

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

1/3  
✓

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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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 :

  
(Mr. Weerachai Decchaiyae)

Approved by :

  
(Mr. Prawate Khunyapa)  
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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E-mail : sumalee@tistr.or.th



# CERTIFICATE OF CALIBRATION

NO. 20241212034

Name of Product:	Sound Level Meter
Model:	ST-11D
Serial Number:	820265
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2024-12-13
Due Date:	2025-12-12

Calibrated by: *Jim Lin*



- 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: AWA14425-54838

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	-14.6	0.2	1000	0.0	0.0	-0.1
20	-50.3	-6.1	-0.4	2000	1.2	-0.2	0.0
31.5	-39.6	-3.1	0.1	4000	1.0	-0.8	0.0
63	-26.3	-0.9	-0.1	8000	-1.2	-3.2	0.0
125	-16.2	-0.2	-0.2	12500	-5.8	-7.8	0.1
250	-8.7	0.0	0.0	16000	-11.7	-13.7	0.0
500	-3.2	0.0	0.0	20000	-23.8	-25.8	-0.2

#### 6. Self-generated noise

Microphone replaced by electrical input signal device

7.6 dB(A)	11.0 dB(C)	18.9 dB(Z)
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#### 7. F&S Weighting

Rate of the F weighting decrease ( dB/s)	35.2
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
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. 20241212035

Name of Product:	Sound Level Meter
Model:	ST-11D
Serial Number:	820384
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2024-12-13
Due Date:	2025-12-12

Calibrated by: *Jim Lin*



- 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.
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1. Preliminary inspection: OK

2. Type & serial No. of Microphone: AWA14425-54570

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	-71.0	-14.6	0.2	1000	0.0	0.0	-0.1
20	-50.3	-6.4	-0.4	2000	0.1	0.0	0.0
31.5	-39.4	-2.2	0.1	4000	1.3	-0.1	0.0
63	-26.1	-0.8	-0.1	8000	1.2	-0.8	0.0
125	-16.3	-0.2	-0.2	12500	-5.7	-7.2	0.1
250	-8.6	0.1	0.0	16000	-11.7	-13.4	0.2
500	-3.2	0.1	0.0	20000	-23.9	-25.8	-0.3



## 6. Self-generated noise

Microphone replaced by electrical input signal device

8.8 dB(A)	8.4 dB(C)	15.9 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
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 Scarlett'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. 20241212037

Name of Product:	Sound Level Meter
Model:	ST-11
Serial Number:	820628
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2024-12-13
Due Date:	2025-12-12

*Jim Lin*

Calibrated by:



- 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

4. Measuring up limit: 140.dBA

2. Type & serial No. of Microphone: AWA14425-47407

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

3. Adjustments to indicated sound levels:

Type of Calibrator B&K 4231

Sound Pressure Level 94.0 dB

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	-14.4	-0.7	1000	0.0	0.1	-0.1
20	-50.4	-6.2	0.0	2000	1.2	-0.2	0.5
31.5	-39.4	-3.1	0.1	4000	1.1	-0.5	0.5
63	-26.2	-0.8	0.5	8000	-1.2	-3.1	-0.5
125	-16.2	-0.3	0.1	12500	-6.0	-8.0	-1.5
250	-8.7	-0.1	0.3	16000	-11.8	-13.8	-1.5
500	-3.3	-0.1	0.2	20000	-23.9	-25.9	-0.9

## 6. Self-generated noise

Microphone replaced by electrical input signal device

10.2 dB(A)	16.4 dB(C)	17.1 dB(Z)
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## 7. F&S Weighting

Rate of the F weighting decrease (dB/s)	35.2
Rate of the S weighting decrease (dB/s)	4.4
Deviation of F&S	0.0

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

(Total measuring range: 25 dBA - 140 dBA, frequency 1kHz):

Reference level range (frequency 8kHz):

### ① 10dB Interval

Signal	30.0	34.0	44.0	54.0	64.0	74.0	84.0	94.0	104.0	114.0	124.0	134.0
Indicating value dB(A)	29.9	33.9	44.0	54.0	64.0	74.0	84.0	93.9	103.9	113.9	123.9	134.0
Full scale deviation (dB)	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	0.0

### ② 1dB Interval

Upper Limit	134.0	135.0	136.0	137.0	138.0	139.0
Indicating value dB(A)	134.0	135.0	135.9	136.9	137.9	138.9
Full scale deviation (dB)	0.0	0.0	-0.1	-0.1	-0.1	-0.1
Lower Limit	25.0	26.0	27.0	28.0	29.0	30.0
Indicating value dB(A)	24.9	25.9	26.8	28.0	28.9	29.9
Full scale deviation (dB)	-0.1	-0.1	-0.2	0.0	-0.1	-0.1

Max error at 1dB- 10dB Interval 0.2 dB

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

Single Toneburst duration /ms	Toneburst response /dB			
	L <sub>Afmax</sub> -L <sub>A</sub>	L <sub>ASmax</sub> -L <sub>A</sub>	L <sub>Ae</sub> -L <sub>A</sub>	L <sub>AeqT</sub> -L <sub>A</sub>
500	-0.2	-4.5	-3.0	-7.0
200	-1.0	-7.8	-7.0	-7.0
2	-18.2	-27.0	-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	2.3	2.4	2.3	2.4

**11. Overload indication:** Pass**Environment conditions:**Air temperature: 14 °CRelative humidity: 87 %Static pressure: 101.6 kPa**References:**

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



SMILE  
Laboratory Co., Ltd.

บริษัท สไมล์ แล็บอราทอรี จำกัด

Smile Laboratory Co., Ltd.

563/1 ถนนทองหล่อ แขวงบางนาหว้า เขตภาษีเจริญ กรุงเทพฯ 10160 โทรศัพท์ 02-227-0265 โทรสาร 02-454-0317  
563/1 Thoei Thal Rd., Bangwa, Phasicharoen, Bangkok 10160 Tel. 02-227-0265 Fax. 02-454-0317

## TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

### Site Information

Sampler Location	โครงการนิคมอุตสาหกรรมเวสต์ (ลำพูน) ของบริษัท เวสต์ อินดัสเทรียล เอสเตท จำกัด	Date	05 March 2025
Project Site	โรงเรียนบ้านอ้อมกอม่วง	Person	Mr. Warakorn Charoenkhun

### 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

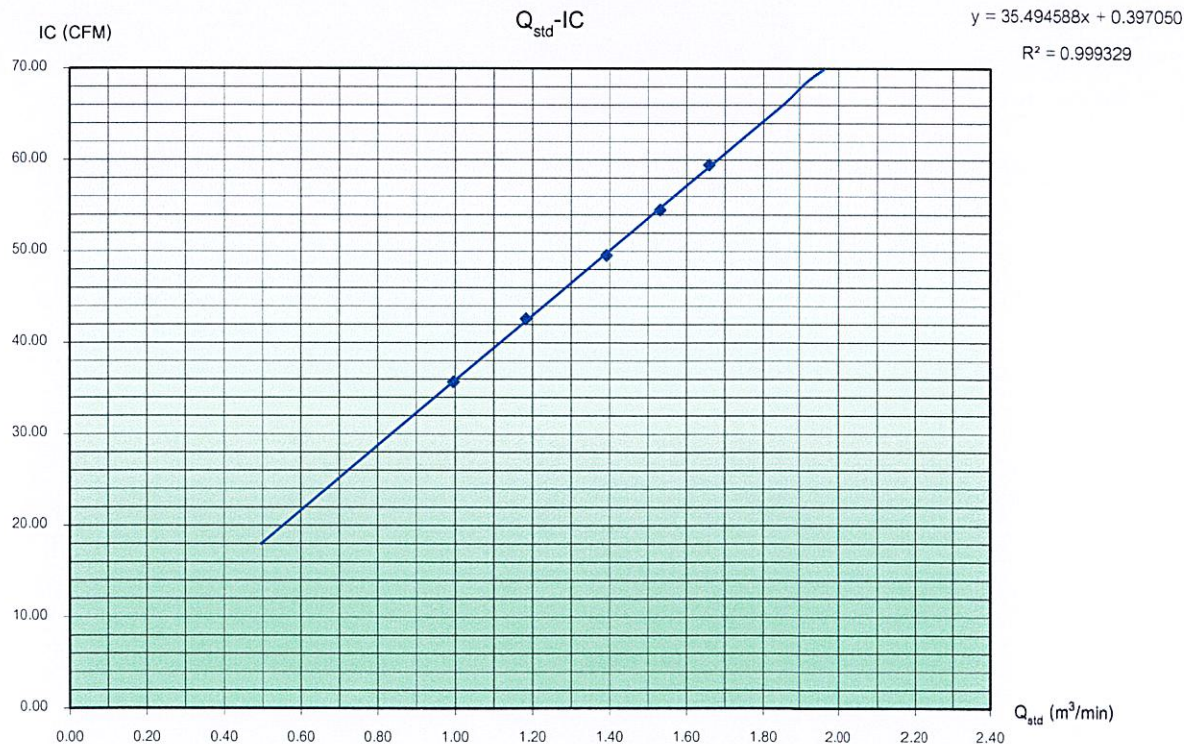
Sampler Number	TSP No.02	Motor Serial Number	1203-421	Recorder Serial Number	598
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Test No.	Pressure Drop Across Orifice ( $\Delta H_2O$ ) (inH <sub>2</sub> O)			(A)	(X)	(I)	(Y)	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
	Positive	Negative	$\Delta H_2O$	$[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	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	2.2	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 <sup>2</sup> )	0.999329
Correlation Coefficient (r)	0.999664

Andersen Instruments, Inc.



Calibrated By

วรากรณ์  
Mr. Warakorn Charoenkhun

SMILE  
Laboratory Co., Ltd.





**SMILE**  
Laboratory Co., Ltd.

บริษัท สไมล์ แล็บอราทอรี จำกัด

**Smile Laboratory Co., Ltd.**

563/1 ถนนเทอดไท แขวงบางหว้า 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

## PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

### Site Information

Sampler Location	โครงการนิคมอุตสาหกรรมเวสต์ (สำหุน) ของบริษัท เวสต์ อินดัสเทรียล เอสเตท จำกัด	Date	05 March 2025
Project Site	โรงเรียนบ้านช่องกอม่วง	Person	Mr. Warakorn Charoenkhun

### 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

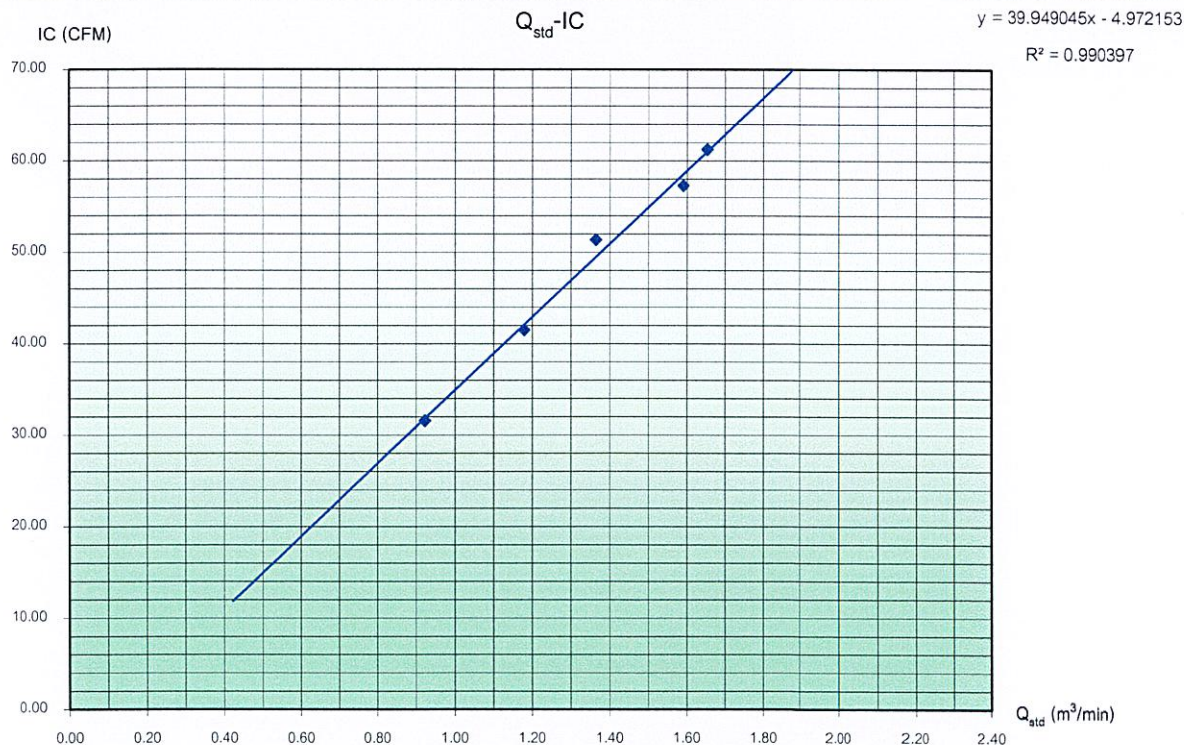
Sampler Number	PM10 No.04	Motor Serial Number	1203-440	Recorder Serial Number	606
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Test No.	Pressure Drop Across Orifice ( $\Delta H_2O$ ) (inH <sub>2</sub> O)			(A)	(X)	(I)	(Y)	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
	Positive	Negative	$\Delta H_2O$	$[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (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

วรากร  
Mr. Warakorn Charoenkhun

**SMILE**  
Laboratory Co., Ltd.

## Analyzer Performance Test

Calibrated Date: 05 March 2025

### Instruments Information

Analyzer Type: SO2 Analyzer	Manufacturer API Environmental
Model: M100A	S/N: 1810

### Calibration System

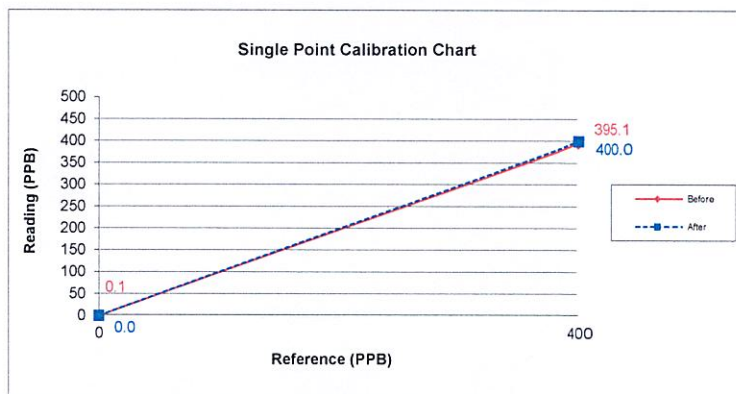
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008	NO Conc 55.47 PPM
S/N: 705	SO2 Conc 55.11 PPM
ZERO AIR Generator API MODEL 701	CO Conc 4,535 PPM
S/N: 1924	Cylinder number EB0129027
	Expire Date: 29 Oct. 2027

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	395.1	-1.2
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

Mr.PASAGORN SAMOL



## Analyzer Performance Test

Calibrated Date: 05 March 2025

### Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 200A	Manufacturer API Environmental S/N: 612
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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 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

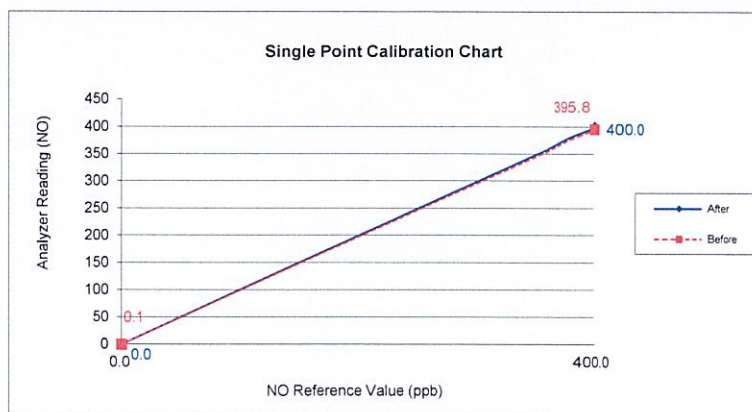
Humidity: 51 %RH

### 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	395.8	400.0	-1.1
NOx	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
NOx	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : Mr. Pasagorn Samol



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 Raeng, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

### Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 05 March 2025

Certificate No. 124/21

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 :

Mr. Pasagorn Samol



## The Result of Calibration

Date of Issue 05 March 2025

Certificate No. 124/21

Page : 2 of 2

Standard  Ultrasonic Anemometer m/sec	HOOK GAGE NO 1425			TESTED ANEMOMETER			
	Pressure inches	Vacuum inches	Pressure hPa	Pressure hPa	Correction hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	-	-	0.7	0.30
3.02	-	-	-	-	-	2.7	0.32
5.04	-	-	-	-	-	4.7	0.34
7.03	-	-	-	-	-	6.7	0.33
9.01	-	-	-	-	-	8.5	0.51
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 :



Mr. Pasagorn Samol



**SMILE**  
Laboratory Co., Ltd.

บริษัท สไมล์ แล็บอราทอรี จำกัด

**Smile Laboratory Co., Ltd.**

563/1 ถนนทองหล่อ แขวงบางหว้า เขตภาษีเจริญ กรุงเทพฯ 10160 โทรศัพท์ 02-227-0265 โทรสาร 02-454-0317  
563/1 Thoe 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	โครงการนิคมอุตสาหกรรมเวสต์ (ลำพูน) ของบริษัท เวสต์ อินดัสเทรียล เอสเตท จำกัด	Date	05 March 2025
Project Site	วัดวังทอง	Person	Mr. Warakorn Charoenkhun

### 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

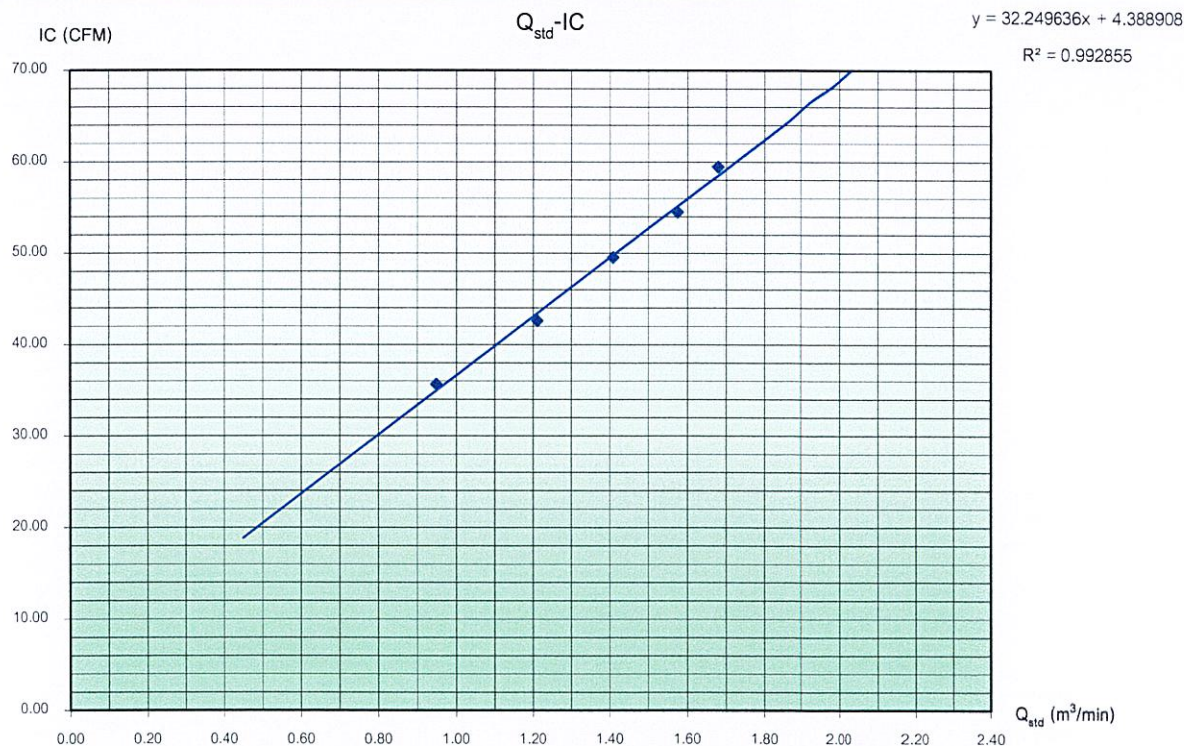
Sampler Number	TSP No.03	Motor Serial Number	1203-426	Recorder Serial Number	600
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Test No.	Pressure Drop Across Orifice ( $\Delta H_2O$ ) (inH <sub>2</sub> O)			(A)	(X)	(I)	(Y)	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
	Positive	Negative	$\Delta H_2O$	$[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	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

Andersen Instruments, Inc.



Calibrated By

วรากรณ์  
Mr. Warakorn Charoenkhun

**SMILE**  
Laboratory Co., Ltd.





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บริษัท สไมล์ แล็บอราทอรี จำกัด

Smile Laboratory Co., Ltd.

563/1 ถนนเทอดไท แขวงบางหว้า เขตภาษีเจริญ กรุงเทพฯ 10160 โทรศัพท์ 02-227-0265 โทรสาร 02-454-0317  
563/1 Thoeet Thal Rd., Bangwa, Phasicharoen, Bangkok 10160 Tel. 02-227-0265 Fax. 02-454-0317

## PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

### Site Information

Sampler Location	โครงการนิคมอุตสาหกรรมเวสต์ (ลำพูน) ของบริษัท เวสต์ อินดัสเทรียล เอสเตท จำกัด	Date	05 March 2025
Project Site	วัดวังทอง	Person	Mr. Warakorn Charoenkhun

### 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

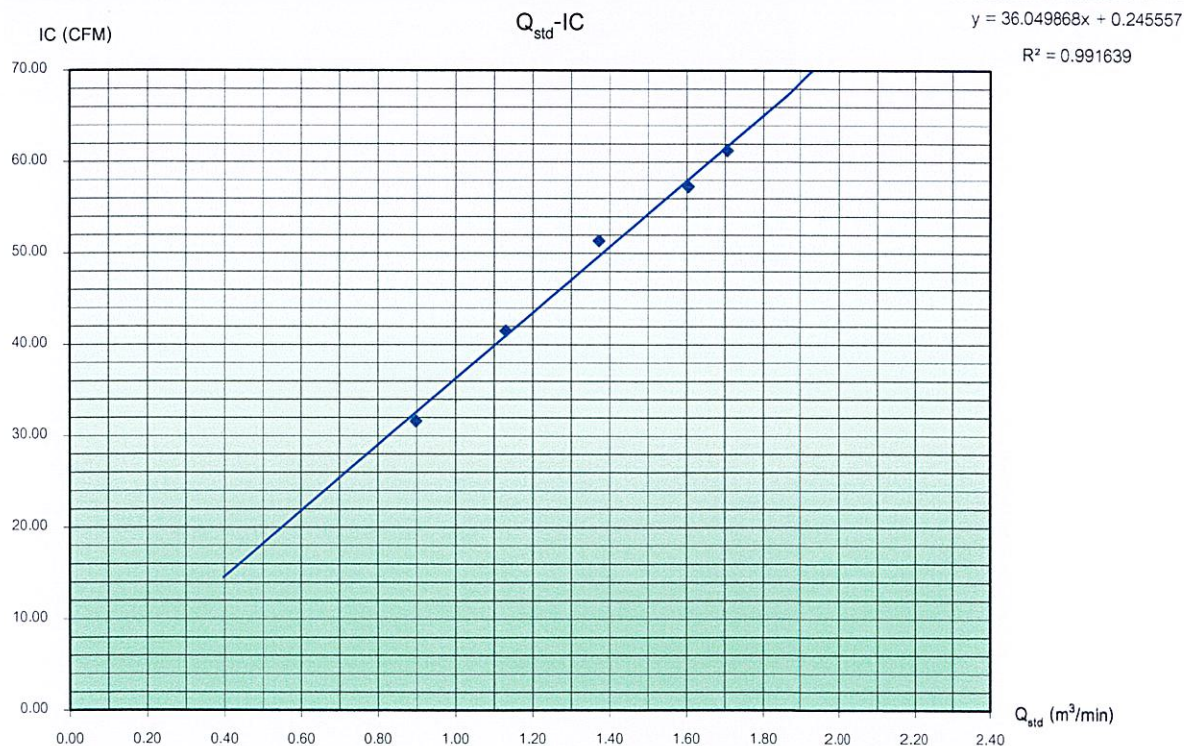
Sampler Number	PM10 No.03	Motor Serial Number	1203-449	Recorder Serial Number	608
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Test No.	Pressure Drop Across Orifice ( $\Delta H_2O$ ) (inH <sub>2</sub> O)			(A)	(X)	(I)	(Y)	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
	Positive	Negative	$\Delta H_2O$	$[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (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	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.



Calibrated By

วรงค์  
Mr. Warakorn Charoenkhun

**SMILE**  
Laboratory Co., Ltd.

## Analyzer Performance Test

Calibrated Date: 05 March 2025

### Instruments Information

Analyzer Type: SO <sub>2</sub> Analyzer Model: 43C	Manufacturer Thermo Environmental S/N: 50811048
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### Calibration System

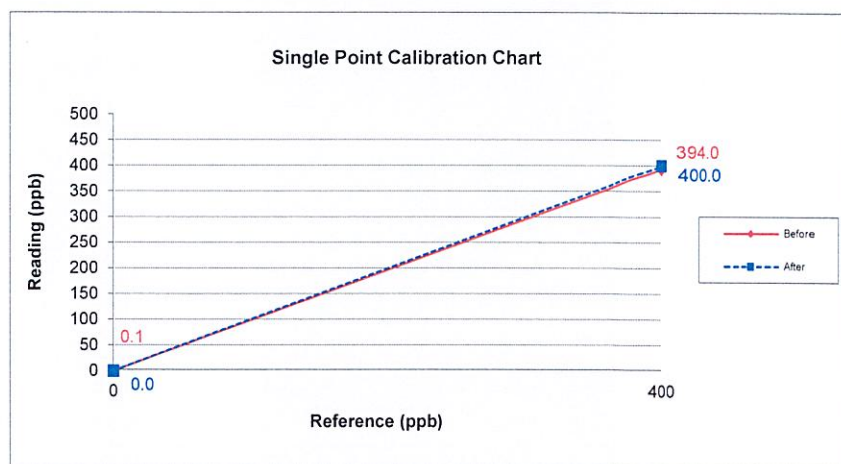
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 46.05 ppm SO <sub>2</sub> Conc 46.01 ppm CO Conc 4,487 ppm Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

### Calibration 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 :

Mr.PASAGORN SAMOL



## Analyzer Performance Test

Calibrated Date: 05 March 2025

### Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 200A	Manufacturer TELEDYNE INSTRUMENTS S/N: 2609
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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 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

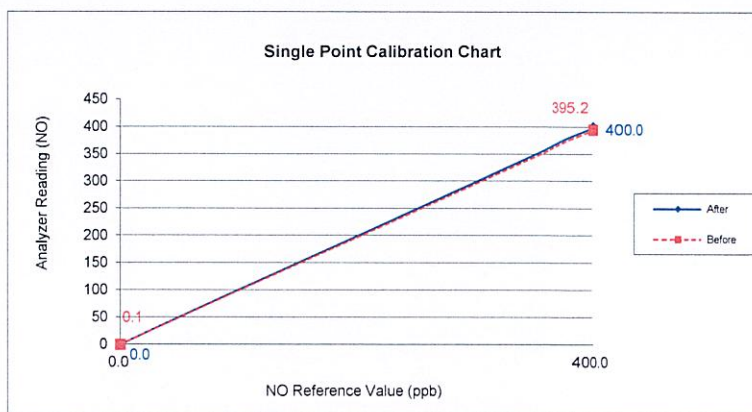
Humidity: 51 %RH

### 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	395.2	400.0	-1.2
NOx	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
NOx	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : Mr. Pasagorn Samol

## Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 05 March 2025

Certificate No. 123/21

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 Vaisaia Type RTB220 No. V1220015

Calibrated by :



Mr. Pasagorn Samol



## The Result of Calibration

Date of Issue 05 March 2025

Certificate No. 123/21

Page : 2 of 2

Standard  Ultrasonic Anemometer m/sec	HOOK GAGE NO 1425			TESTED ANEMOMETER			
	Pressure inches	Vacuum inches	Pressure hPa	Pressure hPa	Correction hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	-	-	0.7	0.30
3.02	-	-	-	-	-	2.7	0.32
5.04	-	-	-	-	-	4.7	0.34
7.03	-	-	-	-	-	6.7	0.33
9.01	-	-	-	-	-	8.5	0.51
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 :



Mr. Pasagorn Samol



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Laboratory Co., Ltd.

บริษัท สไมล์ แล็บอราทอรี จำกัด

Smile Laboratory Co., Ltd.

563/1 ถนนเทอดไท แขวงบางหว้า เขตภาษีเจริญ กรุงเทพฯ 10160 โทรศัพท์ 02-227-0265 โทรสาร 02-454-0317

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

## TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

### Site Information

Sampler Location	โครงการนิคมอุตสาหกรรมเวสต์ (ลำพูน) ของบริษัท เวสต์ อินดัสเทรียล เอสเตท จำกัด	Date	05 March 2025
Project Site	ชุมชนหมู่ 4 บ้านสันป่าฝ้าย	Person	Mr. Warakorn Charoenkhun

### 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

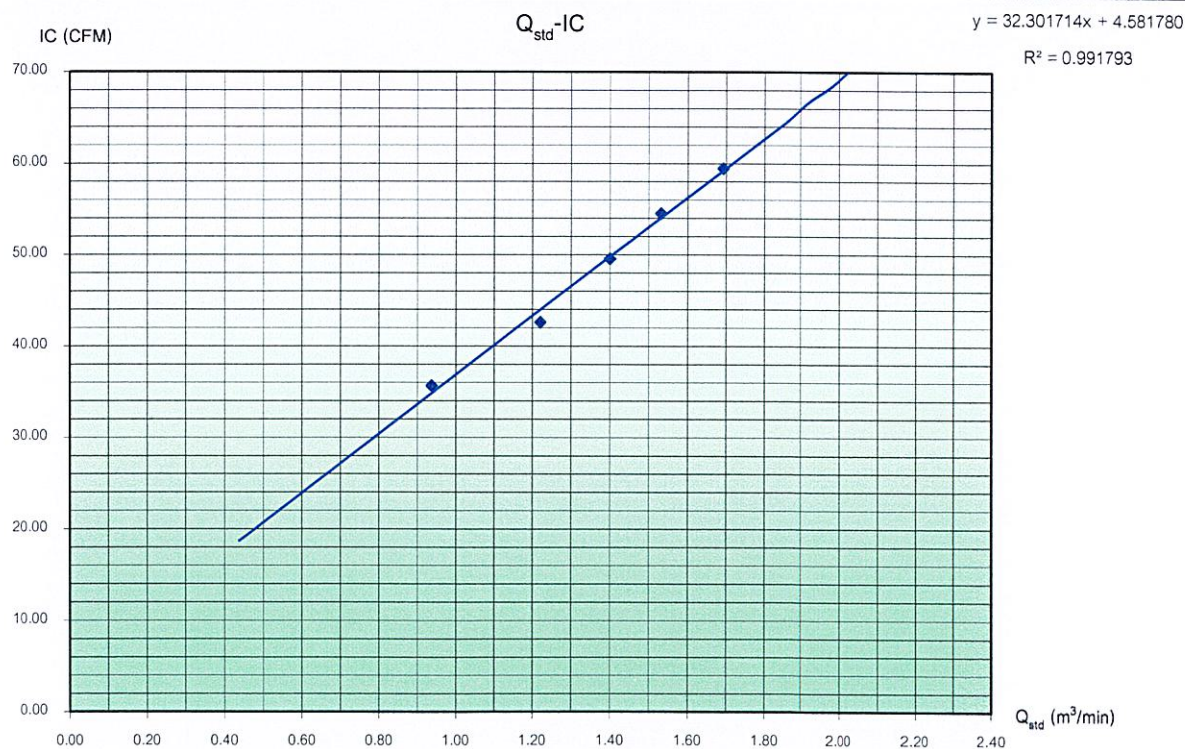
Sampler Number	TSP No.07	Motor Serial Number	1203-432	Recorder Serial Number	602
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Test No.	Pressure Drop Across Orifice ( $\Delta H_2O$ ) (inH <sub>2</sub> O)			(A)	(X)	(I)	(Y)	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
	Positive	Negative	$\Delta H_2O$	$[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	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	1.9	1.9	3.80	1.93321	0.93744	36.0	35.70	303.0	760.0
2	3.3	3.2	6.50	2.52839	1.22036	43.0	42.64	303.0	760.0
3	4.4	4.2	8.60	2.90828	1.40094	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	6.4	6.2	12.60	3.52024	1.69183	60.0	59.50	303.0	760.0
Average								303.0	760.0

Linear Regression : y = mX + b

Slope (m)	32.301714
Intercept (b)	4.581780
R-Square (R <sup>2</sup> )	0.991793
Correlation Coefficient (r)	0.995888

Andersen Instruments, Inc.



Calibrated By

วรากรณ์  
Mr. Warakorn Charoenkhun

**SMILE**  
Laboratory Co., Ltd.





**SMILE**  
Laboratory Co., Ltd.

บริษัท สไมล์ แล็บอราทอรี จำกัด

**Smile Laboratory Co., Ltd.**

563/1 ถนนทองเอก แขวงบางหว้า เขตภาษีเจริญ กรุงเทพฯ 10160 โทรศัพท์ 02-227-0265 โทรสาร 02-454-0317  
563/1 Thoeet Thal Rd., Bangwa, Phasicharoen, Bangkok 10160 Tel. 02-227-0265 Fax. 02-454-0317

## PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

### Site Information

Sampler Location	โครงการนิคมอุตสาหกรรมเวสต์ (สำหุน) ของบริษัท เวสต์ อินดัสเทรียล เอสเตท จำกัด	Date	05 March 2025
Project Site	ชุมชน หมู่ 4 บ้านสันป่าฝ้าย	Person	Mr. Warakorn Charoenkhun

### 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

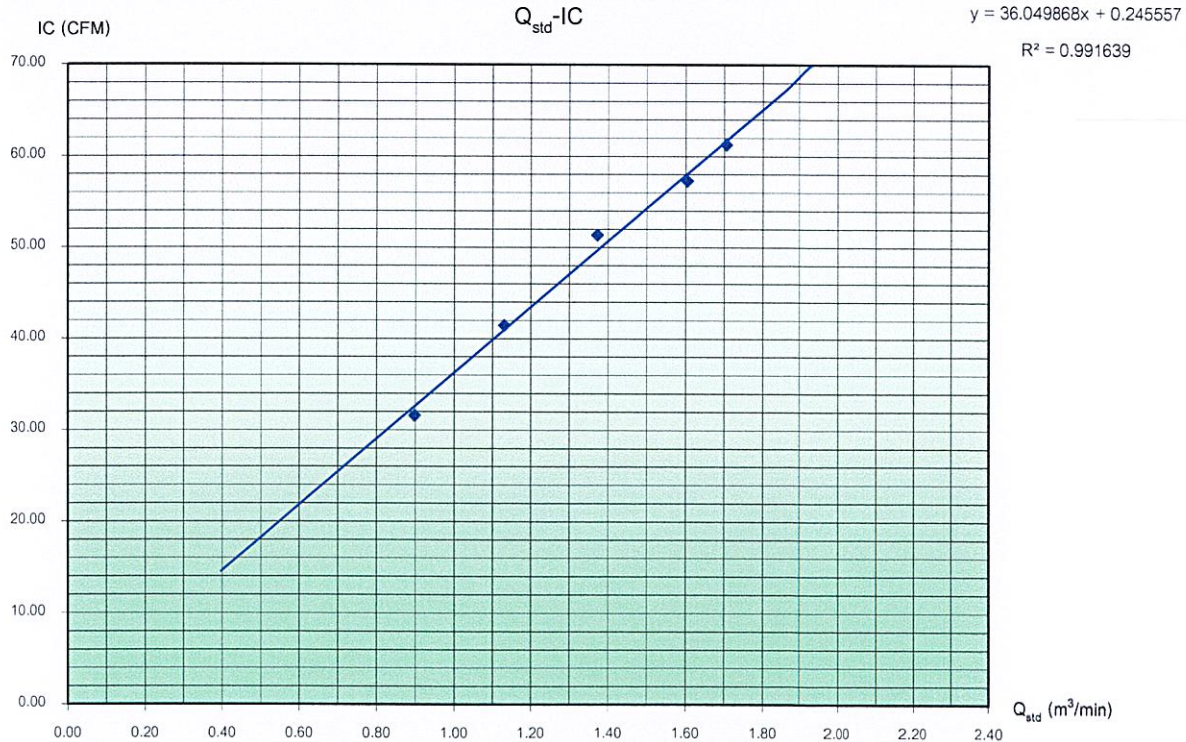
Sampler Number	PM10 No.09	Motor Serial Number	1203-444	Recorder Serial Number	606
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Test No.	Pressure Drop Across Orifice (ΔH <sub>2</sub> O) (inH <sub>2</sub> O)			(A)	(X)	(I)	(Y)	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
	Positive	Negative	ΔH <sub>2</sub> O	$\Delta H_2O(P_a/P_{std})(T_{std}/T_a)^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (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 <sup>2</sup> )	0.991639
Correlation Coefficient (r)	0.995811

Andersen Instruments, Inc.



Calibrated By

วรากรณ์

Mr. Warakorn Charoenkhun

**SMILE**  
Laboratory Co., Ltd.

## Analyzer Performance Test

Calibrated Date: 05 March 2025

### Instruments Information

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

### Calibration System

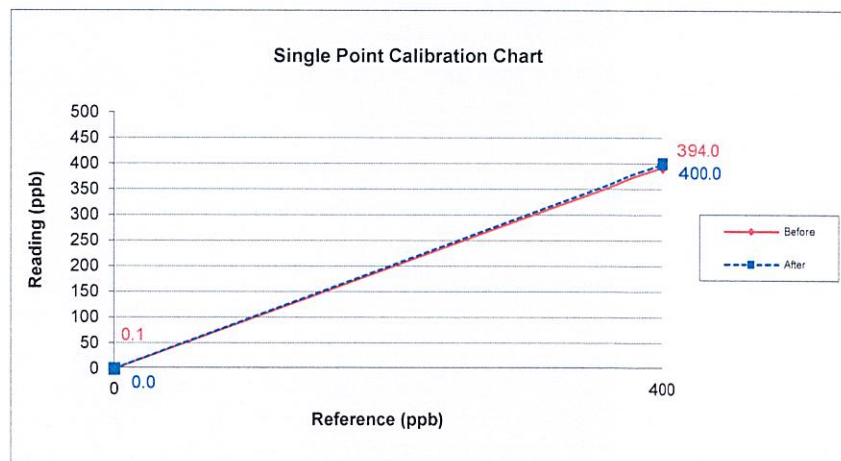
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008	NO Conc 46.05 ppm
S/N: 705	SO <sub>2</sub> Conc 46.01 ppm
ZERO AIR Generator API MODEL 701	CO Conc 4,487 ppm
S/N: 1924	Expire Date: 29 Oct. 2027

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 :

Mr.PASAGORN SAMOL



## Analyzer Performance Test

Calibrated Date: 05 March 2025

### 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 55.47 PPM SO <sub>2</sub> Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

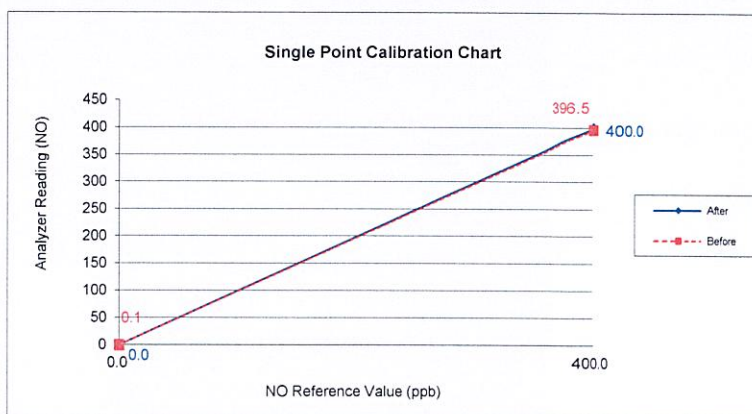
Humidity: 51 %RH

### 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	396.5	400.0	-0.9
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 : Mr. Pasagorn Samol



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

### Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 05 March 2025

Certificate No. 122/21

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 Vaisaia Type RTB220 No. V1220015

Calibrated by :

Mr. Pasagorn Samol



## The Result of Calibration

Date of Issue 05 March 2025

Certificate No. 122/21

Page : 2 of 2

Standard  Ultrasonic Anemometer m/sec	HOOK GAGE NO 1425			TESTED ANEMOMETER			
	Pressure inches	Vacuum inches	Pressure hPa	Pressure hPa	Correction hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	-	-	0.7	0.30
3.02	-	-	-	-	-	2.7	0.32
5.04	-	-	-	-	-	4.5	0.54
7.03	-	-	-	-	-	6.7	0.33
9.01	-	-	-	-	-	8.5	0.51
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 :



Mr. Pasagorn Samol



## Certificate of Calibration

Certificate Number : SPR25040308-2

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

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

Location of Calibration : On-Site

Calibration Procedure : SP-CPT-04-01

Received Date : 24 Apr 2025

Calibration Date : 28 Apr 2025

Recommend Due Date : N/A

Date of Issue : 29 Apr 2025

### 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 : Ms. Apinya Pinyo

Calibration Officer

Approved by :

( Mr. Prayoon Topart )

Authorized Signatory





## Calibration Report

Certificate Number : SPR25040308-2

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Data Acquisition/Switch Unit	34970A	MY44074688	SPR24080102-24	07 Sep 2025

### Traceability

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

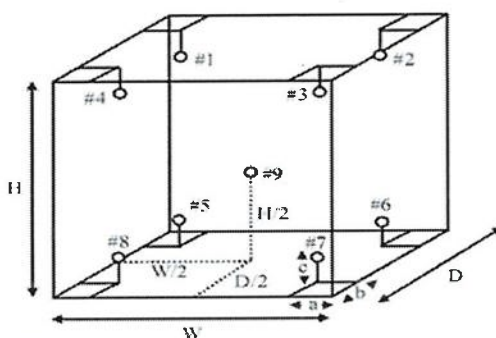


ID LINE : IEC17025

## Result of Calibration

Certificate Number : SPR25040308-2

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	20.05	20.11	20.14	20.12	20.06	19.92	19.91	19.98	19.99	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	0.30	0.41

### 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 : SPR25040308-7

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

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

Location of Calibration : On-Site

Calibration Procedure : SP-CPT-04-01

Received Date : 24 Apr 2025

Calibration Date : 28 Apr 2025

Recommend Due Date : N/A

Date of Issue : 29 Apr 2025

### 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 : Ms. Apinya Pinyo

Calibration Officer

Approved by :

( Mr. Prayoon Topart )

Authorized Signatory



## Calibration Report

Certificate Number : SPR25040308-7

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Data Acquisition/Switch Unit	34970A	MY44074688	SPR24080102-24	07 Sep 2025

### Traceability

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

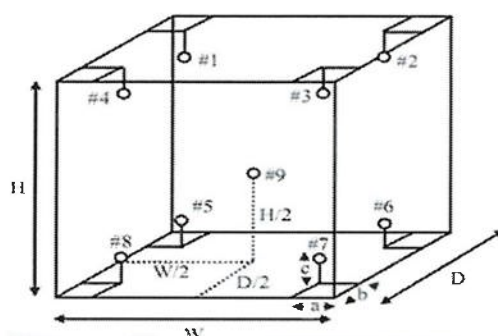




## Result of Calibration

Certificate Number : SPR25040308-7

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	104.40	104.32	104.44	104.41	104.36	104.11	104.52	104.21	104.16	0.26
150.0	150.55	150.49	150.61	150.58	150.22	150.18	150.25	150.16	150.21	0.26
180.0	180.52	180.41	180.55	180.56	180.26	180.23	180.21	180.18	180.24	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	0.54	0.60
150.0	150.0	0.11	0.60	0.67
180.0	180.0	0.10	0.51	0.57

### 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 : SPR25040308-3

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 : M214A

Serial Number : CHA2000931

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-CPM-04-01

Received Date : 24 Apr 2025

Calibration Date : 28 Apr 2025

Recommend Due Date : N/A

Date of Issue : 29 Apr 2025

### 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 : Ms. Apinya Pinyo

Calibration Officer

Approved by :

( Mr. Prayoon Topart )

Authorized Signatory





## Calibration Report

Certificate Number : SPR25040308-3

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Standard Weight Set	Class E2	B323414833	C02241167	04 Jul 2025

### Traceability

This certification is traceable to the International System of Unit maintained at :  
DKSH - DKSH Technology Limited.



## Result of Calibration

Certificate Number : SPR25040308-3

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

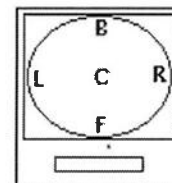
Unit : g

Nominal Value	UUC Reading	Error	Uncertainty ( ± )
No Load	0.0000	0.0000	0.000058
20.0	20.0000	0.0000	0.000064
40.0	40.0000	0.0000	0.000080
60.0	60.0000	0.0000	0.00011
80.0	80.0000	0.0000	0.00016
100.0	100.0000	0.0000	0.00016
120.0	120.0000	0.0000	0.00020
140.0	140.0000	0.0000	0.00020
160.0	160.0000	0.0000	0.00030
180.0	180.0000	0.0000	0.00030
200.0	200.0000	0.0000	0.00030

Off – Center Loading

Center	50.0000 g
Front	50.0002 g
Back	50.0001 g
Left	50.0001 g
Right	50.0002 g
Maximum difference	0.0002 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.

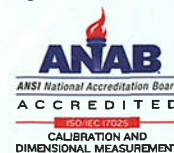
### Measurement Uncertainty

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 -

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 Tel: (662) 193-2217-20 www.spmetrology.co.th www.สเปคเมทรีโลยี จำกัด





ID LINE : IEC17025

## Certificate of Calibration

Certificate Number : SPR25040308- 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 :  $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$

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

Location of Calibration : In-Lab

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

Received Date : 24 Apr 2025

Calibration Date : 05 May 2025

Recommend Due Date : N/A

Date of Issue : 06 May 2025

### 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

Calibration Officer

Approved by :

( Mr. Prayoon Topart )

Authorized Signatory



ID LINE : IEC17025

## Calibration Report

Certificate Number : SPR25040308- 4

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Standard pH Solution	PH016.L5	Lot No.1077072	61310674	23 Feb 2026
Standard pH Solution	PH107.L5	Lot No.1077041	61318175	23 Feb 2026
Standard pH Solution	PH020.L5	Lot No.1077043	61325050	24 Feb 2026
Super Thermometer with PRT	1575/3850-40-392	58087/100288	PSL-T 0396/68	06 Mar 2026

### 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 Number : SPR25040308-4

Page : 3 of 3

pH Measurement @ 25 °C

Unit : pH

Standard Solution	UUC Reading	Error	Uncertainty ( ± )
4.007	4.01	0.003	0.012
6.965	7.00	0.035	0.012
10.011	9.98	-0.031	0.012

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
40.0	40.3	0.3	0.070

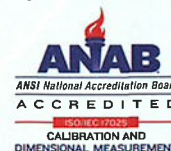
### Note :

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 : SPR25040308-5

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

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

Location of Calibration : On-Site

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

Received Date : 24 Apr 2025

Calibration Date : 28 Apr 2025

Recommend Due Date : N/A

Date of Issue : 29 Apr 2025

### 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 : Ms. Apinya Pinyo

Calibration Officer

Approved by :

( Mr. Prayoon Topart )

Authorized Signatory





## Calibration Report

Certificate Number : SPR25040308-5

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Standard pH Solution	PH016.L5	Lot No.1077072	61310674	23 Feb 2026
Standard pH Solution	PH107.L5	Lot No.1077041	61318175	23 Feb 2026
Standard pH Solution	PH020.L5	Lot No.1077043	61325050	24 Feb 2026
Super Thermometer with PRT	1575/3850-40-392	58087/100288	PSL-T 0396/68	06 Mar 2026

### 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



## Result of Calibration

Certificate Number : SPR25040308-5

Page : 3 of 3

pH Measurement @ 25 °C

Unit : pH

Standard Solution	UUC Reading	Error	Uncertainty ( ± )
4.007	4.01	0.003	0.012
6.965	6.97	0.005	0.012
10.011	10.01	-0.001	0.012

Temperature Measurement

Unit : °C

Standard Value	UUC Reading	Error	Uncertainty ( ± )
20.008	20.0	-0.008	0.070
25.007	25.0	-0.007	0.070
30.010	30.0	-0.010	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 -





## Certificate of Calibration

Certificate Number : SPR25040308-6

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

Received Date : 24 Apr 2025

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

Calibration Date : 28 Apr 2025

Location of Calibration : On-Site

Recommend Due Date : N/A

Calibration Procedure : SP-CPT-04-01

Date of Issue : 29 Apr 2025

### 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 : Ms. Apinya Pinyo

Calibration Officer

Approved by :

( Mr. Prayoon Topart )

Authorized Signatory



## Calibration Report

Certificate Number : SPR25040308-6

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Data Acquisition/Switch Unit	34970A	MY44074688	SPR24080102-24	07 Sep 2025

### Traceability

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

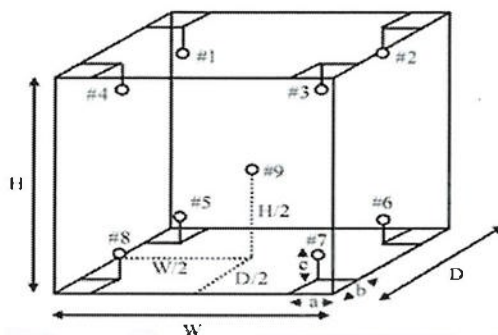




## Result of Calibration

Certificate Number : SPR25040308-6

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	4.11	4.25	4.18	4.20	4.36	4.28	4.38	4.40	4.26	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	0.29	0.47

### 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 -

# Avio220 Preventive Maintenance Report

Company Name: SP Environmental Development

Instrument Location: Company Limited.

69/1 Moo 1, Bo Kwang Thong, Bo Thong, Chonburi 20270


Instrument Serial No.: M79S2103081

Date: 09-April-2025



## ICP-OES/Avio220 Preventive Maintenance (PM)

<b>Company Name:</b>	SP Environmental Development Company Limited.		
<b>Address (Instrument Location):</b>	69/1 Moo 1, Bo Kwang Thong, Bo Thong, Chonburi 20270		
<b>Serial Number:</b>	M79S2103081	<b>PM Number:</b>	2 OF 2
<b>Customer Name (if applicable):</b>	K. Athithaya	<b>Telephone Number:</b>	085-4311178
<b>Service Engineer Name:</b>	Khun Piyawit	<b>Service Order Number:</b>	WO-03026834
<b>Date PM Performed: (DD-MMM-YYYY)</b>	09-Apr-2025	<b>Next PM Due Date: (DD-MMM-YYYY)</b>	09-Oct-2025
<b>Standard Labor Hours to Complete PM :</b>		<b>4 hours</b>	

Part Number	Release	Publication Date	
TH09370183 Rev.2	B	July 2020	

### Scope

The purpose of this PM is to ensure the continued functionality of the PerkinElmer/Avio220 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 #	Configuration Notes
Avio220Max	M79S2103081	Syngistix v.5.1.0.0293
Autosampler S23	022111S23	

## Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
09995098	Air Filter-Spectrometer	Not Applicable
N077520	Air Filter-RF Generator	Not Applicable
09992731	Axial Window	Not Applicable
B0810377	Radial Window	Not Applicable
N0770438	O-ring kit, injector support adapter	Not Applicable
N0780437	O-ring kit, torch	Not Applicable

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date: (MM/YY)
N0691579	Multi-Element Standard (N069-1579 diluted 10X)	1	62-162CRX1	30-Dec-2025
N9300221	Instrument Calibration-4 (N9300221 diluted 100X)	1	61-190CRY1	30-Aug-2025



# Procedure Checklist

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

## 1. General:

- ✓ Ask customer about unit's performance since last visit.
- ✓ Check incoming AC line voltage under load for proper levels and grounding.
- ✓ Is the instrument operational?

## 2. Mechanical:

- ✓ Inspect and clean all fans and filters.
- ✓ Inspect and replace torch components and necessary.

Torch Components Replaced: ☐ Yes ☒ No

If yes, list components replaced:

- ✓ Inspect all tubing for signs of cracking or leaking and replace as necessary.

Tubing Replaced: ☒ Yes ☐ No

If yes, list tubing replaced:

- ✓ Inspect the peristaltic pump for proper operation.
- ✓ Check and adjust if necessary, the external nitrogen, argon shear gas and water supply pressures.
- ✓ Check and adjust if necessary, the internal nitrogen, main argon, torch argon and shear gas pressures

Regulator	Measured Pressure	Set Pressure
Nitrogen	N/A	NA (calibrated in Factory)
Main Argon	76psig	76psig
Torch Argon	67psig	67psig
Shear Gas	65psig	65psig
Water	35psig	35psig

- ✓ Check the shear gas nozzle for blockages and proper, uniform flow.
- ✓ Inspect nitrogen Hi/Low purge and shear gas solenoids for proper function.
- ✓ Inspect the function of all spectrometer motors. Drive the motors from the Spectrometer DCM. Check all motors, couplings, set screws, gears or drive assembly located on the spectrometer (prism/grating wavelength drives, slits, shutter, DV mirror, X/Y mirror) if problems are found.
- ✓ Perform preventative maintenance on the chiller as required. Make the customer aware of the importance of maintaining the chiller fluid level and filter replacement.
- ✓ Drain air compressor surge tank.
- ✓ Clean exterior of instrument.

### 3. Electrical:

- ☒ Visually inspect all PC boards for cleanliness and signs of corrosion.
  - ☒ Check all RF generator and spectrometer power supply voltages.
  - ☒ Run instrument diagnostic checks from the appropriate Device Control Module.

#### **RF Generator:**

- ☒ Check the RF generator status screens.
- ☒ Check the function of all interlocks.

#### **Spectrometer:**

- ☒ Check the spectrometer status screens.
- ☒ Check for proper function of all motors from the Motor Control window.

### 4. Optical:

- ☒ Check the neon lamp for proper operation.
- ☒ Ensure that neon initialization passes at power up.
- ☒ Ensure that there is a single, well defined peak of sufficient intensity (approximately 15,000 to 60,000 cts.) for the 703.241nm neon line viewed in the DCM Collect Spectra window. Re-generate the neon correction table if problems are encountered. If problems are still exhibited after the table is re-generated, replace the neon lamp assembly.

Neon Lamp Replaced: ☐ Yes ☒ No

- ☒ Perform the Initialize Optics routine from the Spectrometer Control window.
- ☒ Insure that the routine passes with no error codes. If it fails, run a manual prism scan from the spectrometer DCM.
- ☒ Insure the Dark Current measurement (Detector Calibration) passes at initialization.
- ☒ Check the shutter home sensor position.
- ☒ Check prism/electronics temperature sensor readback values from the DCM. It is normal for these readings to be shown in red. A typical prism temperature is approximately 29.5 degree C. A typical electronics temperature is approximately 35 degree C.
- ☒ Check the detector temperature from the DCM for -7.0 to -8.5 degree C. If outside of this range the detector cooling fan may not be operational. Further inspection may be necessary.
- ☒ Inspect for proper function of the transfer optics. 1) shutter 2) DV mirror 3) X/Y mirror.
- ☒ Clean or replace the axial and radial view windows as necessary.

Axial Window Replaced: ☐ Yes ☒ No

Radial Window Replaced: ☐ Yes ☒ No

### 5. Post PM Performance Tests:

- ☒ Perform View Align.

#### **Test Spectral Resolution:**

- ☒ Measure the spectrometers ability to separate two adjacent wavelengths.

Parameter	Specification	Test Result	Pass/Fail
As 193.696 - Resolution	≤0.009	0.00826	Passed
Ni 231.604 - Resolution	≤0.011	0.00883	Passed
Ni 341.476 - Resolution	≤0.015	0.01298	Passed
Ba 455.403 - Resolution	≤0.020	0.01818	Passed



**Test Precision**

- ☒ Test for reproducibility of a set of measurement.

Parameter	Specification	Test Result	Pass/Fail
<b>Zn 213.856</b>	%RSD $\leq$ 1 %	0.55%	Passed
<b>Mg 280.856</b>	%RSD $\leq$ 1 %	0.86%	Passed
<b>Mg 285.207</b>	%RSD $\leq$ 1 %	0.25%	Passed
<b>Ba 455.403</b>	%RSD $\leq$ 1 %	0.33%	Passed

**Test MnBEC:**

- ☒ Run Axial and Radial BEC according to the A&T spec, or the commissioning test procedure.

**Mn Background Equivalent Concentration:**

Method "MnBEC" For Samples "IB (2% $\text{HNO}_3$ )" and "IS (N069-1579/10)", record intensities.

Calculated BEC:  $\text{BEC} = (\text{IB} * \text{Conc of Std}) / (\text{IS} - \text{IB})$ . Where Conc of Std = 1,000 PPB

Element	Mode	Conc.	IB	IS	
<b>Mn 257.610</b>	Radial	1,000 ppb	42,985.6	6,828,222.4	
<b>Mn 257.610</b>	Axial	1,000 ppb	44,880.2	6,827,992.0	
<b>Mn 257.610</b>	<b>IB*Conc.</b>	<b>IS - IB</b>	<b>BEC</b>	<b>Spec</b>	<b>Pass/Fail</b>
<b>Radial</b>	42,985,60	6,785,236.8	6.34	<b>&lt;30 PPB</b>	Passed
<b>Axial</b>	44,880,20	6,783,111.8	6.62	<b>&lt;30 PPB</b>	Passed

**6. Review:**

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

## Additional Comments

### Additional Comments Regarding the PM

## Review

*The preventive maintenance checks and if applicable performance tests for ICP-OES/Avio220 have been completed.*

*This ICP-OES/Avio220 Passes ☒ Fails ☐ the preventive maintenance.*

### Review of Preventive Maintenance:

Authorized PerkinElmer Representative:

*Piyawit S.*

Date:

09-Apr-2025

(DD-MMM-YYYY)

Authorized Customer Representative:

Date:

09-Apr-2025

(DD-MMM-YYYY)





## Certificate of Calibration

Certificate Number : SPR25040308-1

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 : 24 Apr 2025

Calibration Date : 28 Apr 2025

Recommend Due Date : N/A

Date of Issue : 29 Apr 2025

### 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 : Ms. Apinya Pinyo

Calibration Officer

Approved by :

( Mr. Prayoon Topart )

Authorized Signatory



## Calibration Report

Certificate Number : SPR25040308-1

Page : 2 of 4

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Data Acquisition/Switch Unit	34970A	MY44074688	SPR24080102-24	07 Sep 2025

### Traceability

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



## Result of Calibration

Certificate Number : SPR25040308-1

Page : 3 of 4

Temperature Measurement

Unit : °C

Pole No.	UUC Setting	Standard Reading	Error	Uncertainty ( ± )
1	150	150.67	-0.67	0.26
2	150	150.43	-0.43	0.26
3	150	150.83	-0.83	0.26
4	150	150.65	-0.65	0.26
5	150	150.82	-0.82	0.26
6	150	150.79	-0.79	0.26
7	150	150.87	-0.87	0.26
8	150	150.63	-0.63	0.26
9	150	150.38	-0.38	0.26
10	150	150.82	-0.82	0.26
11	150	149.72	0.28	0.26
12	150	150.76	-0.76	0.26
13	150	149.75	0.25	0.26
14	150	150.81	-0.81	0.26
15	150	149.78	0.22	0.26
16	150	149.68	0.32	0.26
17	150	149.85	0.15	0.26
18	150	150.46	-0.46	0.26
19	150	149.79	0.21	0.26
20	150	149.54	0.46	0.26
21	150	149.73	0.27	0.26
22	150	149.81	0.19	0.26
23	150	149.71	0.29	0.26
24	150	150.13	-0.13	0.26





## Result of Calibration

Certificate Number : SPR25040308-1

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 -