

ภาคผนวกที่ 4

สรุปเอกสารสอบเทียบอุปกรณ์เครื่องมือ

เอกสารการสอบเทียบเครื่องมือตรวจวัดระดับเสียงในบรรยากาศ

Certificate No.: CP20250024EB

Operation No.: CP2025010014

Certificate of Calibration

This certificate was issued to substitute to Certificate No. CP20250024EA

Equipment: Sound Level Meter

Manufacturer: ACO

Model/Type: 6236 (Meter), 7052NR (Microphone), - (Preamplifier)

Serial No.: 222185 (Meter), 84158 (Microphone), - (Preamplifier)

ID No.: NS-03-015

Customer: C.E.M. Technology (Thailand) Co.,Ltd.

Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran,
Nakorn Phatom 73210

Received Date: 13 January 2025

Calibrated Date: *17 - 20 January 2025*

Issued Date: 25 February 2025

Calibrated by: Ms. Juntaporn Kunhakom

Approved by:



(Mr. Sittichai Swaksuriyawong)
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

Certificate No.: CP20250024EB

Calibration Report

Equipment: Sound Level Meter
 Manufacturer: ACO
 Model/Type: 6236 (Meter), 7052NR (Microphone), - (Preamplifier)
 Serial No.: 222185 (Meter), 84158 (Microphone), - (Preamplifier)
 ID No.: NS-03-015
 Ambient Temperature: (23 ± 2) °C
 Relative Humidity: (50 ± 15) %
 Pressure: (101.3 ± 1.5) kPa
 Method of Calibration :-
 IEC61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2661000	AA-1007-24	6 June 2025
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2913	EF-0021-24	3 June 2025
4) 6.5 Digit precision multimeter	8846A	9609027	CB20240128EA	31 July 2025
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P240022 CD20240180EA	20 March 2025 7 August 2025
6) Performance Audio Analyzer	U8903B	MY56510003	CB20240035EB CK20240069EA	13 February 2025 19 September 2025

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

3. This certification is traceable to the international system of unit maintained at :-

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)
- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)
- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-

Certificate No.: CP20250024EB

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
18.8

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	13.6
C-weighting	18.2
Z-weighting	24.4

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

Meter free-field acoustic response at a level of 84 dB.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.1	-0.2	0.1	±1.5
1000	-0.2	-0.1	-0.2	±1.0
8000	0.6	0.7	0.9	±5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.0	-0.2	0.0	±2.0
125	0.0	-0.1	0.0	±1.5
250	0.0	-0.1	0.0	±1.5
500	0.1	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	-0.1	0.0	0.0	±2.0
4000	-0.3	-0.3	-0.1	±3.0
8000	-0.5	-0.3	-0.1	±5.0

Certificate No.: CP20250024EB

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.3

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
120.0	120.1	0.1	±1.1
121.0	121.1	0.1	±1.1
122.0	122.1	0.1	±1.1
123.0	123.1	0.1	±1.1

Certificate No.: CP20250024EB

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	58.8	-0.2	±1.1
54.0	53.8	-0.2	±1.1
49.0	48.8	-0.2	±1.1
44.0	43.9	-0.1	±1.1
39.0	38.8	-0.2	±1.1
34.0	33.9	-0.1	±1.1
33.0	33.0	0.0	±1.1
32.0	32.1	0.1	±1.1
31.0	31.3	0.3	±1.1
30.0	30.4	0.4	±1.1
29.0	29.6	0.6	±1.1

Function : 8. Level Linearity including level range control

8.1. Level Linearity Including the Level Range (Reference Signal)

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-100	94.0	94.0	0.0	±1.1
20-110	94.0	94.0	0.0	±1.1
30-120	94.0	94.0	0.0	±1.1
40-130	94.0	94.0	0.0	±1.1

8.2. Level Linearity Including the Level range (5dB Above Under-range)

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-80	25.0	25.3	0.3	±1.1
20-90	25.0	25.3	0.3	±1.1
20-100	25.0	25.4	0.4	±1.1
20-110	25.0	25.3	0.3	±1.1
30-120	35.0	35.0	0.0	±1.1
40-130	45.0	45.1	0.1	±1.1

Certificate No.: CP20250024EB

Calibration Report

Function : 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	116.1	0.1	±1.0
	2	99.0	0.0	+1.0 ; -2.5
	0.25	89.9	-0.1	+1.5 ; -5.0
Slow	200	109.5	-0.1	±1.0
	2	89.9	-0.1	+1.0 ; -5.0
LAE	200	110.0	0.0	±1.0
	2	90.0	0.0	+1.0 ; -2.5
	0.25	80.9	-0.1	+1.5 ; -5.0

Function : 10. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	125.4	125.7	0.3	±3.0
Positive half cycle	124.4	124.2	-0.2	±2.0
Negative half cycle	124.4	124.2	-0.2	±2.0

Function : 11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
-	-	-	-

Function : 12. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	129.0	129.0	0.0	±0.3

Certificate No.: CP20250024EB

Calibration Report

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Level Linearity including level range control	0.30	0.30
9) Tone burst response	0.20	0.30
10) Peak C sound level	0.20	0.35
11) Overload indication	0.24	0.25
12) High-Level Stability	0.10	0.10

- Remarks:
1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
 2. Overload indication can not measured because sound level meter can not set to Reference value of the standard calibration.
 3. The acceptance limit is for the deviated value.
 4. Acceptance limits was IEC61672-3:2013 Class 2.
 5. The coverage factor $k = 2.00$

- - End of Report - -

Certificate No.: CP20240126EA

Operation No.: CP2024030095

Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: ACO

Model/Type: 6236 (Meter), 7052NR (Microphone), - (Preamplifier)

Serial No.: 222186 (Meter), 84150 (Microphone), - (Preamplifier)

ID No.: NS-03-016

Customer: C.E.M. Technology (Thailand) Co.,Ltd.

Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran,
Nakorn Phatom 73210

Received Date: 7 March 2024

Calibrated Date: 13 - 18 March 2024

Issued Date: 19 March 2024

Calibrated by: Ms. Juntaporn Kunhakom

Approved by:



(Mr. Sittichai Swaksuriyawong)
Group Manager

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Certificate No.: CP20240126EA

Calibration Report

Equipment: Sound Level Meter
 Manufacturer: ACO
 Model/Type: 6236 (Meter), 7052NR (Microphone), - (Preamplifier)
 Serial No.: 222186 (Meter), 84150 (Microphone), - (Preamplifier)
 ID No.: NS-03-016
 Ambient Temperature: (23 ± 2) °C
 Relative Humidity: (50 ± 15) %
 Pressure: (101.3 ± 1.5) kPa
 Method of Calibration :-
 IEC61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20230040EA	26 June 2024
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9609027	CB20230108EB	8 June 2024
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P230024 CD20230196EA	20 March 2024 23 July 2024
6) Pressure humidity and Temperature Transmitter	PTU301	F0640003	CL1-P230032 CD20230197EA	4 April 2024 23 July 2024
7) Performance Audio Analyzer	U8903B	MY56510003	CB20240035EA CK20230072EA	13 February 2025 13 September 2024

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

3. This certification is traceable to the international system of unit maintained at :-

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-

Certificate No.: CP20240126EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
21.9

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	18.6
C-weighting	41.7
Z-weighting	43.2

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

Meter free-field acoustic response at a level of 84 dB.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.3	-0.6	0.2	±1.5
1000	0.3	0.3	0.3	±1.0
8000	-0.2	0.4	0.5	±5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.1	-0.3	0.0	±2.0
125	0.2	-0.2	0.1	±1.5
250	0.2	-0.1	0.1	±1.5
500	0.2	0.0	0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.1	-0.1	0.0	±2.0
4000	-0.1	-0.3	0.0	±3.0
8000	-0.4	-0.4	-0.2	±5.0

Certificate No.: CP20240126EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.3

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
120.0	120.0	0.0	±1.1
121.0	121.0	0.0	±1.1

Certificate No.: CP20240126EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.5	0.5	±1.1
33.0	33.7	0.7	±1.1
32.0	32.9	0.9	±1.1
31.0	32.1	1.1	±1.1
30.0	31.1	1.1	±1.1

Function : 8. Level Linearity including level range control

8.1. Level Linearity Including the Level Range (Reference Signal)

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-100	94.0	94.0	0.0	±1.1
20-110	94.0	94.0	0.0	±1.1
30-120	94.0	94.0	0.0	±1.1
40-130	94.0	94.0	0.0	±1.1

8.2. Level Linearity Including the Level range (5dB Above Under-range)

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-80	25.0	25.5	0.5	±1.1
20-90	25.0	25.7	0.7	±1.1
20-100	25.0	25.8	0.8	±1.1
20-110	25.0	26.0	1.0	±1.1
30-120	35.0	35.0	0.0	±1.1
40-130	45.0	44.9	-0.1	±1.1

Certificate No.: CP20240126EA

Calibration Report

Function : 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	116.0	0.0	±1.0
	2	98.9	-0.1	+1.0 ; -2.5
	0.25	89.8	-0.2	+1.5 ; -5.0
Slow	200	109.4	-0.2	±1.0
	2	89.8	-0.2	+1.0 ; -5.0
LAE	200	109.9	-0.1	±1.0
	2	90.0	0.0	+1.0 ; -2.5
	0.25	80.9	-0.1	+1.5 ; -5.0

Function : 10. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	125.4	125.3	-0.1	±3.0
Positive half cycle	124.4	124.2	-0.2	±2.0
Negative half cycle	124.4	124.2	-0.2	±2.0

Function : 11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
-	-	-	-

Function : 12. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	129.0	129.0	0.0	±0.3

Certificate No.: CP20240126EA

Calibration Report

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Level Linearity including level range control	0.30	0.30
9) Tone burst response	0.20	0.30
10) Peak C sound level	0.20	0.35
11) Overload indication	0.20	0.25
12) High-Level Stability	0.10	0.10

- Remarks:
1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
 2. Overload indication can not measured because sound level meter can not set to Reference value of the standard calibration.
 3. The acceptance limit is for the deviated value.
 4. Acceptance limits was IEC61672-3:2013 Class 2.
 5. The coverage factor $k = 2.00$

- - End of Report - -

Certificate No.: CP20240426EA

Operation No.: CP2024120406

Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: ACO

Model/Type: 6236 (Meter), 7052NR (Microphone), - (Preamplifier)

Serial No.: 222197 (Meter), 82953 (Microphone), - (Preamplifier)

ID No.: NS-03-020

Customer: C.E.M. Technology (Thailand) Co.,Ltd.

Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran,
Nakorn Phatom 73210

Received Date: 16 December 2024

Calibrated Date: 20 - 23 December 2024

Issued Date: 24 December 2024

Calibrated by: Ms. Juntaporn Kunhakom

Approved by:



(Mr. Sittichai Swaksuriyawong)
Group Manager

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Certificate No.: CP20240426EA

Calibration Report

Equipment: Sound Level Meter
 Manufacturer: ACO
 Model/Type: 6236 (Meter), 7052NR (Microphone), - (Preamplifier)
 Serial No.: 222197 (Meter), 82953 (Microphone), - (Preamplifier)
 ID No.: NS-03-020
 Ambient Temperature: (23 ± 2) °C
 Relative Humidity: (50 ± 15) %
 Pressure: (101.3 ± 1.5) kPa
 Method of Calibration :-
 IEC61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2661000	AA-1007-24	6 June 2025
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2913	EF-0021-24	3 June 2025
4) 6.5 Digit precision multimeter	8846A	9609027	CB20240128EA	31 July 2025
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P240022 CD20240180EA	20 March 2025 7 August 2025
6) Performance Audio Analyzer	U8903B	MY56510003	CB20240035EB CK20240069EA	13 February 2025 19 September 2025

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

3. This certification is traceable to the international system of unit maintained at :-

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)
- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)
- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-

Certificate No.: CP20240426EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
21.4

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	19.0
C-weighting	26.0
Z-weighting	32.3

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

Meter free-field acoustic response at a level of 84 dB.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.2	-0.1	0.1	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-0.5	-0.3	-0.3	±5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	-0.3	-0.2	0.0	±2.0
125	-0.2	-0.2	0.0	±1.5
250	-0.2	-0.1	0.0	±1.5
500	-0.1	-0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	-0.2	-0.1	0.0	±2.0
4000	-0.4	-0.3	0.0	±3.0
8000	-0.6	-0.3	-0.1	±5.0

Certificate No.: CP20240426EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.3

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
120.0	120.1	0.1	±1.1
121.0	121.1	0.1	±1.1
122.0	122.1	0.1	±1.1
123.0	123.1	0.1	±1.1

Certificate No.: CP20240426EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	78.9	-0.1	±1.1
74.0	73.8	-0.2	±1.1
69.0	68.7	-0.3	±1.1
64.0	63.7	-0.3	±1.1
59.0	58.7	-0.3	±1.1
54.0	53.7	-0.3	±1.1
49.0	48.7	-0.3	±1.1
44.0	43.7	-0.3	±1.1
39.0	38.7	-0.3	±1.1
34.0	33.7	-0.3	±1.1
33.0	32.9	-0.1	±1.1
32.0	32.0	0.0	±1.1
31.0	31.1	0.1	±1.1
30.0	30.4	0.4	±1.1
29.0	29.5	0.5	±1.1

Function : 8. Level Linearity including level range control

8.1. Level Linearity Including the Level Range (Reference Signal)

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-100	94.0	94.0	0.0	±1.1
20-110	94.0	94.0	0.0	±1.1
30-120	94.0	94.0	0.0	±1.1
40-130	94.0	94.0	0.0	±1.1

8.2. Level Linearity Including the Level range (5dB Above Under-range)

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-80	25.0	26.0	1.0	±1.1
20-90	25.0	25.9	0.9	±1.1
20-100	25.0	26.0	1.0	±1.1
20-110	25.0	26.0	1.0	±1.1
30-120	35.0	35.0	0.0	±1.1
40-130	45.0	44.9	-0.1	±1.1

Certificate No.: CP20240426EA

Calibration Report

Function : 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	116.0	0.0	±1.0
	2	98.9	-0.1	+1.0 ; -2.5
	0.25	89.9	-0.1	+1.5 ; -5.0
Slow	200	109.5	-0.1	±1.0
	2	89.8	-0.2	+1.0 ; -5.0
LAE	200	109.9	-0.1	±1.0
	2	90.0	0.0	+1.0 ; -2.5
	0.25	80.9	-0.1	+1.5 ; -5.0

Function : 10. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	125.4	125.1	-0.3	±3.0
Positive half cycle	124.4	124.2	-0.2	±2.0
Negative half cycle	124.4	124.2	-0.2	±2.0

Function : 11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
-	-	-	-

Function : 12. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	129.0	129.0	0.0	±0.3

Certificate No.: CP20240426EA

Calibration Report

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Level Linearity including level range control	0.30	0.30
9) Tone burst response	0.20	0.30
10) Peak C sound level	0.20	0.35
11) Overload indication	0.24	0.25
12) High-Level Stability	0.10	0.10

- Remarks:
1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
 2. Overload indication can not measured because sound level meter can not set to Reference value of the standard calibration.
 3. The acceptance limit is for the deviated value.
 4. Acceptance limits was IEC61672-3:2013 Class 2.
 5. The coverage factor $k = 2.00$

- - End of Report - -

G.Ruamkit Panich Co.,Ltd.

219/44 Moo 12 Petchkasem Rd., Omnoi, Krathumban Samutsakorn 74130

CERTIFICATE No : GR 17 E 30063

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226
SERIAL No. : 060210
ID No. : CEM-SI-03

SUBMITTED BY : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.
219/43 MOO 12, PETCHKASEM RD., OMNOI,
KRATHUMBAN SAMUTSAKORN 74130

CALIBRATED BY : 
CALIBRATION DATE : 25-April-24

APPROVED BY : 
DHUDIT P.

ISSUED DATE : 25-April-24

G.Ruamkit Panich Co.,Ltd.

219/44 Moo 12 Petchkasem Rd., Omnoi,Krathumban Samutsakorn 74130

CERTIFICATE No : GR 17 E 30063

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226 SERIAL NUMBER : 060210
ID No. : CEM-SI-03
RECEIVED DATE : 23-April-24 CALIBRATION DATE : 25-April-24
AMBIENT TEMPERATURE : 22 °C ± 3°C RELATIVE HUMIDITY : 50%RH ± 20%RH

CONDITION OF THIS RESULTS OF CALIBRATION

- THIS INSTRUMENT WAS CALIBRATED ACCORDING TO IEC 61672-2:2003-04 AGAINST MULTIFUNCTION SOUND CALIBRATOR.
THIS INSTRUMENT WAS PERFORMED SELF-CALIBRATION BY CALIBRATOR FROM CUSTOMER AT 114 Hz BEFORE CALIBRATION.
- REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No.	CERTIFICATTE No.	DUE DATE
1) MULTIFUNCTION SOUND CALIBRATOR.	1986	01827	EEL.BP.67/0974	10-Jan-25

- THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
- THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
- THIS CERTIFICATE IS TRACEABLE TO :-
 - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
125.00	-16.10	-15.80	-0.30	0.50
250.00	-8.60	-8.10	-0.50	0.50
500.00	-3.20	-3.0	-0.20	0.50
1000.00	0.00	0.00	0.0	0.50
2000.00	1.20	0.90	0.3	0.50

2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
125.00	-0.20	0.1	-0.3	0.50
250.00	0.00	0.5	-0.5	0.50
500.00	0.00	0.3	-0.3	0.50
1000.00	0.00	0.0	0.0	0.50
2000.00	-0.20	-0.4	0.2	0.50

3. SOUND LEVEL LINEARITY TEST AT 1000 Hz

STANDARD APPLIED (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
74	74.0	0.0	0.50
84	84.0	0.0	0.50
94	94.0	0.0	0.50
104	104.1	-0.1	0.50
114	114.2	-0.2	0.50

UUC* : UNIT UNDER CALIBRATION

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%

END OF CALIBRATION REPORT

G.Ruamkit Panich Co.,Ltd.

219/44 Moo 12 Petchkasem Rd., Omnoi, Krathumban Samutsakorn 74130

CERTIFICATE No : GR 17 E 30066

PAGE : 1 OF 2


Certificate of Calibration

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226
SERIAL No. : 150006
ID No. : CEM-SI-06

SUBMITTED BY : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.
219/43 MOO 12, PETCHKASEM RD., OMNOI,
KRATHUMBAN SAMUTSAKORN 74130

CALIBRATED BY : 
SURAWIT K.

CALIBRATION DATE : 25-April-24

APPROVED BY : 
PHUDIT P.

ISSUED DATE : 25-April-24

G.Ruamkit Panich Co.,Ltd.

219/44 Moo 12 Petchkasem Rd., Omnoi,Krathumban Samutsakorn 74130

CERTIFICATE No : GR 17 E 30066

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226 SERIAL NUMBER : 150006
ID No. : CEM-SI-06
RECEIVED DATE : 23-April-24 CALIBRATION DATE : 25-April-24
AMBIENT TEMPERATURE : 22 °C ± 3°C RELATIVE HUMIDITY : 50%RH ± 20%RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO IEC 61672-2:2003-04 AGAINST MULTIFUNCTION SOUND CALIBRATOR. THIS INSTRUMENT WAS PERFORMED SELF-CALIBRATION BY CALIBRATOR FROM CUSTOMER AT 114 Hz BEFORE CALIBRATION.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No.	CERTIFICATL No.	DUE DATE
1) MULTIFUNCTION SOUND CALIBRATOR.	1986	01827	EEL.BP.67/0974	10-Jan-25

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO :-
 - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
125.00	-16.10	-15.80	-0.30	0.50
250.00	-8.60	-8.10	-0.50	0.50
500.00	-3.20	-3.0	-0.20	0.50
1000.00	0.00	0.00	0.0	0.50
2000.00	1.20	0.90	0.3	0.50

2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
125.00	-0.20	0.1	-0.3	0.50
250.00	0.00	0.5	-0.5	0.50
500.00	0.00	0.3	-0.3	0.50
1000.00	0.00	0.0	0.0	0.50
2000.00	-0.20	-0.4	0.2	0.50

3. SOUND LEVEL LINEARITY TEST AT 1000 Hz

STANDARD APPLIED (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
74	74.0	0.0	0.50
84	84.0	0.0	0.50
94	94.0	0.0	0.50
104	104.1	-0.1	0.50
114	114.2	-0.2	0.50

UUC* : UNIT UNDER CALIBRATION

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%

END OF CALIBRATION REPORT

G.Ruamkit Panich Co.,Ltd.

219/44 Moo 12 Petchkasem Rd., Omnoi, Krathumban Samutsakorn 74130

CERTIFICATE No : GR 17 E 30067

PAGE : 1 OF 2


Certificate of Calibration

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226
SERIAL No. : 150007
ID No. : CEM-SI-07

SUBMITTED BY : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.
219/43 MOO 12, PETCHKASEM RD., OMNOI,
KRATHUMBAN SAMUTSAKORN 74130

CALIBRATED BY : 
SURAWIT K.

CALIBRATION DATE : 25-April-24

APPROVED BY : 
PHUDIT P.

ISSUED DATE : 25-April-24

G.Ruamkit Panich Co.,Ltd.

219/44 Moo 12 Petchkasem Rd., Omnoi,Krathumban Samutsakorn 74130

CERTIFICATE No : GR 17 E 30067

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226 SERIAL NUMBER : 150007
ID No. : CEM-SI-07
RECEIVED DATE : 23-April-24 CALIBRATION DATE : 25-April-24
AMBIENT TEMPERATURE : 22 °C ± 3°C RELATIVE HUMIDITY : 50%RH ± 20%RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO IEC 61672-2:2003-04 AGAINST MULTIFUNCTION SOUND CALIBRATOR. THIS INSTRUMENT WAS PERFORMED SELF-CALIBRATION BY CALIBRATOR FROM CUSTOMER AT 114 Hz BEFORE CALIBRATION.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No.	CERTIFICATL No.	DUE DATE
1) MULTIFUNCTION SOUND CALIBRATOR.	1986	01827	EEL.BP.67/0974	10-Jan-25

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO :-
 - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
125.00	-16.10	-15.80	-0.30	0.50
250.00	-8.60	-8.10	-0.50	0.50
500.00	-3.20	-3.0	-0.20	0.50
1000.00	0.00	0.00	0.0	0.50
2000.00	1.20	0.90	0.3	0.50

2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
125.00	-0.20	0.1	-0.3	0.50
250.00	0.00	0.5	-0.5	0.50
500.00	0.00	0.3	-0.3	0.50
1000.00	0.00	0.0	0.0	0.50
2000.00	-0.20	-0.4	0.2	0.50

3. SOUND LEVEL LINEARITY TEST AT 1000 Hz

STANDARD APPLIED (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
74	74.0	0.0	0.50
84	84.0	0.0	0.50
94	94.0	0.0	0.50
104	104.1	-0.1	0.50
114	114.2	-0.2	0.50

UUC* : UNIT UNDER CALIBRATION

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%

END OF CALIBRATION REPORT

G.Ruamkit Panich Co.,Ltd.

219/44 Moo 12 Petchkasem Rd., Omnoi, Krathumban Samutsakorn 74130

CERTIFICATE No : GR 17 E 30068

PAGE : 1 OF 2


Certificate of Calibration

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226
SERIAL No. : 150008
ID No. : CEM-SI-08

SUBMITTED BY : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.
219/43 MOO 12, PETCHKASEM RD., OMNOI,
KRATHUMBAN SAMUTSAKORN 74130

CALIBRATED BY : 
SURAWIT K.

CALIBRATION DATE : 25-April-24

APPROVED BY : 
PHUDIT P.

ISSUED DATE : 25-April-24

G.Ruamkit Panich Co.,Ltd.

219/44 Moo 12 Petchkasem Rd., Omnoi,Krathumban Samutsakorn 74130

CERTIFICATE No : GR 17 E 30068

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226 SERIAL NUMBER : 150008
ID No. : CEM-SI-08
RECEIVED DATE : 23-April-24 CALIBRATION DATE : 25-April-24
AMBIENT TEMPERATURE : 22 °C ± 3°C RELATIVE HUMIDITY : 50%RH ± 20%RH

CONDITION OF THIS RESULTS OF CALIBRATION

- THIS INSTRUMENT WAS CALIBRATED ACCORDING TO IEC 61672-2:2003-04 AGAINST MULTIFUNCTION SOUND CALIBRATOR.
THIS INSTRUMENT WAS PERFORMED SELF-CALIBRATION BY CALIBRATOR FROM CUSTOMER AT 114 Hz BEFORE CALIBRATION.
- REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No.	CERTIFICATTE No.	DUE DATE
1) MULTIFUNCTION SOUND CALIBRATOR.	1986	01827	EEL.BP.67/0974	10-Jan-25

- THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
- THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
- THIS CERTIFICATE IS TRACEABLE TO :-
 - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
125.00	-16.10	-15.80	-0.30	0.50
250.00	-8.60	-8.10	-0.50	0.50
500.00	-3.20	-3.0	-0.20	0.50
1000.00	0.00	0.00	0.0	0.50
2000.00	1.20	0.90	0.3	0.50

2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
125.00	-0.20	0.1	-0.3	0.50
250.00	0.00	0.5	-0.5	0.50
500.00	0.00	0.3	-0.3	0.50
1000.00	0.00	0.0	0.0	0.50
2000.00	-0.20	-0.4	0.2	0.50

3. SOUND LEVEL LINEARITY TEST AT 1000 Hz

STANDARD APPLIED (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
74	74.0	0.0	0.50
84	84.0	0.0	0.50
94	94.0	0.0	0.50
104	104.1	-0.1	0.50
114	114.2	-0.2	0.50

UUC* : UNIT UNDER CALIBRATION

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%

END OF CALIBRATION REPORT

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในบรรยากาศ

Certificate of Analyzer Performance Testing

Calibrated Date : 2-Aug-24

Certificate No. : 0824-001

Page : 1/1

Analyzer Instruments

Analyzer Type : SO2 Analyzer

Manufacturer : Thermo Environmental

Model : 43C

Serial No. : 43C-62201-334

Environmental

Temperature : 25.7 °C

Humidity : 44.6 %RH

Calibration System

Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

Standard Gas

NO Conc. : 2 ppm

Cylinder No. : 307199

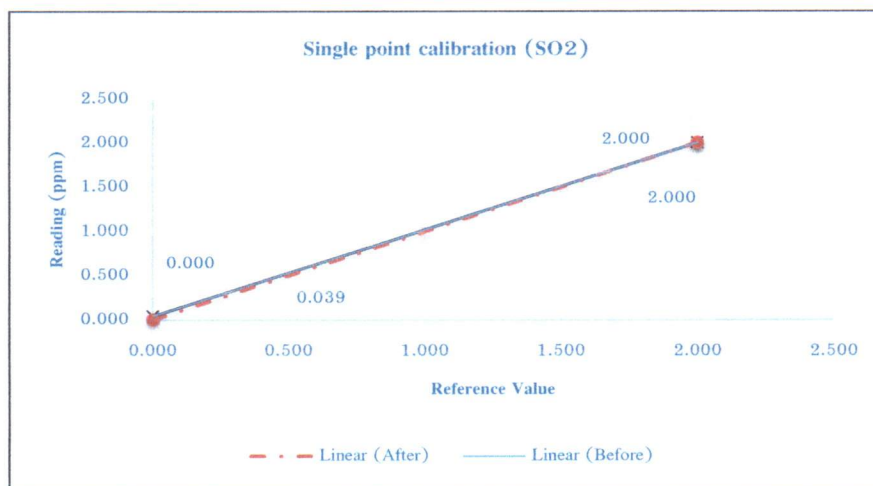
SO2 Conc. : 2 ppm

Expire Date : 10-Oct-25

CO Conc. : 50 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
SO2	0.039	0.000	0.04	2.00	2.000	0.00
After						
SO2	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by :

Tong Piima
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 20-Aug-24

Certificate No. : 0824-004

Page : 1/1

Analyzer Instruments

Analyzer Type : SO2 Analyzer

Manufacturer : Thermo Environmental

Model : 43C

Serial No. : 43C-70853-367

Environmental

Temperature : 25.1 °C

Humidity : 40.4 %RH

Calibration System

Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

Standard Gas

NO Conc. : 2 ppm

Cylinder No. : 307199

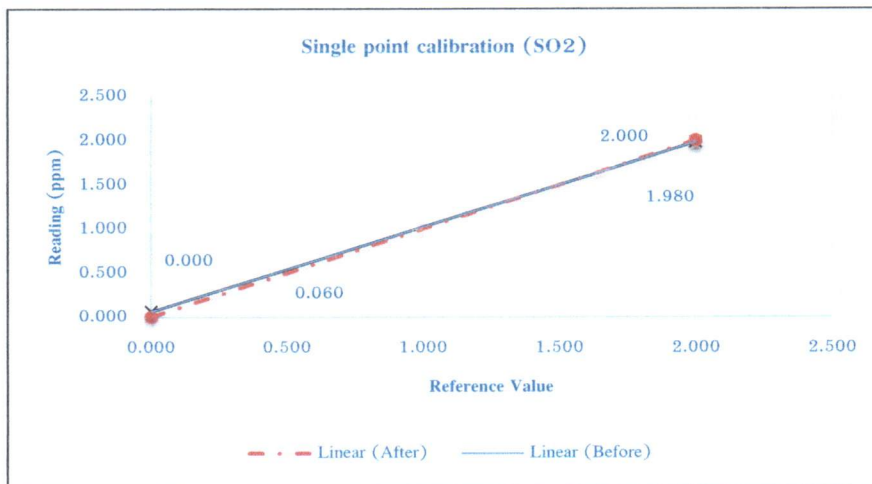
SO2 Conc. : 2 ppm

Expire Date : 10-Oct-25


CO Conc. : 50 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
SO2	0.060	0.000	0.06	1.98	2.000	-1.00
After						
SO2	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by :


 (Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 20-Aug-24

Certificate No. : 0824-006

Page : 1/1

Analyzer Instruments

Analyzer Type : SO2 Analyzer

Manufacturer : Thermo Environmental

Model : 43C

Serial No. : 43C-77419-385

Environmental

Temperature : 25.0 °C

Humidity : 48.6 %RH

Calibration System

Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

Standard Gas

NO Conc. : 2 ppm

Cylinder No. : 307199

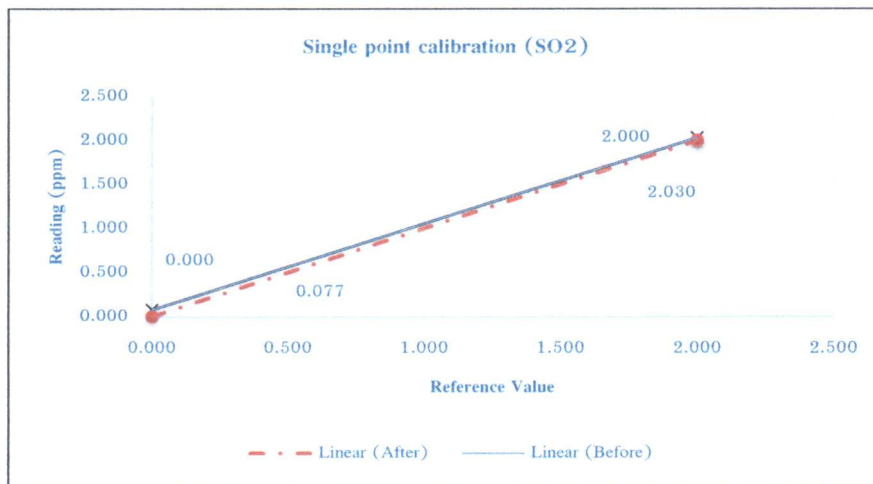
SO2 Conc. : 2 ppm

Expire Date : 10-Oct-25


CO Conc. : 50 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
SO2	0.077	0.000	0.08	2.03	2.000	1.50
After						
SO2	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by :


 (Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 23-Aug-24

Certificate No. : 0824-007

Page : 1/1

Analyzer Instruments

Analyzer Type : NO/NO/NOx Analyzer
Model : 42C

Manufacturer : Thermo Environmental
Serial No. : 66193-351

Environmental

Temperature : 26.2 °C
Humidity : 44.1 %RH

Calibration System

Calibrator Units

Gas Calibration : Thermo Environmental
Model : 146C
Serial No. : 514811458

Zero Air Generator : API
Model : 701
Serial No. : 179

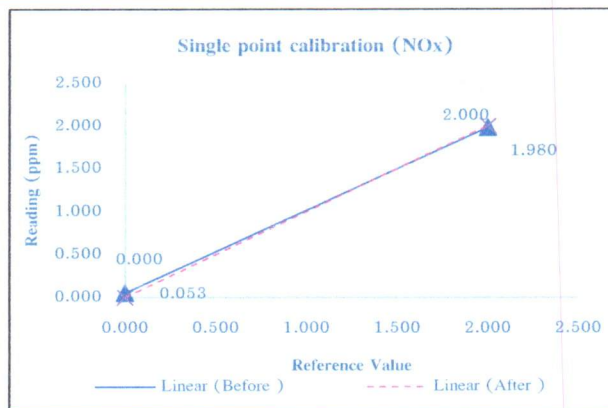
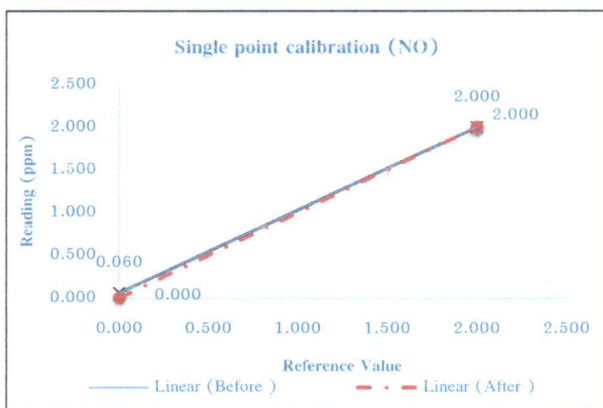
Standard Gas

NO Conc. : 2 ppm
SO2 : 2 ppm
CO Conc. : 50 ppm

Cylinder No. : 307199
Expire Date : 10-Oct-25

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.060	0.000	0.06	2.00	2.00	0.00
NOx	0.053	0.000	0.05	1.98	2.00	-1.00
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NOx	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by :

Tong Piima
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 28-Mar-23

Certificate No. : 0324-007

Page : 1/1

Analyzer Instruments

Analyzer Type : NO/NO/NOx Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial No. : 72454-371

Environmental

Temperature : 25.3 °C

Humidity : 40.2 %RH

Calibration System

Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

Standard Gas

NO Conc. : 2 ppm

Cylinder No. : 307199

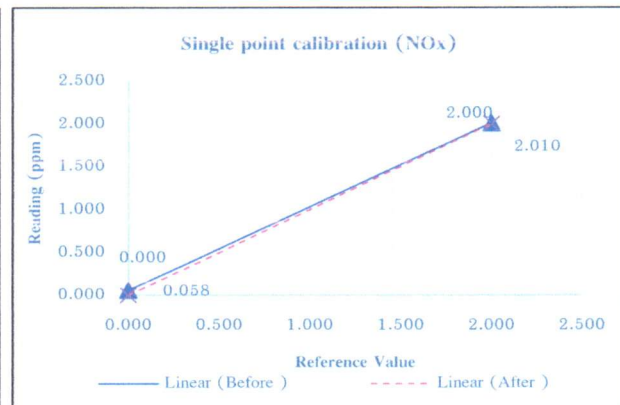
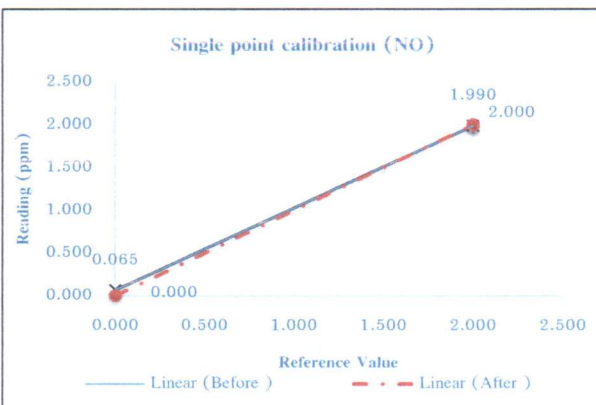
SO2 : 2 ppm

Expire Date : 10-Oct-25

CO Conc. : 50 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.065	0.000	0.07	1.99	2.00	-0.50
NOx	0.058	0.000	0.06	2.01	2.00	0.50
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NOx	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by :

Tong Piima
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 1-Jul-24

Certificate No. : 0724-001

Page : 1/1

Analyzer Instruments

Analyzer Type : NO/NO/NOx Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial No. : 63470-339

Environmental

Temperature : 26.3 °C

Humidity : 42.5 %RH

Calibration System

Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

Standard Gas

NO Conc. : 2 ppm

Cylinder No. : 307199

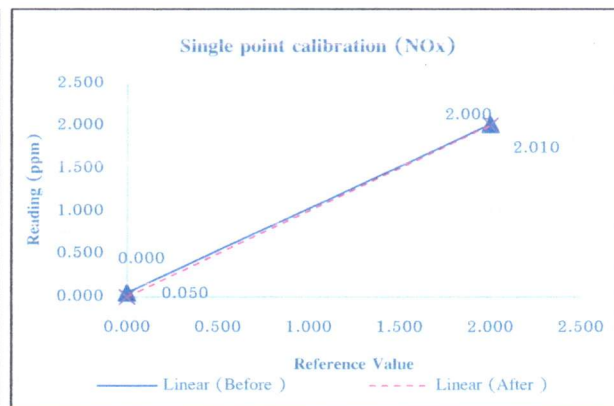
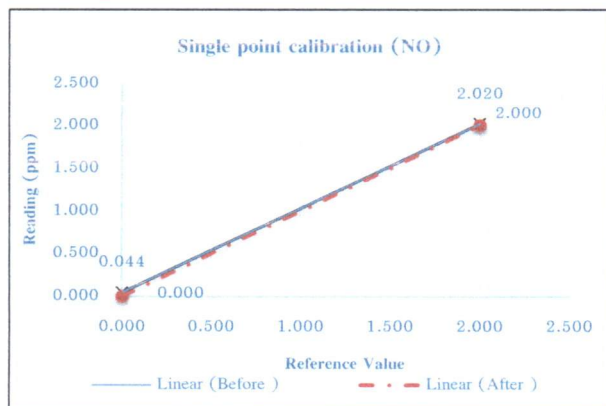
SO2 : 2 ppm

Expire Date : 10-Oct-25


CO Conc. : 50 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.044	0.000	0.04	2.02	2.00	1.00
NOx	0.050	0.000	0.05	2.01	2.00	0.50
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NOx	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by :


 (Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 2-Aug-24

Certificate No. : 0824-003

Page : 1/1

Analyzer Instruments

Analyzer Type : NO/NO/NOx Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial No. : 59406-323

Environmental

Temperature : 25.7 °C

Humidity : 46.6 %RH

Calibration System

Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

Standard Gas

NO Conc. : 2 ppm

Cylinder No. : 307199

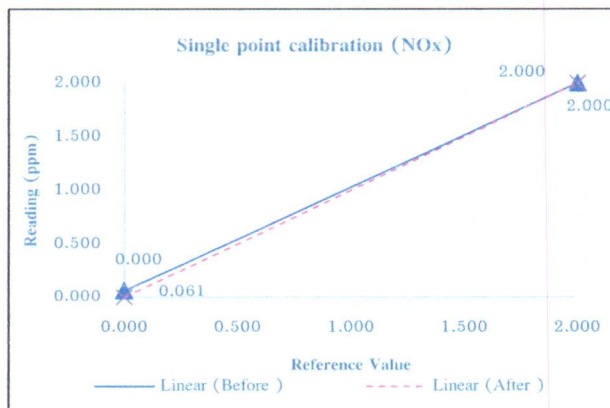
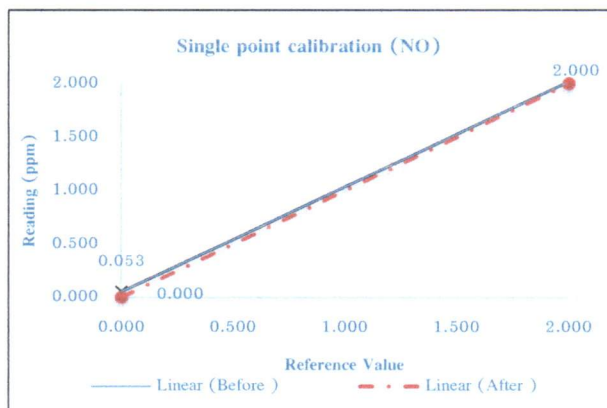
SO2 : 2 ppm

Expire Date : 10-Oct-25


CO Conc. : 50 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.053	0.000	0.05	2.02	2.00	1.00
NOx	0.061	0.000	0.06	2.00	2.00	0.00
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NOx	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by :


 (Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 18-Jul-24

Certificate No. : 0724-001

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Analyzer Instruments

Analyzer Type : CO Analyzer

Manufacturer : Thermo Environmental

Model : 48C

Serial No. : 508011061

Environmental

Temperature : 26.7 °C

Humidity : 47.7 %RH

Calibration System

Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

Standard Gas

NO Conc. : 2 ppm

Cylinder No. : 307199

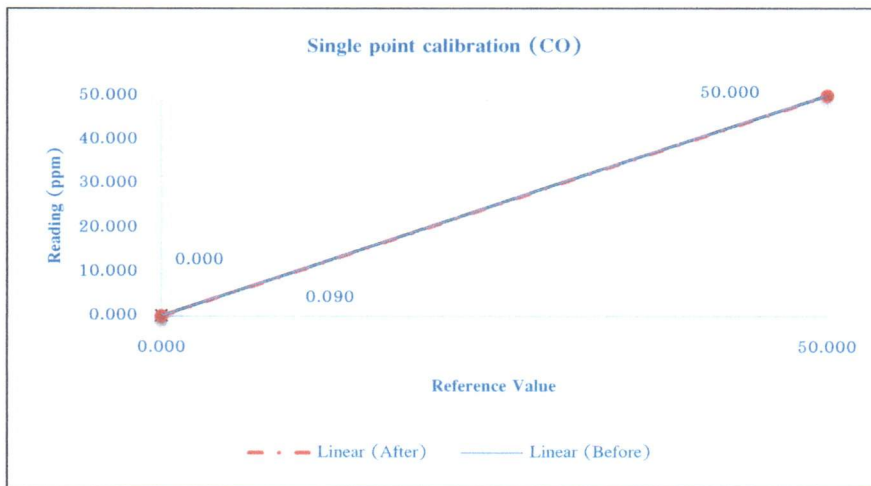
SO₂ Conc. : 2 ppm

Expire Date : 10-Oct-25

CO Conc. : 50 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
CO	0.090	0.000	0.09	50.1	50.000	0.20
After						
CO	0.000	0.000	0.00	50.0	50.000	0.00



Calibrated by :

Tong Piima
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 25-Mar-25

Certificate No. : 0325-004

Page : 1/1

Analyzer Instruments

Analyzer Type : CO Analyzer

Manufacturer : Thermo Environmental

Model : 48C

Serial No. : 401304261

Environmental

Temperature : 20.8 °C

Humidity : 46.9 %RH

Calibration System

Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

Standard Gas

NO Conc. : 2 ppm

Cylinder No. : 307199

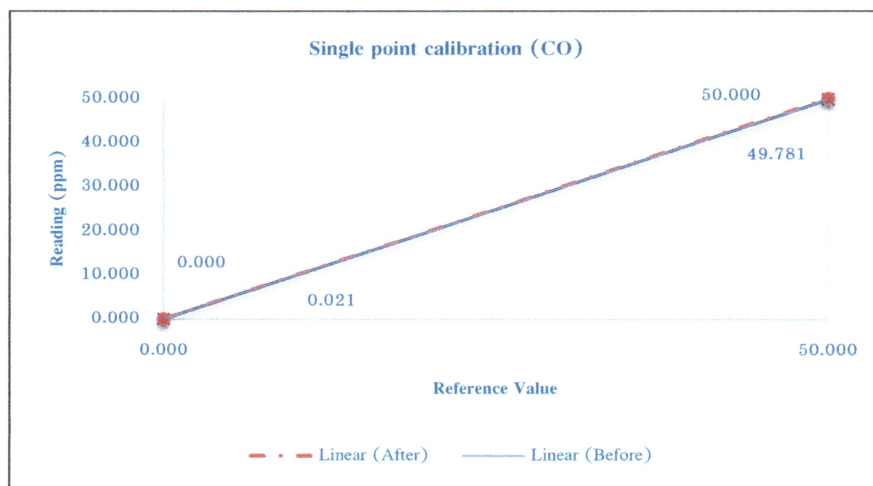
SO₂ Conc. : 2 ppm

Expire Date : 10-Oct-25

CO Conc. : 50 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
CO	0.021	0.000	0.02	49.781	50.000	-0.44
After						
CO	0.000	0.000	0.00	50.000	50.000	0.00



Calibrated by :

(Mr. Tong Puima)

Certificate of Analyzer Performance Testing

Calibrated Date : 23-Aug-24

Certificate No. : 0824-008

Page : 1/1

Analyzer Instruments

Analyzer Type : CO Analyzer

Manufacturer : Thermo Environmental

Model : 48C

Serial No. : 508011064

Environmental

Temperature : 26.2 °C

Humidity : 51.8 %RH

Calibration System

Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

Standard Gas

NO Conc. : 2 ppm

Cylinder No. : 307199

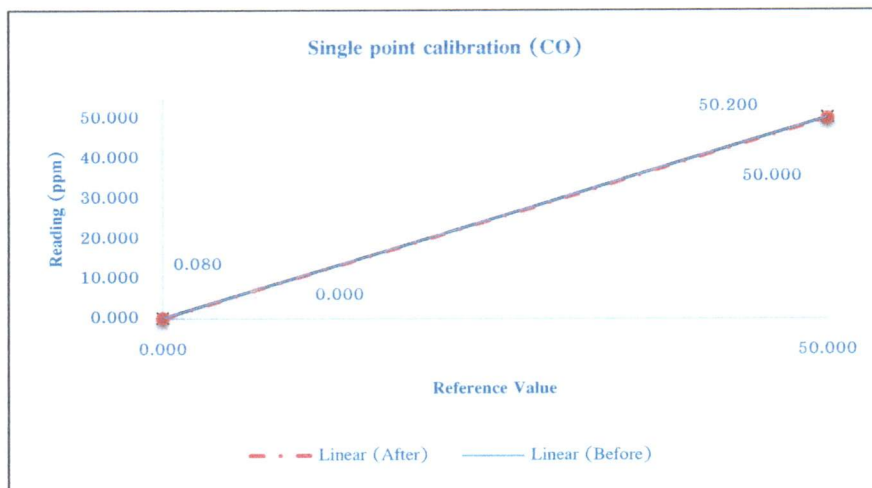
SO2 Conc. : 2 ppm

Expire Date : 10-Oct-25

CO Conc. : 50 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
CO	0.080	0.000	0.08	50.2	50.000	0.40
After						
CO	0.000	0.000	0.00	50.0	50.000	0.00



Calibrated by :


(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 5-Jun-24

Certificate No. : 0624-001

Page : 1/1

Analyzer Instruments

Analyzer Type : CO Analyzer

Manufacturer : Thermo Environmental

Model : 48C

Serial No. : 508011068

Environmental

Temperature : 25.0 °C

Humidity : 51.5 %RH

Calibration System

Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

Standard Gas

NO Conc. : 2 ppm

Cylinder No. : 307199

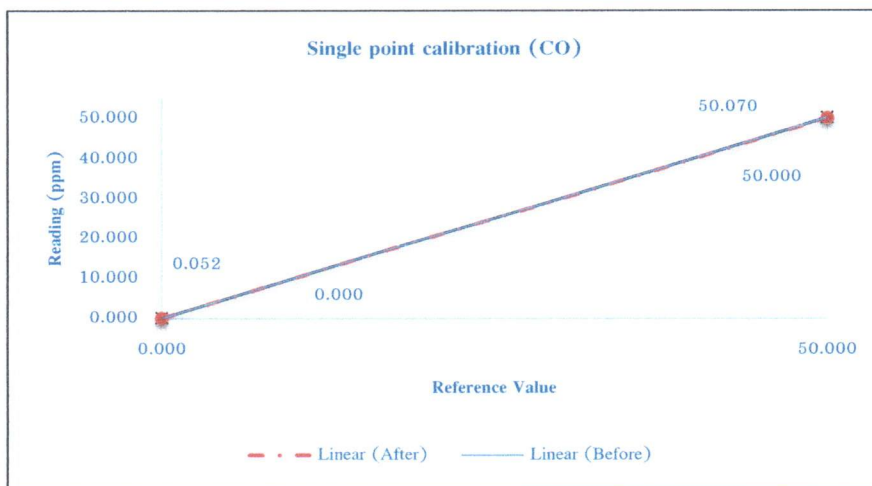
SO2 Conc. : 2 ppm

Expire Date : 10-Oct-25

CO Conc. : 50 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
CO	0.052	0.000	0.05	50.1	50.000	0.14
After						
CO	0.000	0.000	0.00	50.0	50.000	0.00



Calibrated by :

Tong Piima
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 13-Jan-25

Certificate No. : 0125-001

Page : 1/1

Analyzer Instruments

Analyzer Type : THC Analyzer

Manufacturer : Thermo Environmental

Model : 51

Serial No. : 51HT-73244-373

Environmental

Temperature : 26.2 °C

Humidity : 44.1 %RH

Calibration System

Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

Standard Gas

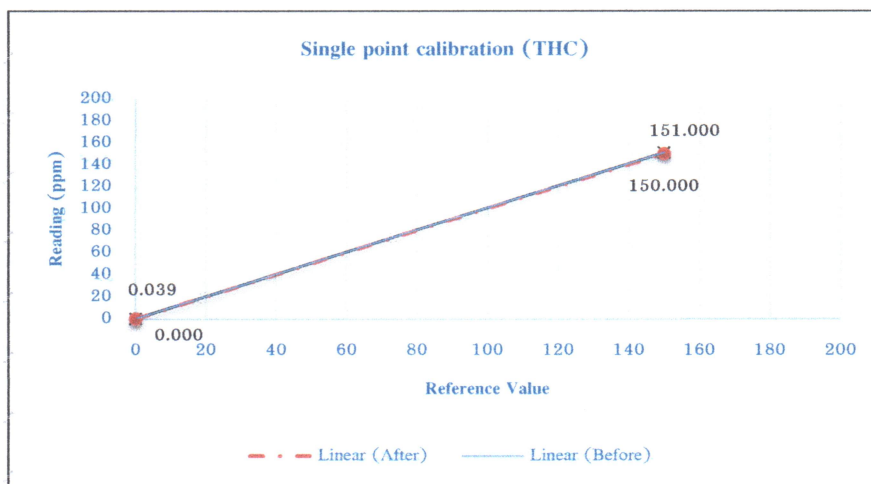
Propane Conc. : 150 ppm

Cylinder No. : 21W281046

Expire Date : 26-Sep-25

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
THC	0.039	0.000	0.039	151	150	0.667
After						
THC	0.000	0.000	0.000	150	150	0.000



Calibrated by :


 (Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 13-Jan-25

Certificate No. : 0125-002

Page : 1/1

Analyzer Instruments

Analyzer Type : THC Analyzer

Manufacturer : Baseline

Model : Series 8800

Serial No. : 584

Environmental

Temperature : 26.7 °C

Humidity : 44.0 %RH

Calibration System

Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

Standard Gas

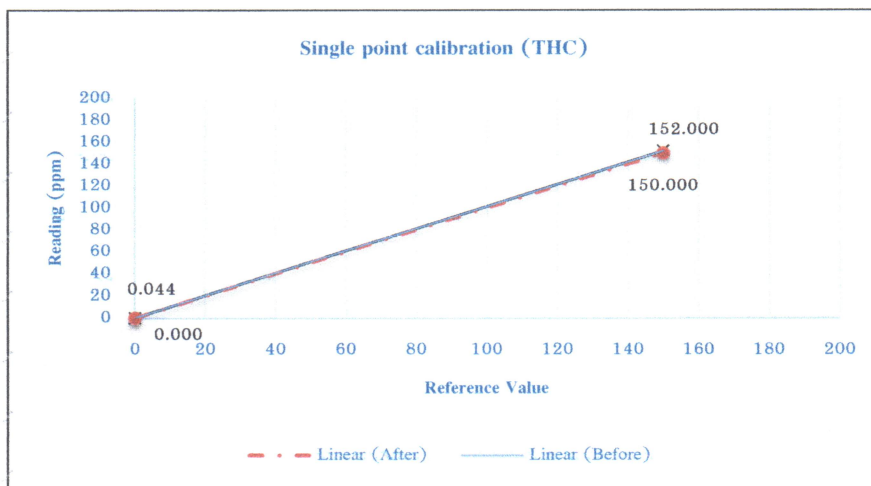
Propane Conc. : 150 ppm

Cylinder No. : 21W281046


Expire Date : 26-Sep-25

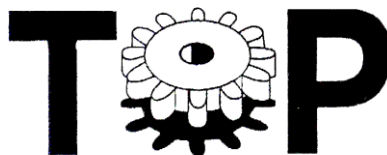
Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
THC	0.044	0.000	0.044	152	150	1.333
After						
THC	0.000	0.000	0.000	150	150	0.000



Calibrated by :


(Mr. Tong Piima)



Trade & Engineering
TSP High Volume Sampler
TE-5000 TSP Sampler Verification

Site Information

Location: -	Site ID: -	Date: 21 Dec 24
Sampler: TE-5000 TSP	Serial No: 3263	Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 27.80	Corrected Pressure (mm Hg): 706.1
Temperature (deg F): 76.0	Temperature (deg K): 297.6
Average Press. (in Hg): 26.30	Corrected Average (mm Hg): 668.0
Average Temp (Deg F): 75.0	Average Temp (Deg K): 297.0

Calibration Orifice

Make: Tisch	Qstd Slope: 1.58304
Model: TE-5028A	Qstd Intercept: -0.01520
Serial#: 1179	Calibration Due Date 10 December 2025

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	6.10	1.514	60.8	58.65	Slope: 31.4134
2	4.30	1.273	54.3	52.38	Intercept: 11.5313
3	3.20	1.100	47.2	45.53	Corr. Coeff: 0.9947
4	2.40	0.954	44.0	42.44	
5	2.00	0.871	39.5	38.10	

of Observations: 5

Calculations

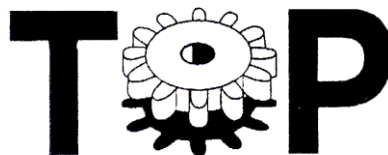
$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta)) - b]$
 $IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$

Qstd = standard flow rate
IC = corrected chart response
I = actual chart response
m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg
For subsequent calculation of sampler flow:
 $1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)] - b)$

m = sampler slope
b = sampler intercept
I = chart response
Tav = daily average temperature
Pav = daily average pressure

Enter Average I (chart):	49.2
Average Flow Calculation m3/min	1.102476438
Average Flow Calculation in cfm	38.92925225
Sample Time (Hrs):	24.0
Total flow in 24 hours m3/min	1587.566071
Total flow in 24 hours cfm	56058.12323

NOTE: Ensure calibration orifice has been certified within 12 months of use



Trade & Engineering
TSP High Volume Sampler
TE-5000 TSP Sampler Verification

Site Information

Location: -	Site ID: -	Date: 20 Dec 24
Sampler: TE-5000 TSP	Serial No: 3264	Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 27.30	Corrected Pressure (mm Hg): 693.4
Temperature (deg F): 75.2	Temperature (deg K): 297.2
Average Press. (in Hg): 26.20	Corrected Average (mm Hg): 665.5
Average Temp (Deg F): 74.3	Average Temp (Deg K): 296.7

Calibration Orifice

Make: Tisch	Qstd Slope: 1.58304
Model: TE-5028A	Qstd Intercept: -0.01520
Serial#: 1179	Calibration Due Date 10 December 2025

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	6.60	1.562	62.3	59.59	Slope: 37.1602
2	5.10	1.374	55.8	53.38	Intercept: 1.5130
3	4.20	1.248	48.3	46.20	Corr. Coeff: 0.9903
4	3.10	1.074	44.7	42.76	
5	2.70	1.002	40.0	38.26	

of Observations: 5

Calculations

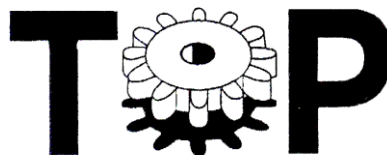
$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta)) - b]$
 $IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$

Qstd = standard flow rate
IC = corrected chart response
I = actual chart response
m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg
For subsequent calculation of sampler flow:
 $1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)] - b)$

m = sampler slope
b = sampler intercept
I = chart response
Tav = daily average temperature
Pav = daily average pressure

Enter Average I (chart):	50.2
Average Flow Calculation m3/min	1.226776562
Average Flow Calculation in cfm	43.31838087
Sample Time (Hrs):	24.0
Total flow in 24 hours m3/min	1766.55825
Total flow in 24 hours cfm	62378.46845

NOTE: Ensure calibration orifice has been certified within 12 months of use



Trade & Engineering
TSP High Volume Sampler
TE-5000 TSP Sampler Verification

Site Information

Location: - Site ID: - Date: 14 Oct 24
Sampler: TE-5000 TSP Serial No: 3269 Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 27.75 Corrected Pressure (mm Hg): 704.9
Temperature (deg F): 76.5 Temperature (deg K): 297.9
Average Press. (in Hg): 27.31 Corrected Average (mm Hg): 693.7
Average Temp (Deg F): 74.9 Average Temp: (Deg K): 297.0

Calibration Orifice

Make: Tisch Qstd Slope: 1.57894
Model: TE-5028A Qstd Intercept: -0.01520
Serial#: 1179 Calibration Due Date 10 December 2024

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.00	1.735	60.1	57.89	Slope: 39.5761
2	6.55	1.571	55.7	53.65	Intercept: -9.7403
3	5.15	1.394	47.8	46.04	Corr. Coeff: 0.9955
4	4.55	1.311	43.3	41.71	
5	4.00	1.112	35.2	33.91	

of Observations: 5

Calculations

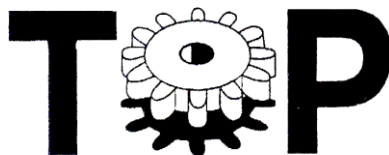
$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$
 $IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$

Qstd = standard flow rate
IC = corrected chart response
I = actual chart response
m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg
For subsequent calculation of sampler flow:
 $1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)]-b)$

m = sampler slope
b = sampler intercept
I = chart response
Tav = daily average temperature
Pav = daily average pressure

Enter Average I (chart): 48.4
Average Flow Calculation m3/min
1.416976485
Average Flow Calculation in cfm
50.03447975
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min
2040.446139
Total flow in 24 hours cfm
72049.65084

NOTE: Ensure calibration orifice has been certified within 12 months of use



Trade & Engineering
TSP High Volume Sampler
TE-5000 TSP Sampler Verification

Site Information

Location: - Site ID: - Date: 10 Oct 24
Sampler: TE-5000 TSP Serial No: 3276 Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 28.50 Corrected Pressure (mm Hg): 723.9
Temperature (deg F): 75.5 Temperature (deg K): 297.3
Average Press. (in Hg): 27.30 Corrected Average (mm Hg): 693.4
Average Temp (Deg F): 75.0 Average Temp (Deg K): 297.0

Calibration Orifice

Make: Tisch Qstd Slope: 1.57894
Model: TE-5028A Qstd Intercept: -0.01520
Serial#: 1179 Calibration Due Date 10 December 2024

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.40	1.803	61.8	60.38	Slope: 36.6686
2	6.50	1.587	56.2	54.91	Intercept: -4.7465
3	5.35	1.441	50.1	48.95	Corr. Coeff: 0.9926
4	4.65	1.344	44.3	43.28	
5	4.25	1.112	36.8	35.96	

of Observations: 5

Calculations

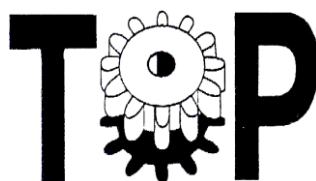
$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta)) - b]$
 $IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$

Qstd = standard flow rate
IC = corrected chart response
I = actual chart response
m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg
For subsequent calculation of sampler flow:
 $1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)] - b)$

m = sampler slope
b = sampler intercept
I = chart response
Tav = daily average temperature
Pav = daily average pressure

Enter Average I (chart): 49.8
Average Flow Calculation m3/min
1.429841813
Average Flow Calculation in cfm
50.48876392
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min
2058.972211
Total flow in 24 hours cfm
72703.82005

NOTE: Ensure calibration orifice has been certified within 12 months of use



Trade & Engineering

PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 27 September 2024
Sampler: TE-6070 PM10 Serial No: 3310 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 27.20 Corrected Pressure (mm Hg): 690.9
Temperature (deg F): 75.6 Temperature (deg K): 297.2
Average Press. (in Hg): 26.69 Corrected Average (mm Hg): 677.9
Average Temp. (deg F): 76.1 Average Temp. (deg K): 297.5

Calibration Orifice

Make: Tisch Environmental, Inc. Qstd Slope: 1.57894
Model: TE-5028A Qstd Intercept: -0.01520
Serial#: 1179 Calibration Due Date: 10 Dec 24

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	9.40	1.283	60.8	39.88	Slope 28.3708
2	7.65	1.159	56.7	37.19	Intercept 3.8982
3	6.35	1.056	53.2	34.89	Corr. Coeff 0.9700
4	5.70	1.037	50.9	33.39	SFR 1.108
5	5.00	1.006	47.8	31.35	SSP 53.86
# of Observations:					5

Calculations

$Qa = 1/m(\text{Sqrt}((H2O)(Ta/Pa)))-b$
 $IC = I(\text{Sqrt}(Ta/Pa))$

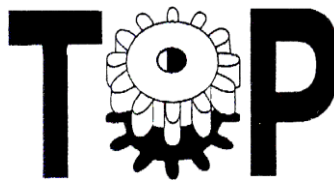
Qa = actual flow rate
IC = corrected chart response
m = calibrator slope
b = calibrator intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
For subsequent calculation
of sampler flow:

$SFR = 1.13(Ps/Pa)(Ta/Ts)$
 $SSP = (m*SFR+b)(\text{Sqrt}(Pa/Ta))$
SFR = sampler set point flow rate
SSP = sampler chart set point
m = sampler slope
b = sampler intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
Ts = Average temperature (deg K)
Ps = Average pressure (mm Hg)

m = sampler slope
b = sampler intercept
I = chart response
Tav = daily average temperature
Pav = daily average pressure

NOTE: Ensure calibration orifice has been certified within 12 months of

Average I(chart): 53.9
Average Flow over Sample (m3/min)
1.120681202
Enter Total Time (Hrs) 24.0
Total flow over sample (m3/min)
1613.780931
Total flow over sample (CFM)
56982.60468



Trade & Engineering

PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 27 September 2024
Sampler: TE-6070 PM10 Serial No: 3524 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 27.19 Corrected Pressure (mm Hg): 690.6
Temperature (deg F): 75.8 Temperature (deg K): 297.3
Average Press. (in Hg): 26.73 Corrected Average (mm Hg): 678.9
Average Temp. (deg F): 76.3 Average Temp. (deg K): 297.6

Calibration Orifice

Make: Tisch Environmental, Inc. Qstd Slope: 1.57894
Model: TE-5028A Qstd Intercept: -0.01520
Serial#: 1179 Calibration Due Date: 10 Dec 24

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	9.50	1.290	61.2	40.16	Slope 27.5806
2	7.55	1.151	56.9	37.33	Intercept 5.0169
3	6.30	1.053	53.4	35.04	Corr. Coeff 0.9675
4	5.45	1.037	51.3	33.66	SFR 1.110
5	4.95	1.006	48.2	31.63	SSP 54.30
# of Observations:					5

Calculations

$Qa = 1/m(\text{Sqrt}((H2O)(Ta/Pa)) - b)$
 $IC = I(\text{Sqrt}(Ta/Pa))$

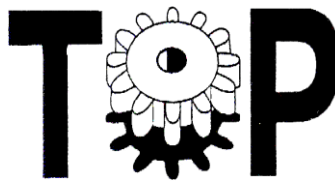
Qa = actual flow rate
IC = corrected chart response
m = calibrator slope
b = calibrator intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
For subsequent calculation
of sampler flow:

$SFR = 1.13(Ps/Pa)(Ta/Ts)$
 $SSP = (m*SFR + b)(\text{Sqrt}(Pa/Ta))$
SFR = sampler set point flow rate
SSP = sampler chart set point
m = sampler slope
b = sampler intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
Ts = Average temperature (deg K)
Ps = Average pressure (mm Hg)

m = sampler slope
b = sampler intercept
I = chart response
Tav = daily average temperature
Pav = daily average pressure

Average I(chart): 54.2
Average Flow over Sample (m3/min)
1.11917939
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min)
1611.618321
Total flow over sample (CFM)
56906.24292

NOTE: Ensure calibration orifice has been certified within 12 months of use



Trade & Engineering

PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 27 September 2024
Sampler: TE-6070 PM10 Serial No: 3211 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 27.20 Corrected Pressure (mm Hg): 690.9
Temperature (deg F): 76.1 Temperature (deg K): 297.5
Average Press. (in Hg): 26.80 Corrected Average (mm Hg): 680.7
Average Temp. (deg F): 76.4 Average Temp. (deg K): 297.7

Calibration Orifice

Make: Tisch Environmental, Inc. Qstd Slope: 1.57894
Model: TE-5028A Qstd Intercept: -0.01520
Serial#: 1179 Calibration Due Date: 10 Dec 24

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	9.55	1.294	61.3	40.23	Slope 29.8924
2	7.60	1.155	56.6	37.14	Intercept 1.9740
3	6.45	1.065	52.3	34.32	Corr. Coeff 0.9868
4	5.50	1.037	50.2	32.94	SFR 1.113
5	5.00	1.006	47.8	31.37	SSP 53.70

of Observations: 5

Calculations

$Qa = 1/m(\text{Sqrt}((H2O)(Ta/Pa))-b)$
 $IC = I(\text{Sqrt}(Ta/Pa))$

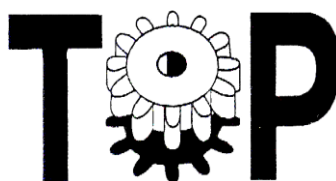
Qa = actual flow rate
IC = corrected chart response
m = calibrator slope
b = calibrator intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
For subsequent calculation
of sampler flow:

$SFR = 1.13(Ps/Pa)(Ta/Ts)$
 $SSP = (m*SFR+b)(\text{Sqrt}(Pa/Ta))$
SFR = sampler set point flow rate
SSP = sampler chart set point
m = sampler slope
b = sampler intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
Ts = Average temperature (deg K)
Ps = Average pressure (mm Hg)

m = sampler slope
b = sampler intercept
I = chart response
Tav = daily average temperature
Pav = daily average pressure

Average I(chart): 53.6
Average Flow over Sample (m3/min)
1.120575835
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min)
1613.629203
Total flow over sample (CFM)
56977.24716

NOTE: Ensure calibration orifice has been certified within 12 months of use



Trade & Engineering

PM10 High Volume Sampler Verification

Site Information

Location: -

Site ID: -

Date: 27 September 2024

Sampler: TE-6070 PM10

Serial No: 3482

Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 26.50

Temperature (deg F): 76.0

Average Press. (in Hg): 26.50

Average Temp. (deg F): 76.8

Corrected Pressure (mm Hg): 673.1

Temperature (deg K): 297.4

Corrected Average (mm Hg): 673.1

Average Temp. (deg K): 297.9

Calibration Orifice

Make: Tisch Environmental, Inc.

Model: TE-5028A

Serial#: 1179

Qstd Slope: 1.57894

Qstd Intercept: -0.01520

Calibration Due Date: 10 Dec 24

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	9.30	1.294	62.3	41.41	Slope 34.1870
2	8.25	1.219	59.3	39.42	Intercept -2.4824
3	7.30	1.147	55.6	36.96	Corr. Coeff 0.9952
4	6.25	1.037	50.2	33.37	SFR 1.128
5	5.05	1.006	47.2	31.38	SSP 54.29
# of Observations:					5

Calculations

$Qa = 1/m(\text{Sqrt}((H2O)(Ta/Pa)) - b)$
 $IC = I(\text{Sqrt}(Ta/Pa))$

$SFR = 1.13(Ps/Pa)(Ta/Ts)$
 $SSP = (m * SFR + b)(\text{Sqrt}(Pa/Ta))$

m = sampler slope
b = sampler intercept
I = chart response
Tav = daily average temperature
Pav = daily average pressure

Qa = actual flow rate
IC = corrected chart response
m = calibrator slope
b = calibrator intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
For subsequent calculation of sampler flow:

SFR = sampler set point flow rate
SSP = sampler chart set point
m = sampler slope
b = sampler intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
Ts = Average temperature (deg K)
Ps = Average pressure (mm Hg)

NOTE: Ensure calibration orifice has been certified within 12 months of use

Average I(chart): 54.9
Average Flow over Sample (m3/min)
1.141316786
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min)
1643.496172
Total flow over sample (CFM)
58031.84983

เอกสารการสอบเทียบเครื่องมือตรวจวัดความชื้นสะท้อน



**ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT**

975 Moo 4, Bangpoo Industrial Estate, Soi 8, Sukhumvit Road km 37

Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

Tel: +66 2709 4860 Fax: +66 2324 0917

Certificate No.: CP20240388EA

Operation No.: CP2024100354

Certificate of Calibration

Equipment: Vibration Meter

Manufacturer: Instantel

Model/Type: Micromate

Serial No.: UM14163

ID No.: VB-01-001

Customer: C.E.M. Technology (Thailand) Co.,Ltd.

Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran,
Nakorn Phatom 73210

Received Date: 16 October 2024

Calibrated Date: 7 - 15 November 2024

Issued Date: 20 November 2024

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: _____

(Mr. Sittichai Swaksuriyawong)

Group Manager

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Certificate No.: CP20240388EA

Calibration Report

Equipment: Vibration Meter
Manufacturer: Instantel
Model: Micromate
Serial No.: UM14163
ID No.: VB-01-001
Ambient Temperature: (23 ± 5) °C
Relative Humidity: (50 ± 15) %

Method of Calibration :-

In-house method : CC-SV004 by comparison with standard accelerometer.

Condition of this result of calibration

1. Reference standards instrument :-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Standard Accelerometer	8305	2708237	AV-0040-24	19-Sep-2025
2) Measuring Amplifier	2525	2685967	AV-0034-24	7-Aug-2025
3) PULSE Multi-analyzer system	3560-C	2705645	CQ20230026EA	25-Dec-2024
4) Humidity and Temperature Transmitter	HMT331	K3810009	CD20240141EA	12-Jun-2025

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

3. This certification is traceable to the international system of unit maintained at :-

- National Institute of Metrology (Thailand)
- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Certificate No.: CP20240388EA

Calibration Report

Result of Calibration:-

Function : Frequency response and Linearity test at 16 Hz

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty \pm (%)	Direction
4.0	10.000	10.004	9.758	-0.246	1.50	Longitudinal (L)
5.0	10.000	10.004	9.805	-0.199	1.50	
6.3	10.000	10.011	9.953	-0.058	1.60	
8.0	10.000	10.006	9.718	-0.288	1.50	
10.0	10.000	10.002	9.710	-0.292	1.50	
12.5	10.000	10.006	9.734	-0.272	1.50	
16.0	10.000	9.997	9.813	-0.184	1.50	
	20.000	19.997	19.517	-0.480	1.50	
	30.000	29.995	29.210	-0.785	1.50	
	50.000	49.992	48.732	-1.260	1.50	
20.0	10.000	10.001	9.805	-0.196	1.50	
25.0	10.000	9.997	9.837	-0.160	1.50	
31.5	10.000	10.004	9.907	-0.097	1.50	
40.0	10.000	10.004	9.955	-0.049	1.50	
52.0	10.000	10.004	10.041	0.037	1.50	
63.0	10.000	10.008	10.270	0.262	1.50	
80.0	10.000	9.991	10.467	0.476	1.50	

Certificate No.: CP20240388EA

Calibration Report

Function : Frequency response and Linearity test at 16 Hz (Cont.)

Frequency	Nominal	Standard	UUC	Deviation	Uncertainty	Direction
(Hz)	(mm/s)	(mm/s)	(mm/s)	(mm/s)	± (%)	
4.0	10.000	9.997	9.852	-0.145	1.50	Transverse (T)
5.0	10.000	9.998	9.915	-0.083	1.60	
6.3	10.000	9.996	10.183	0.187	1.50	
8.0	10.000	9.990	10.053	0.063	1.60	
10.0	10.000	10.007	9.953	-0.054	1.60	
12.5	10.000	10.008	9.950	-0.058	1.60	
16.0	10.000	10.003	9.945	-0.058	1.60	
	20.000	19.983	19.917	-0.066	1.60	
	30.000	29.970	29.762	-0.208	1.50	
	50.000	49.992	49.671	-0.321	1.50	
20.0	10.000	10.007	9.954	-0.053	1.60	
25.0	10.000	10.003	9.947	-0.056	1.60	
31.5	10.000	9.998	9.939	-0.059	1.60	
40.0	10.000	9.997	10.034	0.037	1.50	
52.0	10.000	9.996	10.114	0.118	1.50	
63.0	10.000	10.001	10.262	0.261	1.50	
80.0	10.000	10.003	10.491	0.488	1.50	

Certificate No.: CP20240388EA

Calibration Report

Function : Frequency response and Linearity test at 16 Hz (Cont.)

Frequency	Nominal	Standard	UUC	Deviation	Uncertainty	Direction
(Hz)	(mm/s)	(mm/s)	(mm/s)	(mm/s)	± (%)	
4.0	10.000	10.004	9.923	-0.081	1.50	Vertical (V)
5.0	10.000	10.010	10.183	0.173	1.50	
6.3	10.000	9.983	10.420	0.437	1.50	
8.0	10.000	10.006	10.286	0.280	1.50	
10.0	10.000	9.984	10.207	0.223	1.50	
12.5	10.000	9.987	10.160	0.173	1.50	
16.0	10.000	10.003	10.191	0.188	1.50	
	20.000	20.011	20.402	0.390	1.60	
	30.000	29.995	30.589	0.594	1.50	
	50.000	49.992	51.011	1.019	1.50	
20.0	10.000	10.011	10.215	0.204	1.50	
25.0	10.000	9.983	10.120	0.137	1.50	
31.5	10.000	9.983	10.047	0.064	1.60	
40.0	10.000	9.990	10.081	0.091	1.50	
52.0	10.000	9.998	10.294	0.296	1.50	
63.0	10.000	10.010	10.404	0.394	1.50	
80.0	10.000	10.004	10.696	0.692	1.50	

Remark

1. UUC: Unit Under Calibration
2. The coverage factor $k = 2.00$

-- End of Report --



**ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT**

975 Moo 4, Bangpoo Industrial Estate, Soi 8, Sukhumvit Road km 37

Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

Tel: +66 2709 4860 Fax: +66 2324 0917

Certificate No.: CP20250099EA

Operation No.: CP2025030090

Certificate of Calibration

Equipment: Vibration Meter

Manufacturer: InstanTEL

Model/Type: Micromate

Serial No.: UM15904

ID No.: VB-01-002

Customer: C.E.M. Technology (Thailand) Co.,Ltd.

Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran,
Nakorn Phatom 73210

Received Date: 7 March 2025

Calibrated Date: 14 - 18 March 2025

Issued Date: 19 March 2025

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: _____

(Mr. Sittichai Swaksuriyawong)
Group Manager

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Certificate No.: CP20250099EA

Calibration Report

Equipment: Vibration Meter
Manufacturer: Instantel
Model: Micromate
Serial No.: UM15904
ID No.: VB-01-002
Ambient Temperature: (23 ± 5) °C
Relative Humidity: (50 ± 15) %

Method of Calibration :-

In-house method : CC-SV004 by comparison with standard accelerometer.

Condition of this result of calibration

1. Reference standards instrument :-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Standard Accelerometer	8305	2708237	AV-0040-24	19-Sep-2025
2) Measuring Amplifier	2525	2685967	AV-0034-24	7-Aug-2025
3) LAN XI Analyzer	3160-4-042	3060-106135	CQ20240016EA	1-Dec-2025
4) Humidity and Temperature Transmitter	HMT331	K3810009	CD20240141EA	12-Jun-2025

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

3. This certification is traceable to the international system of unit maintained at :-

- National Institute of Metrology (Thailand)
- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Certificate No.: CP20250099EA

Calibration Report

Result of Calibration:-

Function : Frequency response and Linearity test at 16 Hz

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty \pm (%)	Direction
4.0	10.000	10.001	10.357	0.356	1.50	Longitudinal (L)
5.0	10.000	9.998	10.246	0.248	1.50	
6.3	10.000	10.000	10.372	0.372	1.50	
8.0	10.000	9.998	10.144	0.146	1.50	
10.0	10.000	10.008	10.089	0.081	1.50	
12.5	10.000	10.008	9.955	-0.053	1.60	
16.0	10.000	9.996	10.057	0.061	1.60	
	20.000	19.997	19.943	-0.054	1.60	
	30.000	29.970	29.864	-0.106	1.50	
	50.000	49.992	49.695	-0.297	1.50	
20.0	10.000	9.993	10.057	0.064	1.60	
25.0	10.000	9.998	10.077	0.079	1.50	
31.5	10.000	9.996	10.073	0.077	1.50	
40.0	10.000	9.996	10.120	0.124	1.50	
52.0	10.000	10.008	10.238	0.230	1.50	
63.0	10.000	9.991	10.388	0.397	1.50	
80.0	10.000	9.994	10.593	0.599	1.50	

Certificate No.: CP20250099EA

Calibration Report

Function : Frequency response and Linearity test at 16 Hz (Cont.)

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
4.0	10.000	10.003	10.104	0.101	1.50	Transverse (T)
5.0	10.000	9.996	10.069	0.073	1.60	
6.3	10.000	10.006	10.136	0.130	1.60	
8.0	10.000	10.011	9.957	-0.054	1.60	
10.0	10.000	10.008	9.953	-0.055	1.60	
12.5	10.000	9.998	9.939	-0.059	1.60	
16.0	10.000	10.000	9.915	-0.085	1.50	
	20.000	19.997	19.807	-0.190	1.50	
	30.000	29.995	29.738	-0.257	1.50	
	50.000	49.992	49.553	-0.439	1.50	
20.0	10.000	10.010	9.955	-0.055	1.60	
25.0	10.000	10.006	9.947	-0.059	1.60	
31.5	10.000	9.993	10.045	0.052	1.70	
40.0	10.000	10.003	10.059	0.056	1.50	
52.0	10.000	10.006	10.152	0.146	1.50	
63.0	10.000	10.001	10.309	0.308	1.50	
80.0	10.000	9.998	10.472	0.474	1.50	

Certificate No.: CP20250099EA

Calibration Report

Function : Frequency response and Linearity test at 16 Hz (Cont.)

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
4.0	10.000	10.006	9.663	-0.343	1.50	Vertical (V)
5.0	10.000	9.997	9.632	-0.365	1.50	
6.3	10.000	9.998	9.813	-0.185	1.50	
8.0	10.000	10.010	9.766	-0.244	1.50	
10.0	10.000	9.996	9.851	-0.145	1.60	
12.5	10.000	10.000	9.923	-0.077	1.50	
16.0	10.000	9.997	10.059	0.062	1.60	
	20.000	19.997	20.060	0.063	1.60	
	30.000	29.995	30.061	0.066	1.60	
	50.000	49.992	50.215	0.223	1.50	
20.0	10.000	10.004	10.175	0.171	1.50	
25.0	10.000	10.001	10.183	0.182	1.50	
31.5	10.000	10.008	10.175	0.167	1.50	
40.0	10.000	9.997	10.294	0.297	1.50	
52.0	10.000	9.998	10.617	0.619	1.50	
63.0	10.000	10.013	10.672	0.659	1.50	
80.0	10.000	10.006	10.940	0.934	1.50	

Remark 1. UUC: Unit Under Calibration
2. The coverage factor $k = 2.00$

-- End of Report --