

ภาคผนวก ง

ใบรับรองการสอบเทียบเครื่องมือ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0580

MTC No. EEL. BP. 10/0766

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 Panasonic VP-7722A S/N 041477D122.
 7. Condenser Microphone B&K 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 : 5 Jul. 2023

Date of Calibration : 14 Jul. 2023

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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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0580

MTC No. EEL. BP. 10/0766

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 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ 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	93.85	-0.15	± 0.10	± 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	1000.4	0.4	± 1.5	$\pm 1.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.40	± 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.

Date of Calibration : 14 Jul. 2023

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0580

MTC No. EEL. BP. 10/0766

Nominal Output of Unit Under Test = 114 dB re 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ 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	114.01	0.01	± 0.10	± 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	1000.4	0.4	± 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	0.44	± 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 Deechaiyae)

Approved by :

(Mr.Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 14 Jul. 2023

Date of Issue : 17 Jul. 2023

Ref : 2011266070502629001

End of Certificate

3 / 3

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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: 

- 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: AWA14425-57258

3. Adjustments to indicated sound levels:

Type of Calibrator B&K 4231 SoundPressure Level 94.0 dB4. 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
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 Scarlet's Sound level Meter has been calibrated in accordance with the requirements as specified in ISO 17025 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

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

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

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

3. Adjustments to indicated sound levels:

Type of Calibrator B&K 4231 SoundPressure Level 94.0 dB4. 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
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 ISO 17025 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

CERTIFICATE OF CALIBRATION

NO. 20240113133

Name of Product:	Sound Level Meter
Model:	ST-11D
Serial Number:	820893
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2024-01-31
Due Date:	2025-01-29

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

2. Type & serial No. of Microphone: AWA14425-58633

3. Adjustments to indicated sound levels:

Type of Calibrator B&K 4231 SoundPressure Level 94.0 dB4. 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	-71.2	-14.3	-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	-2.5	-0.1	4000	1.1	-0.8	-0.1
63	-26.1	-0.2	-0.1	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	-0.1	20000	-23.9	-25.9	-0.1

6. Self-generated noise

Microphone replaced by electrical input signal device

7.0 dB(A)	8.6 dB(C)	13.8 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
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 Scarlet's Sound level Meter has been calibrated in accordance with the requirements as specified in ISO 17025 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

CERTIFICATE OF CALIBRATION

NO. 20240113134

Name of Product:	Sound Level Meter
Model:	ST-11D
Serial Number:	820894
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2024-01-31
Due Date:	2025-01-29

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

 2. Type & serial No. of Microphone: AWA14425-58728

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	-0.1	1000	0.0	0.0	-0.1
20	-50.1	-6.3	-0.2	2000	1.3	-0.1	-0.1
31.5	-39.2	-2.5	-0.1	4000	1.2	-0.8	-0.1
63	-26.1	-0.2	-0.1	8000	-1.0	-3.2	0.0
125	-16.2	-0.1	0.1	12500	-11.6	-13.5	0.1
250	-8.7	0.1	-0.1	16000	-11.5	-13.3	0.1
500	-3.3	0.2	-0.1	20000	-23.8	-25.9	-0.1

6. Self-generated noise

Microphone replaced by electrical input signal device

7.4 dB(A)	10.4 dB(C)	14.6 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
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 Scarlet's Sound level Meter has been calibrated in accordance with the requirements as specified in ISO 17025 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



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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 Thoet Thai Rd., Bangwa, Phasi Charoen, Bangkok 10160 Tel. 02-227-0265 Fax. 02-454-0317

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Site Information

Sampler Location	บริษัท เอเพ็กซ์ ปาร์ค จำกัด	Date	02 June 2024
Project Site	หมู่ที่ 13 บ้านคลองหนึ่ง	Person	Mr. Anupong Kotchasongkhram

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

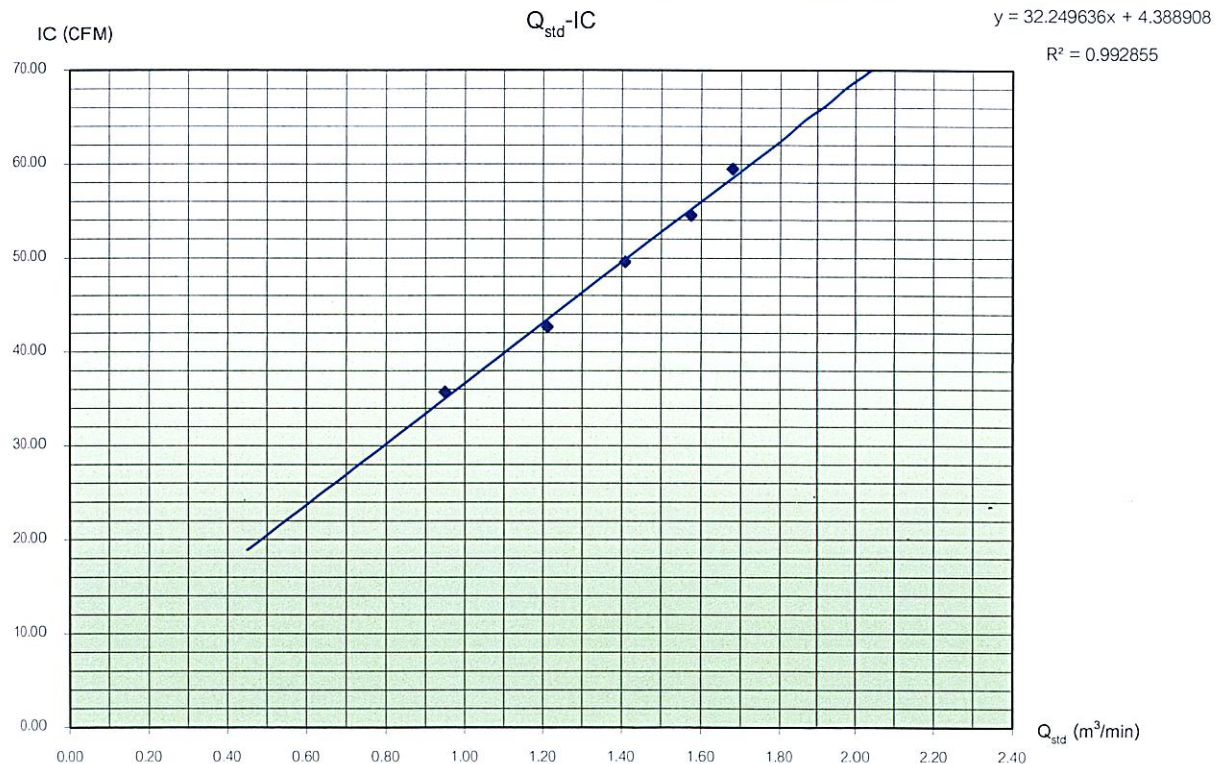
Sampler Number	TSP No.01	Motor Serial Number	1203-415	Recorder Serial Number	653
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Test No.	Pressure Drop Across Orifice (ΔH_2O) (in H_2O)			(A)	(X)	(I)	(Y)	Temperature ($^{\circ}K = ^{\circ}C + 273$)	Barometric Pressure (mmHg)
	Positive	Negative	ΔH_2O	$[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m^3/min)	Sample Flow Rate Indication (ft^3/min)	$IC = I[(P_a/P_{std})(T_{std}/T_a)]^{1/2}$ (ft^3/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^2)	0.992855
Correlation Coefficient (r)	0.996421

Andersen Instruments, Inc.



Calibrated By

Mr. Anupong Kotchasongkhram

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Laboratory Co., Ltd.



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Laboratory Co., Ltd.

บริษัท สไมล์ แล็บอราทอรี จำกัด

Smile Laboratory Co., Ltd.

563/1 ถนนเอกชัย 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	บริษัท เอเพ็กซ์ ปาร์ค จำกัด	Date	02 June 2024
Project Site	หมู่ที่ 13 บ้านคลองหนึ่ง	Person	Mr. Anupong Kotchasongkhram

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

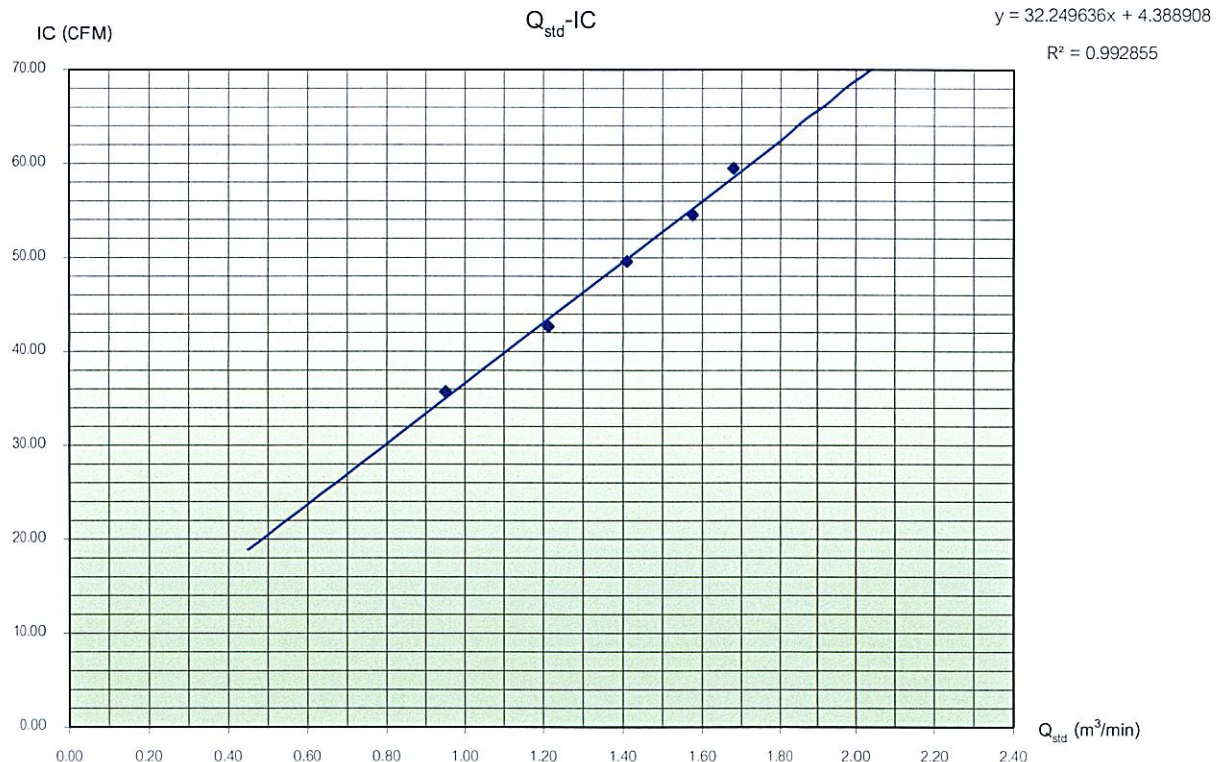
Sampler Number	PM-10 No.01	Motor Serial Number	1203-449	Recorder Serial Number	643
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Test No.	Pressure Drop Across Orifice (ΔH_2O) (inH ₂ O)			(A)	(X)	(I)	(Y)	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
	Positive	Negative	ΔH_2O	$[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m ³ /min)	Sample Flow Rate Indication (ft ³ /min)	$IC = I[(P_a/P_{std})(T_{std}/T_a)]^{1/2}$ (ft ³ /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^2)	0.992855
Correlation Coefficient (r)	0.996421

Andersen Instruments, Inc.



Calibrated By

Mr. Anupong Kotchasongkhram

SMILE
Laboratory Co., Ltd.



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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 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	บริษัท เอเพ็กซ์ ปาร์ค จำกัด	Date	02 June 2024
Project Site	หมู่ที่ 12 บ้านคลองสอง (บ้านแปลงยาวบน)	Person	Mr. Anupong Kotchasongkham

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

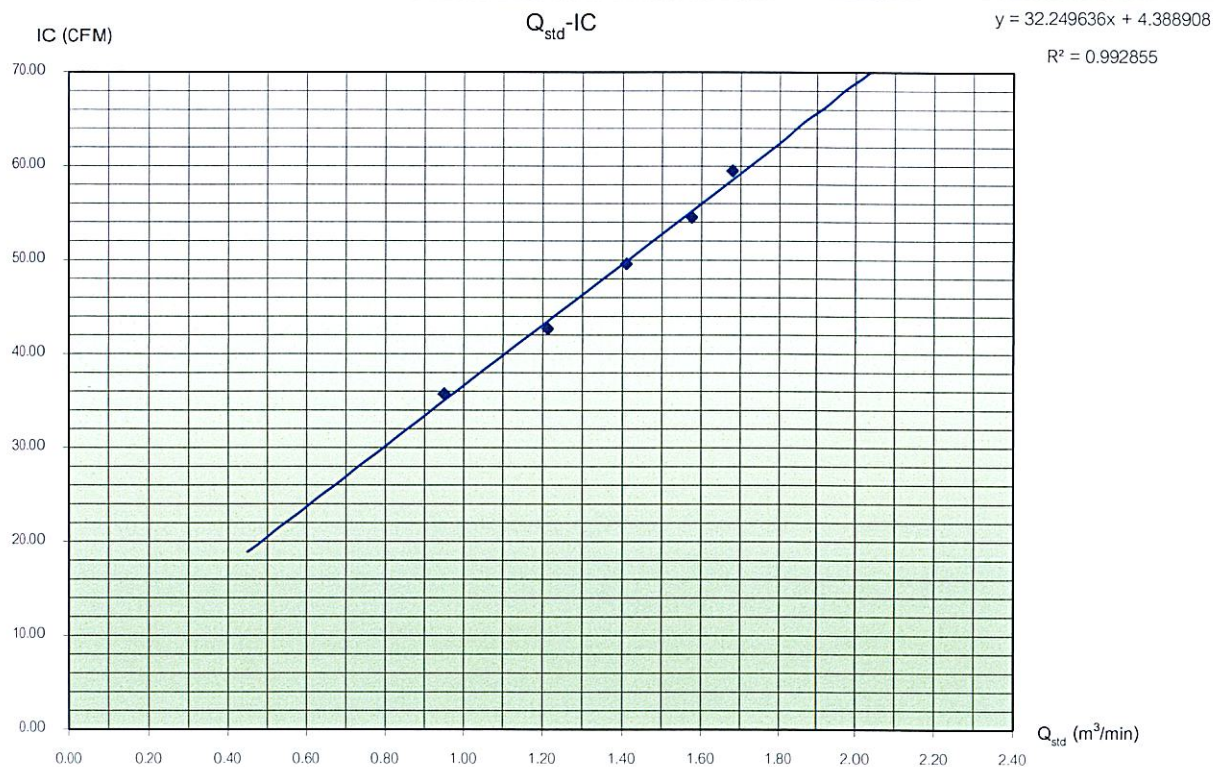
Sampler Number	TSP No.02	Motor Serial Number	1203-416	Recorder Serial Number	654
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Test No.	Pressure Drop Across Orifice (ΔH_2O) (in H_2O)			(A)	(X)	(I)	(Y)	Temperature ($^{\circ}K = ^{\circ}C + 273$)	Barometric Pressure (mmHg)
	Positive	Negative	ΔH_2O	$[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m^3/min)	Sample Flow Rate Indication (ft^3/min)	$IC = I[(P_a/P_{std})(T_{std}/T_a)]^{1/2}$ (ft^3/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^2)	0.992855
Correlation Coefficient (r)	0.996421

Andersen Instruments, Inc.



Calibrated By

Mr. Anupong Kotchasongkham

SMILE
Laboratory Co., Ltd.



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บริษัท สไมล์ แล็บอราทอรี จำกัด

Smile Laboratory Co., Ltd.

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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	บริษัท เอเพ็กซ์ ปาร์ค จำกัด	Date	02 June 2024
Project Site	หมู่ที่ 12 บ้านคลองสอง (บ้านแปลงยาวบน)	Person	Mr. Anupong Kotchasongkhram

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

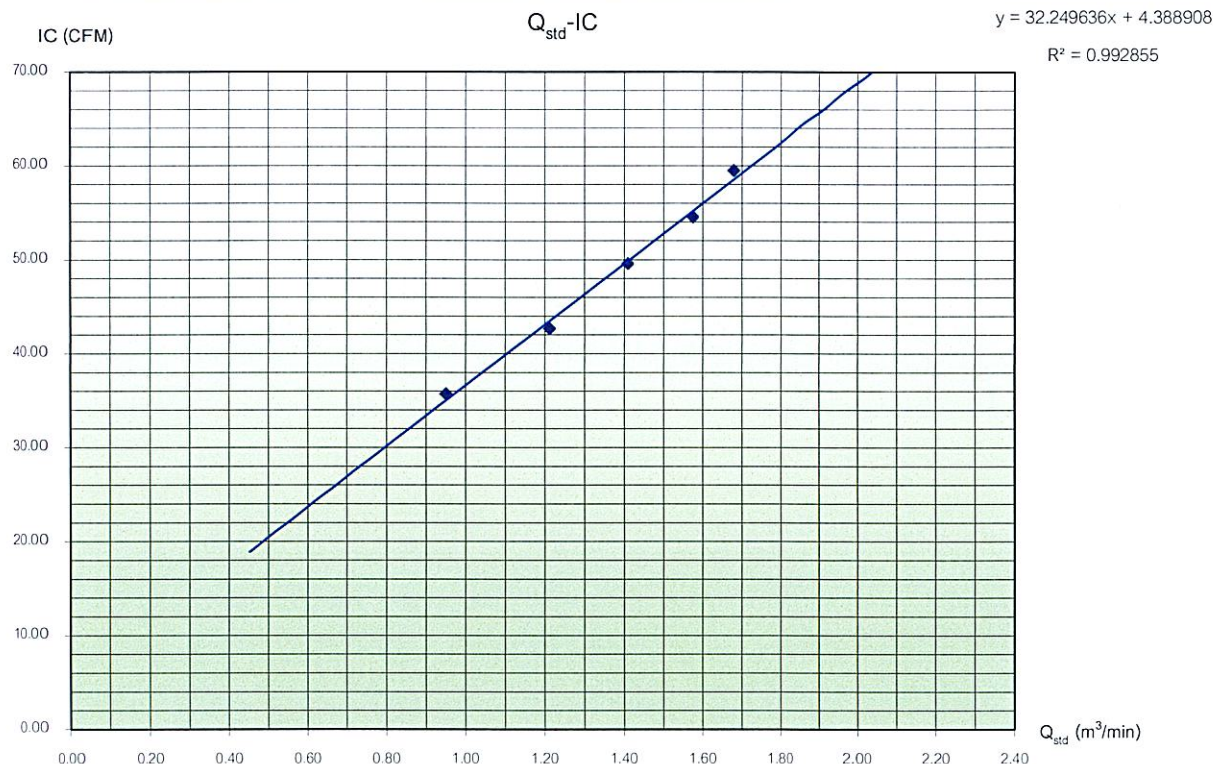
Sampler Number	PM-10 No.02	Motor Serial Number	1203-450	Recorder Serial Number	644
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Test No.	Pressure Drop Across Orifice (ΔH_2O) (inH ₂ O)			(A)	(X)	(I)	(Y)	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
	Positive	Negative	ΔH_2O	$[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m ³ /min)	Sample Flow Rate Indication (ft ³ /min)	$IC = I[(P_a/P_{std})(T_{std}/T_a)]^{1/2}$ (ft ³ /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^2)	0.992855
Correlation Coefficient (r)	0.996421

Andersen Instruments, Inc.



Calibrated By

Mr. Anupong Kotchasongkhram

SMILE
Laboratory Co., Ltd.

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 02 June 2024

Certificate No. 114/22

Page : 1 of 2

Manufacture Yong Instruments

Type four blade helicoid propeller

Model No. 05103

Mfg Code Logger 309020206

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



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, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

The Result of Calibration

Date of Issue 07 December 2022

Certificate No. 114/22

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 :



Mr. Pasagorn Samol

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 02 June 2024

Certificate No. 114/22

Page : 1 of 2

Manufacture Yong Instruments

Type four blade helicoid propeller

Model No. 05103

Mfg Code Logger 309020207

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

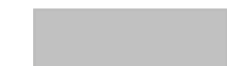
: Theodor Friedrich : Dry No. 8390/94 Wet No. 8389/94

: Thermoschneider No. 918802

STANDARD BAROMETER

: Digital Barometer Vaisaia Type RTB220 No. V1220015

Calibrated by :



Mr. Pasagorn Samol

The Result of Calibration

Date of Issue 07 December 2022

Certificate No. 114/22

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 :



Mr. Pasagorn Samol

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 02 June 2024

Certificate No. 114/22

Page : 1 of 2

Manufacture Yong Instruments

Type four blade helicoid propeller

Model No. 05103

Mfg Code Logger 309020208

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 07 December 2022

Certificate No. 114/22

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 :



Mr. Pasagorn Samol

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 02 June 2024

Certificate No. 114/22

Page : 1 of 2

Manufacture Yong Instruments

Type four blade helicoid propeller

Model No. 05103

Mfg Code Logger 309020209

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



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

The Result of Calibration

Date of Issue 07 December 2022

Certificate No. 114/22

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 :



Mr. Pasagorn Samol

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 02 June 2024

Certificate No. 114/22

Page : 1 of 2

Manufacture Yong Instruments

Type four blade helicoid propeller

Model No. 05103

Mfg Code Logger 309020210

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 07 December 2022

Certificate No. 114/22

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 :



Mr. Pasagorn Samol