.48
150.0	150.0	0.11	1.40	1.92
180.0	180.0	0.10	1.35	1.73

### Note :

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

### Measurement Uncertainty

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

- End of Certificate -





## Certificate of Calibration

Certificate Number : SPR24040264-8

Page : 1 of 3

Customer : SP Environmental Development Co., Ltd

69/1 Moo 1 , Boh Kwang Thong, Boh Thong District, Chon Buri  
20270, Thailand

Equipment Name : DO Meter

Manufacturer : Eutech Instruments

Model : DO2700

Serial Number : 2942701

ID. Number : N/A

### Environmental Conditions

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

Received Date : 23 Apr 2024

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

Calibration Date : 30 Apr 2024

Location of Calibration : In-Lab

Recommend Due Date : N/A

Calibration Procedure : In-House Method

Date of Issue : 01 May 2024

### Method of Calibration

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

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

Calibrated by : Mr.Sarawut Khitmai

Approved by :

Calibration Officer

Authorized Signatory



## Calibration Report

Certificate Number : SPR24040264-8

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Zero Oxygen Solution	HI7040L	Lot S0027-23 _	21C31	21 Mar 2028
Free and Total Chlorine Photometer	HI97711	905160015111	905160015111	19 Apr 2027
Pressure calibrator	718 30G	2314118	24P605	15 Feb 2025

### Traceability

This certification is traceable to the International System of Unit maintained at :  
HANNA - Hanna Instruments (Thailand) Ltd.

TPA - Technology Promotion Association (Thailand-Japan)



## Result of Calibration

Certificate No.: SPR24040264-8

Page : 3 of 3

Range : 400 to 1000 mmHg

Resolution : 1 mmHg

Function : Barometric Pressure

Standard Value	UUC. Reading	Error	Uncertainty ( ± mgHg )
759.0	763	4.0	1.2

Range : 0 to 20 mg/L

Resolution : 0.01 mg/L

Function : Dissolved Oxygen Permanance Test

Standard Value	UUC. Reading	Error	Uncertainty ( ± mg/L )
0.30	0.48	0.18	0.064
8.30	8.40	0.10	0.064

Range : 0 to 100 %

Resolution : 0.1 %

Standard Value	UUC. Reading	Error	Uncertainty ( ± % )
0.0	0.3	0.3	1.5
100.0	100.4	0.4	1.5

### Note:

The result of calibration was found accurate as show on date and place of calibration only.

This Certificate is not certified for any commercial transaction.

### Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2.00$ , providing a level of confidence approximately 95%

- End of Certificate -





ID LINE : IEC17025



## Certificate of Calibration

Certificate Number : SPR24040264-9

Page : 1 of 3

Customer : SP Environmental Development Co., Ltd

69/1 Moo 1 , Boh Kwang Thong, Boh Thong District, Chon Buri  
20270, Thailand

Equipment Name : Volumetric Pipette

Manufacturer : Witeg

Model : 3 ml

Serial Number : N/A

ID. Number : P3-4

### Environmental Conditions

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

Received Date : 23 Apr 2024

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

Calibration Date : 29 Apr 2024

Location of Calibration : In-Lab

Recommend Due Date : N/A

Calibration Procedure : SP-CPC-04-07

Date of Issue : 30 Apr 2024

### Method of Calibration

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

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

Calibrated by : Mr.Lapon Naimpoung

Approved by :

Calibration Officer

Authorized Signatory



ID LINE : IEC17025



## Calibration Report

Certificate Number : SPR24040264-9

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Electronic Balance	XP205	B035062953	SPR23100036-12	15 Oct 2024

### Traceability

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



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## Result of Calibration

Certificate No. : SPR24040264-9

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Range : 3 ml

Calibration report reporting

Unit : ml

UUC Test Point	Actual Volume	Error	Uncertainty ( ± )
3.0	2.99554	0.00446	0.0024

### Note:

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

### Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2.00$ , providing a level of confidence approximately 95%.

- End of Certificate -





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## Certificate of Calibration

Certificate Number : SPR24040264-10

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Customer : SP Environmental Development Co., Ltd

69/1 Moo 1 , Boh Kwang Thong, Boh Thong District, Chon Buri  
20270, Thailand

Equipment Name : Volumetric Pipette

Manufacturer : Witeg

Model : 4 ml

Serial Number : N/A

ID. Number : P4-5

### Environmental Conditions

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

Received Date : 23 Apr 2024

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

Calibration Date : 29 Apr 2024

Location of Calibration : In-Lab

Recommend Due Date : N/A

Calibration Procedure : SP-CPC-04-07

Date of Issue : 30 Apr 2024

### Method of Calibration

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

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

Calibrated by : Mr.Lapon Naimpoung

Approved by :

Calibration Officer

Authorized Signatory



ID LINE : IEC17025



## Calibration Report

Certificate Number : SPR24040264-10

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Electronic Balance	XP205	B035062953	SPR23100036-12	15 Oct 2024

### Traceability

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



ID LINE : IEC17025



## Result of Calibration

Certificate No. : SPR24040264-10

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Range : 4 ml

Calibration report reporting

Unit : ml

UUC Test Point	Actual Volume	Error	Uncertainty ( ± )
4.0	3.99801	0.00199	0.0024

### Note:

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

### Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2.00$ , providing a level of confidence approximately 95%.

- End of Certificate -