

ภาคผนวกที่ 4

สรุปเอกสารสอบเทียบอุปกรณ์เครื่องมือ

เอกสารการสอบเทียบเครื่องมือตรวจวัดระดับเสียงในบรรยากาศ



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240191EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: ACO
Model/Type: 6236 (Meter), 7052NR (Microphone), - (Preamplifier)
Serial No.: 222195 (Meter), 84163 (Microphone), - (Preamplifier)
ID No.: NS-03-025
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-P240022 CD20230196EA	20 March 2025 23 July 2024
6) Pressure humidity and Temperature Transmitter	PTU301	F0640003	CL1-P240029 CD20230197EA	10 April 2025 23 July 2024
7) Performance Audio Analyzer	U8903B	MY56510003	CB20240035EB 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)
-	-	-	-



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.: CP20240191EA

Operation No.: CP2024050161

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: ACO
Model/Type: 6236 (Meter), 7052NR (Microphone), - (Preamplifier)
Serial No.: 222195 (Meter), 84163 (Microphone), - (Preamplifier)
ID No.: NS-03-025
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran, Nakorn Phatom 73210
Received Date: 9 May 2024
Calibrated Date: 27 - 28 May 2024
Issued Date: 30 May 2024
Calibrated by: Ms. Juntaporn Kunhakom

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.: CP20240191EA

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	120.9	-0.1	±1.1

Certificate No.: CP20240191EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
30.0

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	29.8
C-weighting	32.7
Z-weighting	36.5

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	0.0	0.1	±1.5
1000	-0.3	-0.3	-0.3	±1.0
8000	0.6	0.7	0.8	±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	-0.1	-0.1	±2.0
125	0.0	-0.1	-0.1	±1.5
250	-0.1	-0.1	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	-0.1	-0.1	-0.1	±2.0
4000	-0.4	-0.3	-0.1	±3.0
8000	-0.4	-0.4	-0.1	±5.0

Certificate No.: CP20240191EA

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	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	89.8	-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	125.5	0.1	±3.0
Positive half cycle	124.4	124.3	-0.1	±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.: CP20240191EA

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	39.3	0.3	±1.1
34.0	35.2	1.2	±1.1
33.0	34.5	1.5	±1.1
32.0	33.8	1.8	±1.1
31.0	33.3	2.3	±1.1
30.0	32.7	2.7	±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	30.4	5.4	±1.1
20-90	25.0	30.3	5.3	±1.1
20-100	25.0	30.3	5.3	±1.1
20-110	25.0	30.4	5.4	±1.1
30-120	35.0	35.0	0.0	±1.1
40-130	45.0	43.9	-1.1	±1.1



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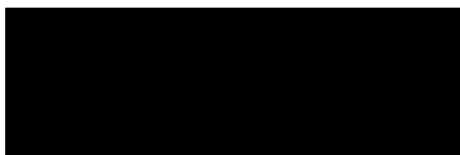
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Tel: +66 2709 4860 Fax: +66 2324 0917



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



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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.



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240191EA

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

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

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

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 : 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

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.: 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



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240384EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: ACO
Model/Type: 6236 (Meter), 7052 (Microphone), - (Preamplifier)
Serial No.: 222129 (Meter), 72838 (Microphone), - (Preamplifier)
ID No.: NS-03-014
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	9610014	CB20230200EA	15 November 2024
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)
-	-	-	-



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.: CP20240384EA

Operation No.: CP2024100365

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: ACO
Model/Type: 6236 (Meter), 7052 (Microphone), - (Preamplifier)
Serial No.: 222129 (Meter), 72838 (Microphone), - (Preamplifier)
ID No.: NS-03-014
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran, Nakorn Phatom 73210
Received Date: 29 October 2024
Calibrated Date: 8 - 11 November 2024
Issued Date: 15 November 2024
Calibrated by: Ms. Juntaporn Kunhakom

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Certificate No.: CP20240384EA

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	122.0	0.0	±1.1
123.0	123.0	0.0	±1.1

Certificate No.: CP20240384EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
20.7

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	15.5
C-weighting	20.6
Z-weighting	26.5

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	-0.4	-0.6	-0.5	±1.5
1000	-0.7	-0.7	-0.7	±1.0
8000	1.5	1.8	1.8	±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	-0.1	±2.0
125	0.0	-0.2	0.0	±1.5
250	0.0	-0.1	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	-0.1	0.0	±2.0
4000	-0.3	-0.3	-0.1	±3.0
8000	-0.4	-0.4	-0.1	±5.0

Certificate No.: CP20240384EA

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	109.5	-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.: CP20240384EA

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	58.9	-0.1	±1.1
54.0	53.9	-0.1	±1.1
49.0	48.9	-0.1	±1.1
44.0	43.9	-0.1	±1.1
39.0	38.9	-0.1	±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	31.2	0.2	±1.1
30.0	30.4	0.4	±1.1
29.0	29.7	0.7	±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	25.7	0.7	±1.1
30-120	35.0	35.0	0.0	±1.1
40-130	45.0	45.0	0.0	±1.1



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Certificate No.: CP20250051EA
Operation No.: CP2025020038

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: 31 January 2025
Calibrated Date: 17 - 19 February 2025
Issued Date: 24 February 2025
Calibrated by: Ms. Juntaporn Kunhakom

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Certificate No.: CP20240384EA

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.: CP20250051EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
21.3

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	20.6
C-weighting	43.3
Z-weighting	44.8

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	-0.1	0.0	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	-0.1	-0.2	0.1	±2.0
125	0.0	-0.2	0.3	±1.5
250	0.0	-0.1	0.4	±1.5
500	0.1	-0.1	0.4	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	-0.1	0.5	±2.0
4000	-0.3	-0.3	0.4	±3.0
8000	-0.5	-0.4	0.2	±5.0

Certificate No.: CP20250051EA

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	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	CB20250030EA CK20240069EA	13 February 2026 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.: CP20250051EA

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	69.1	0.1	±1.1
64.0	64.0	0.0	±1.1
59.0	58.9	-0.1	±1.1
54.0	53.9	-0.1	±1.1
49.0	48.9	-0.1	±1.1
44.0	44.0	0.0	±1.1
39.0	39.2	0.2	±1.1
34.0	34.7	0.7	±1.1
33.0	34.0	1.0	±1.1
32.0	33.3	1.3	±1.1
31.0	32.7	1.7	±1.1
30.0	32.1	2.1	±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	93.9	-0.1	±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	25.6	0.6	±1.1
20-90	25.0	25.6	0.6	±1.1
20-100	25.0	25.8	0.8	±1.1
20-110	25.0	25.8	0.8	±1.1
30-120	35.0	35.0	0.0	±1.1
40-130	45.0	44.9	-0.1	±1.1

Certificate No.: CP20250051EA

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	94.1	0.1	±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	93.9	-0.1	±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

Certificate No.: CP20250051EA

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.: CP20250051EA

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	89.9	-0.1	+1.0 ; -5.0
	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	125.6	0.2	±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



ELECTRICAL AND ELECTRONICS INSTITUTE
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Certificate No.: CP20240354EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: BSWA TECH
Model/Type: BSWA 309 (Meter), MP309 (Microphone), MA231T (Preamplifier)
Serial No.: 590102 (Meter), 395600 (Microphone), 590612 (Preamplifier)
ID No.: NS-04-003
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-

IEC 61672-3:2013.

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	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2913	EF-0021-24	3 June 2025
4) 6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
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 :-

- 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)
-	-	-	-



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Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

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



Certificate No.: CP20240354EA

Operation No.: CP2024090329

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: BSWA TECH
Model/Type: BSWA 309 (Meter), MP309 (Microphone), MA231T (Preamplifier)
Serial No.: 590102 (Meter), 395600 (Microphone), 590612 (Preamplifier)
ID No.: NS-04-003
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran, Nakorn Phatom 73210
Received Date: 18 September 2024
Calibrated Date: 1 - 2 October 2024
Issued Date: 4 October 2024
Calibrated by: Ms. Juntaporn Kunhakom

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Certificate No.: CP20240354EA

Calibration Report

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
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
134.0	134.0	0.0	±1.1
135.0	135.0	0.0	±1.1

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	33.9	-0.1	±1.1

Certificate No.: CP20240354EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
18.4

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	11.2
C-weighting	15.6
Z-weighting	23.3

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	0.2	±1.5
1000	-0.2	-0.2	-0.2	±1.0
8000	0.5	0.4	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	0.0	0.0	±2.0
125	0.0	-0.1	0.0	±1.5
250	0.0	-0.1	-0.1	±1.5
500	-0.1	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	-0.1	0.0	-0.1	±2.0
4000	-0.1	0.0	0.0	±3.0
8000	-0.6	-0.5	-0.1	±5.0

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



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240354EA

Calibration Report

Function : 11. 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	136.0	136.0	0.0	±0.3

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) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.24	0.25
11) 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. The acceptance limit is for the deviated value.
 3. Acceptance limits was IEC61672-3:2013 Class 2.
 4. The coverage factor $k = 2.00$

-- End of Report --



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240354EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower (Cont.)

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.1	0.1	±1.1
25.0	25.1	0.1	±1.1
24.0	24.3	0.3	±1.1
23.0	23.4	0.4	±1.1
22.0	22.4	0.4	±1.1
21.0	21.5	0.5	±1.1
20.0	20.7	0.7	±1.1
19.0	19.8	0.8	±1.1
18.0	18.9	0.9	±1.1

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	133.0	0.0	±1.0
	2	116.0	0.0	+1.0 ; -2.5
	0.25	106.9	-0.1	+1.5 ; -5.0
Slow	200	126.6	0.0	±1.0
	2	107.0	0.0	+1.0 ; -5.0
SEL	200	127.0	0.0	±1.0
	2	107.0	0.0	+1.0 ; -2.5
	0.25	97.9	-0.1	+1.5 ; -5.0

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	132.4	132.0	-0.4	±3.0
Positive half cycle	131.4	131.1	-0.3	±2.0
Negative half cycle	131.4	131.1	-0.3	±2.0

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
138.3	138.3	0.0	±1.5



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20250264EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: BSWA TECH
Model/Type: BSWA 309 (Meter), MP309 (Microphone), MA231T (Preamplifier)
Serial No.: 590102 (Meter), 395600 (Microphone), 590612 (Preamplifier)
ID No.: NS-04-003
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-
IEC 61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2661000	AA-1011-25	24 June 2026
2) Arbitrary Function Generator	AFG2021	C010063	CK20250037EA	25 June 2026
3) Programmable Attenuator	PA5	2755	EF-0035-24	28 October 2025
4) 6.5 Digit precision multimeter	8846A	9610014	CB20240215EA	26 November 2025
5) Pressure humidity and Temperature Transmitter	PTU301	F0640003	CL1-P250034 CD20250096EA	10 April 2026 29 March 2026
6) Performance Audio Analyzer	U8903B	MY56510003	CB20250030EA CK20250065EA	13 February 2026 23 September 2026

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); ILAC Policy, Item 2 (1) No.ILAC-P10:07/2020.
- Reference standards instrument for Electrical function
 - National Institute of Metrology (Thailand)
 - Electrical and Electronics Institute; NSC Accredited Calibration No.0119
 - IRPC Metrology Center, IRPC Public Co., Ltd.; NSC Accredited Calibration No.0204.

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

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



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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.: CP20250264EA

Operation No.: CP2025090258

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: BSWA TECH
Model/Type: BSWA 309 (Meter), MP309 (Microphone), MA231T (Preamplifier)
Serial No.: 590102 (Meter), 395600 (Microphone), 590612 (Preamplifier)
ID No.: NS-04-003
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13, T.Rai Khing, A.Sam Phran, Nakhon Pathom 73210
Received Date: 10 September 2025
Calibrated Date: 23 - 25 September 2025
Issued Date: 26 September 2025
Calibrated by: Ms. Juntaporn Kunhakom

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.



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20250264EA

Calibration Report

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
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
134.0	134.0	0.0	±1.1
135.0	135.0	0.0	±1.1
136.0	136.0	0.0	±1.1

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	34.0	0.0	±1.1



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20250264EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
18.9

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	13.3
C-weighting	18.9
Z-weighting	26.7

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	0.0	-0.1	0.0	±1.5
1000	0.1	0.1	0.1	±1.0
8000	0.5	0.5	1.0	±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	0.0	0.0	±2.0
125	0.0	-0.1	0.0	±1.5
250	0.0	-0.1	0.0	±1.5
500	0.0	-0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	-0.1	±2.0
4000	-0.1	-0.1	0.0	±3.0
8000	-0.6	-0.5	0.0	±5.0

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



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20250264EA

Calibration Report

Function : 11. 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	136.0	136.0	0.0	±0.3

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) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.24	0.25
11) 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. The acceptance limit is for the deviated value.
3. Acceptance limits was IEC61672-3:2013 Class 2.
4. The coverage factor $k = 2.00$

-- End of Report --



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20250264EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower (Cont.)

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
29.0	29.1	0.1	±1.1
28.0	28.1	0.1	±1.1
27.0	27.1	0.1	±1.1
26.0	26.2	0.2	±1.1
25.0	25.3	0.3	±1.1
24.0	24.4	0.4	±1.1
23.0	23.5	0.5	±1.1
22.0	22.6	0.6	±1.1
21.0	21.8	0.8	±1.1
20.0	21.0	1.0	±1.1

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	133.0	0.0	±1.0
	2	116.0	0.0	+1.0 ; -2.5
	0.25	106.9	-0.1	+1.5 ; -5.0
Slow	200	126.6	0.0	±1.0
	2	107.0	0.0	+1.0 ; -5.0
SEL	200	127.0	0.0	±1.0
	2	107.0	0.0	+1.0 ; -2.5
	0.25	97.9	-0.1	+1.5 ; -5.0

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	132.4	132.1	-0.3	±3.0
Positive half cycle	131.4	131.2	-0.2	±2.0
Negative half cycle	131.4	131.2	-0.2	±2.0

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
138.8	138.8	0.0	±1.5

Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2501082-42

Page 2 of 3

Standards Equipment Used

Equipment Name	Serial No.	Certificate No.	Due Date	Traceability to
Sound Calibrator	N975185	5523631031354566	Nov 6, 2025	MP-TH

Traceability

This calibration is traceable to the International System of Unit via :

- MP-TH : Micro Precision Calibration Laboratory (Thailand) Co., Ltd.



SMART TECH CALIBRATION & SERVICES CO., LTD.

14/506 MOO 3, RANGSIT-NAKHON NAYOK ROAD, LAM PHAK KUT,

THANYABURI, PATHUM THANI 12110, THAILAND

Tel. +662-114-3148 Email : stcal.md@gmail.com Website : stc-cal.com



Certificate of Calibration

Certificate No. STCR-2501082-42

Work Order No. STCR-2501082

Page 1 of 3

Customer Name : CEM Technology Thailand Co., Ltd.
31/8 Moo.13 Raikhing Sub-district, Samphan District,
Nakhonpathom, 73210

Equipment Name : Sound Level Meter
Manufacturer : Pulsar
Model : 44
Serial Number : PN2297
Control Number : NS-08-001
Received Date : Jan 24, 2025
Calibration Date : Jan 25, 2025
Recommended Due Date : Jan 25, 2026
Calibration Method : Calibration Procedure No. CPE-04-01

Environmental Conditions
Ambient Temperature : (25 ± 2) °C
Ambient Relative Humidity : (50 ± 15) %RH
Calibration Place : Permanent Calibration Laboratory

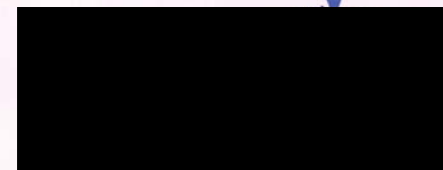
Condition as received : Normal

Calibration Result : See data attached

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
3. The working standard is indicated in page 2 of this certificate.
4. This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Smart Tech Calibration & Services Co., Ltd.
5. This results of this report only to the items calibrated.

Date of issue : Jan 29, 2025

Calibrated by : Y. Perapon





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THANYABURI, PATHUM THANI 12110, THAILAND
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Certificate of Calibration

Certificate No. STCR-2506142-8
Work Order No. STCR-2506142
Page 1 of 3

Customer Name : CEM Technology Thailand Co., Ltd.
31/8 Moo.13 Raikhing Sub-district, Samphran District,
Nakhonpathom, 73210

Equipment Name : Sound Level Meter
Manufacturer : Pulsar
Model : 44
Serial Number : PN 2308
Control Number : NS-08-002
Received Date : Jun 24, 2025
Calibration Date : Jun 25, 2025
Recommended Due Date : Jun 25, 2026
Calibration Method : Calibration Procedure No. CPE-04-01

Environmental Conditions

Ambient Temperature : $(25 \pm 2) ^\circ\text{C}$
Ambient Relative Humidity : $(50 \pm 15) \% \text{RH}$
Calibration Place : Permanent Calibration Laboratory

Condition as received : Normal

Calibration Result : See data attached

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
3. The working standard is indicated in page 2 of this certificate.
4. This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Smart Tech Calibration & Services Co., Ltd.
5. This results of this report only to the items calibrated.

Date of Issue : Jun 27, 2025

Calibrated by : C. Jirayu



@smarttechcal

Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2501082-42

Page 3 of 3

UUC Range : (30 to 130) dB

Resolution : 0.1 dB

Results of Calibration: [] Without adjustment [☒] With adjustment

Appearance and Function of Use Inspection : NOT GOOD

Sound Level Calibration @ Frequency 1 kHz

Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	81.5 dB	-	12.59 dB	0.40 dB
	114.07 dB	111.3 dB	-	2.77 dB	0.40 dB
SLOW	94.09 dB	81.6 dB	-	12.49 dB	0.40 dB
	114.07 dB	111.5 dB	-	2.57 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -



Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2506142-8

Page 3 of 3

UUC Range : (30 to 130) dB

Resolution : 0.1 dB

Results of Calibration: [☒] Without adjustment [☐] With adjustment

Appearance and Function of Use Inspection : GOOD

Sound Level Calibration @ Frequency 1 kHz Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	94.0 dB	-	0.09 dB	0.40 dB
	114.07 dB	113.9 dB	-	0.17 dB	0.40 dB
SLOW	94.09 dB	94.0 dB	-	0.09 dB	0.40 dB
	114.07 dB	113.9 dB	-	0.17 dB	0.40 dB

Sound Level Calibration @ Frequency 1 kHz Select : C

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	94.0 dB	-	0.09 dB	0.40 dB
	114.07 dB	114.0 dB	-	0.07 dB	0.40 dB
SLOW	94.09 dB	94.0 dB	-	0.09 dB	0.40 dB
	114.07 dB	114.0 dB	-	0.07 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -



Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2506142-8

Page 2 of 3

Standards Equipment Used

Equipment Name	Serial No.	Certificate No.	Due Date	Traceability to
Sound Calibrator	N975185	5523631031354566	Nov 6, 2025	MP-TH

Traceability

This calibration is traceable to the International System of Unit via :

- MP-TH : Micro Precision Calibration Laboratory (Thailand) Co., Ltd.



Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2501082-43

Page 2 of 3

Standards Equipment Used

Equipment Name	Serial No.	Certificate No.	Due Date	Traceability to
Sound Calibrator	N975185	5523631031354566	Nov 6, 2025	MP-TH

Traceability

This calibration is traceable to the International System of Unit via :

- MP-TH : Micro Precision Calibration Laboratory (Thailand) Co., Ltd.



SMART TECH CALIBRATION & SERVICES CO., LTD.

14/506 MOO 3, RANGSIT-NAKHON NAYOK ROAD, LAM PHAK KUT,
THANYABURI, PATHUM THANI 12110, THAILAND

Tel. +662-114-3148 Email : stcal.md@gmail.com Website : stc-cal.com



Certificate of Calibration

Certificate No. STCR-2501082-43

Work Order No. STCR-2501082

Page 1 of 3

Customer Name : CEM Technology Thailand Co., Ltd.
31/8 Moo.13 Raikhing Sub-district, Samphan District,
Nakhonpathom, 73210

Equipment Name : Sound Level Meter
Manufacturer : Pulsar
Model : 44
Serial Number : PN2319
Control Number : NS-08-003
Received Date : Jan 24, 2025
Calibration Date : Jan 25, 2025
Recommended Due Date : Jan 25, 2026
Calibration Method : Calibration Procedure No. CPE-04-01

Environmental Conditions
Ambient Temperature : (25 ± 2) °C
Ambient Relative Humidity : (50 ± 15) %RH
Calibration Place : Permanent Calibration Laboratory

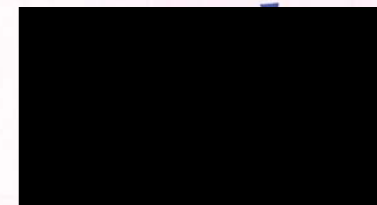
Condition as received : Normal

Calibration Result : See data attached

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
3. The working standard is indicated in page 2 of this certificate.
4. This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Smart Tech Calibration & Services Co., Ltd.
5. This results of this report only to the items calibrated.

Date of Issue : Jan 29, 2025

Calibrated by : Y. Perapon





SMART TECH CALIBRATION & SERVICES CO., LTD.
14/508 MOO 3, RANGSIT-NAKHON NAYOK ROAD, LAM PHAK KUT,
THANYABURI, PATHUM THANI 12110, THAILAND
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Certificate of Calibration

Certificate No. STCR-2410146-4

Work Order No. STCR-2410146

Page 1 of 3

Customer Name : CEM Technology Thailand Co., Ltd.
31/8 Moo.13 Raikhing Sub-district, Samphran District,
Nakhonpathom, 73210

Equipment Name : Sound Level Meter
Manufacturer : Pulsar
Model : 44
Serial Number : PN2319
Control Number : NS-08-003
Received Date : Oct 30, 2024
Calibration Date : Oct 31, 2024
Recommended Due Date : Oct 31, 2025
Calibration Method : Calibration Procedure No. CPE-04-01

Environmental Conditions

Ambient Temperature : $(25 \pm 2) ^\circ\text{C}$
Ambient Relative Humidity : $(50 \pm 15) \% \text{RH}$
Calibration Place : Permanent Calibration Laboratory

Condition as received : Normal

Calibration Result : See data attached

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
3. The working standard is indicated in page 2 of this certificate.
4. This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Smart Tech Calibration & Services Co., Ltd.
5. This results of this report only to the items calibrated.

Date of Issue : Nov 1, 2024

Calibrated by : Y. Perapon



@smartechnical

Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2501082-43

Page 3 of 3

UUC Range : (30 to 130) dB

Resolution : 0.1 dB

Results of Calibration: [] Without adjustment [☒] With adjustment

Appearance and Function of Use Inspection : GOOD

Sound Level Calibration @ Frequency 1 kHz

Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	95.8 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	115.7 dB	113.9 dB	0.17 dB	0.40 dB
SLOW	94.09 dB	95.8 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	115.8 dB	113.9 dB	0.17 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -



Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2410146-4

Page 3 of 3

UUC Range : (30 to 130) dB

Resolution : 0.1 dB

Results of Calibration: [] Without adjustment [☒] With adjustment

Appearance and Function of Use Inspection : GOOD

Sound Level Calibration @ Frequency 1 kHz

Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	93.5 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	113.6 dB	114.1 dB	-0.03 dB	0.40 dB
SLOW	94.09 dB	93.5 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	113.6 dB	114.1 dB	-0.03 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -



Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2410146-4

Page 2 of 3

Standards Equipment Used

<u>Equipment Name</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>	<u>Traceability to</u>
Sound Calibrator	N975185	5523631030918636	Nov 9, 2024	MP-TH

Traceability

This calibration is traceable to the International System of Unit via :

- MP-TH : Micro Precision Calibration Laboratory (Thailand) Co., Ltd.



Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2501082-44

Page 2 of 3

Standards Equipment Used

Equipment Name	Serial No.	Certificate No.	Due Date	Traceability to
Sound Calibrator	N975185	5523631031354566	Nov 6, 2025	MP-TH

Traceability

This calibration is traceable to the International System of Unit via :

- MP-TH : Micro Precision Calibration Laboratory (Thailand) Co., Ltd.



SMART TECH CALIBRATION & SERVICES CO., LTD.

14/506 MOO 3, RANGSIT-NAKHON NAYOK ROAD, LAM PHAK KUT,
THANYABURI, PATHUM THANI 12110, THAILAND

Tel. +662-114-3148 Email : stcal.md@gmail.com Website : stc-cal.com



Certificate of Calibration

Certificate No. STCR-2501082-44

Work Order No. STCR-2501082

Page 1 of 3

Customer Name : CEM Technology Thailand Co., Ltd.
31/8 Moo.13 Raikhing Sub-district, Samphan District,
Nakhonpathom, 73210

Equipment Name : Sound Level Meter
Manufacturer : Pulsar
Model : 44
Serial Number : PN2362
Control Number : NS-08-004
Received Date : Jan 24, 2025
Calibration Date : Jan 25, 2025
Recommended Due Date : Jan 25, 2026
Calibration Method : Calibration Procedure No. CPE-04-01

Environmental Conditions
Ambient Temperature : $(25 \pm 2) ^\circ\text{C}$
Ambient Relative Humidity : $(50 \pm 15) \% \text{RH}$
Calibration Place : Permanent Calibration Laboratory

Condition as received : Normal

Calibration Result : See data attached

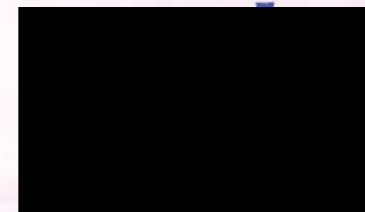
- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.
- The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
- The working standard is indicated in page 2 of this certificate.
- This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Smart Tech Calibration & Services Co., Ltd.
- This results of this report only to the items calibrated.

Date of Issue : Jan 29, 2025

Calibrated by : Y. Perapon



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THANYABURI, PATHUM THANI 12110, THAILAND
Tel. +662-114-3148 Email : stcal.mtd@gmail.com Website : stc-cal.com



Certificate of Calibration

Certificate No. STCR-2501082-45

Work Order No. STCR-2501082

Page 1 of 3

Customer Name : CEM Technology Thailand Co., Ltd.
31/8 Moo.13 Raikhing Sub-district, Samphran District,
Nakhonpathom, 73210

Equipment Name : Sound Level Meter
Manufacturer : Pulsar
Model : 44
Serial Number : PN2366
Control Number : NS-08-006
Received Date : Jan 24, 2025
Calibration Date : Jan 25, 2025
Recommended Due Date : Jan 25, 2026
Calibration Method : Calibration Procedure No. CPE-04-01

Environmental Conditions
Ambient Temperature : (25 ± 2) °C
Ambient Relative Humidity : (50 ± 15) %RH
Calibration Place : Permanent Calibration Laboratory

Condition as received : Normal

Calibration Result : See data attached

- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.
- The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
- The working standard is indicated in page 2 of this certificate.
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- This results of this report only to the items calibrated.

Date of Issue : Jan 29, 2025

Calibrated by : Y. Perapon



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Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2501082-44

Page 3 of 3

UUC Range : (30 to 130) dB

Resolution : 0.1 dB

Results of Calibration: [] Without adjustment [☒] With adjustment

Appearance and Function of Use Inspection : GOOD

Sound Level Calibration @ Frequency 1 kHz

Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	94.8 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	114.8 dB	114.0 dB	0.07 dB	0.40 dB
SLOW	94.09 dB	94.8 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	114.8 dB	114.0 dB	0.07 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -



Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2501082-45

Page 3 of 3

UUC Range : (30 to 130) dB

Resolution : 0.1 dB

Results of Calibration: [] Without adjustment [☒] With adjustment

Appearance and Function of Use Inspection : GOOD

Sound Level Calibration @ Frequency 1 kHz Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	94.0 dB	-	0.09 dB	0.40 dB
	114.07 dB	113.9 dB	-	0.17 dB	0.40 dB
SLOW	94.09 dB	94.0 dB	-	0.09 dB	0.40 dB
	114.07 dB	113.9 dB	-	0.17 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -



Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2501082-45

Page 2 of 3

Standards Equipment Used

<u>Equipment Name</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>	<u>Traceability to</u>
Sound Calibrator	N975185	5523631031354566	Nov 6, 2025	MP-TH

Traceability

This calibration is traceable to the International System of Unit via :

- MP-TH : Micro Precision Calibration Laboratory (Thailand) Co., Ltd.



Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2501082-46

Page 2 of 3

Standards Equipment Used

Equipment Name	Serial No.	Certificate No.	Due Date	Traceability to
Sound Calibrator	N975185	5523631031354566	Nov 6, 2025	MP-TH

Traceability

This calibration is traceable to the International System of Unit via :

- MP-TH : Micro Precision Calibration Laboratory (Thailand) Co., Ltd.



SMART TECH CALIBRATION & SERVICES CO., LTD.

14/506 MOO 3, RANGSIT-NAKHON NAYOK ROAD, LAM PHAK KUT,
THANYABURI, PATHUM THANI 12110, THAILAND

Tel. +662-114-3148 Email : stcal.md@gmail.com Website : stc-cal.com



Certificate of Calibration

Certificate No. STCR-2501082-46

Work Order No. STCR-2501082

Page 1 of 3

Customer Name : CEM Technology Thailand Co., Ltd.
31/8 Moo.13 Raikhing Sub-district, Samphran District,
Nakhonpathom, 73210

Equipment Name : Sound Level Meter
Manufacturer : Pulsar
Model : 44
Serial Number : PN2367
Control Number : NS-08-007
Received Date : Jan 24, 2025
Calibration Date : Jan 25, 2025
Recommended Due Date : Jan 25, 2026
Calibration Method : Calibration Procedure No. CPE-04-01

Environmental Conditions
Ambient Temperature : $(25 \pm 2) ^\circ\text{C}$
Ambient Relative Humidity : $(50 \pm 15) \% \text{RH}$
Calibration Place : Permanent Calibration Laboratory

Condition as received : Normal

Calibration Result : See data attached

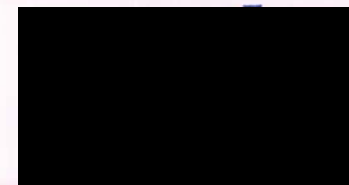
- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.
- The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
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- This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Smart Tech Calibration & Services Co., Ltd.
- This results of this report only to the items calibrated.

Date of Issue : Jan 29, 2025

Calibrated by : Y. Perapon



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Certificate of Calibration

Certificate No. STCR-2501082-49

Work Order No. STCR-2501082

Page 1 of 3

Customer Name : CEM Technology Thailand Co., Ltd.
31/8 Moo.13 Raikhing Sub-district, Samphran District,
Nakhonpathom, 73210

Equipment Name : Sound Level Meter
Manufacturer : Scarlet Tech
Model : ST-25D
Serial Number : 10340892
Control Number : NS-09-003
Received Date : Jan 24, 2025
Calibration Date : Jan 25, 2025
Recommended Due Date : Jan 25, 2026
Calibration Method : Calibration Procedure No. CPE-04-01

Environmental Conditions
Ambient Temperature : (25 ± 2) °C
Ambient Relative Humidity : (50 ± 15) %RH
Calibration Place : Permanent Calibration Laboratory

Condition as received : Normal

Calibration Result : See data attached

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
3. The working standard is indicated in page 2 of this certificate.
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5. This results of this report only to the items calibrated.

Date of Issue : Jan 29, 2025

Calibrated by : Y. Perapon



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Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2501082-46

Page 3 of 3

UUC Range : (30 to 130) dB

Resolution : 0.1 dB

Results of Calibration: [] Without adjustment [☒] With adjustment

Appearance and Function of Use Inspection : NOT GOOD

Sound Level Calibration @ Frequency 1 kHz

Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	79.6 dB	-	14.49 dB	0.40 dB
	114.07 dB	99.3 dB	-	14.77 dB	0.40 dB
SLOW	94.09 dB	79.5 dB	-	14.59 dB	0.40 dB
	114.07 dB	99.2 dB	-	14.87 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -



Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2501082-49

Page 3 of 3

UUC Range : (28 to 133) dB

Resolution : 0.1 dB

Results of Calibration: [] Without adjustment [☒] With adjustment

Appearance and Function of Use Inspection : GOOD

Sound Level Calibration @ Frequency 1 kHz Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	93.5 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	113.5 dB	114.0 dB	0.07 dB	0.40 dB
SLOW	94.09 dB	93.5 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	113.5 dB	114.0 dB	0.07 dB	0.40 dB

Sound Level Calibration @ Frequency 1 kHz Select : C

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	93.5 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	113.3 dB	113.9 dB	0.17 dB	0.40 dB
SLOW	94.09 dB	93.4 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	113.3 dB	113.9 dB	0.17 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -



Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2501082-49

Page 2 of 3

Standards Equipment Used

Equipment Name	Serial No.	Certificate No.	Due Date	Traceability to
Sound Calibrator	N975185	5523631031354566	Nov 6, 2025	MP-TH

Traceability

This calibration is traceable to the International System of Unit via :

- MP-TH : Micro Precision Calibration Laboratory (Thailand) Co., Ltd.



Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2501082-52

Page 2 of 3

Standards Equipment Used

Equipment Name	Serial No.	Certificate No.	Due Date	Traceability to
Sound Calibrator	N975185	5523631031354566	Nov 6, 2025	MP-TH

Traceability

This calibration is traceable to the International System of Unit via :

- MP-TH : Micro Precision Calibration Laboratory (Thailand) Co., Ltd.



SMART TECH CALIBRATION & SERVICES CO., LTD.

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Tel. +662-114-3148 Email : stcal.mtd@gmail.com Website : stc-cal.com



Certificate of Calibration

Certificate No. STCR-2501082-52

Work Order No. STCR-2501082

Page 1 of 3

Customer Name : CEM Technology Thailand Co., Ltd.
31/8 Moo.13 Raikhing Sub-district, Samphran District,
Nakhonpathom, 73210

Equipment Name : Sound Level Meter
Manufacturer : Scarlet Tech
Model : ST-25D
Serial Number : 10340896
Control Number : NS-09-007
Received Date : Jan 24, 2025
Calibration Date : Jan 25, 2025
Recommended Due Date : Jan 25, 2026
Calibration Method : Calibration Procedure No. CPE-04-01

Environmental Conditions
Ambient Temperature : (25 ± 2) °C
Ambient Relative Humidity : (50 ± 15) %RH
Calibration Place : Permanent Calibration Laboratory

Condition as received : Normal

Calibration Result : See data attached

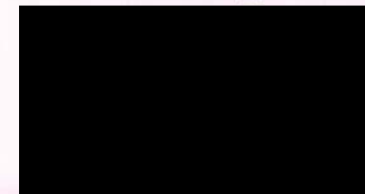
1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
3. The working standard is indicated in page 2 of this certificate.
4. This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Smart Tech Calibration & Services Co., Ltd.
5. This results of this report only to the items calibrated.

Date of Issue : Jan 29, 2025

Calibrated by : Y. Perapon



@smarttechcal





CERTIFICATE OF CALIBRATION

NO. 20240313387

Name of Product: Sound Level Meter
Model: ST-11D
Serial Number: 821487
Specification: Class 1
Conclusion: Pass
Date of calibration: 2024-03-22
Due Date: 2025-03-21

- 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-S8377

4. Measuring up limit: 140 dBA

3. Adjustments to indicated sound levels:

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

Type of Calibrator: B&K 4231

Sound Pressure Level: 94.0 dB

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

Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
10	-70.6	-14.1	-0.8	1000	0.1	0.0	0.0
20	-50.2	-6.1	-0.1	2000	1.3	-0.1	0.0
31.5	-39.4	-2.9	-0.2	4000	1.2	-0.7	0.0
63	-26.2	-0.8	0.0	8000	-1.1	-3.0	0.0
125	-16.1	-0.1	0.0	12500	-6.0	-7.9	-0.1
250	-8.6	0.0	0.0	16000	-11.7	-13.7	0.0
500	-3.2	0.1	0.0	20000	-23.8	-25.8	-0.2

Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2501082-52

Page 3 of 3

UUC Range : (28 to 133) dB

Resolution : 0.1 dB

Results of Calibration: [] Without adjustment [✓] With adjustment

Appearance and Function of Use Inspection : GOOD

Sound Level Calibration @ Frequency 1 kHz Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	87.5 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	108.1 dB	114.2 dB	-0.13 dB	0.40 dB
SLOW	94.09 dB	87.5 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	108.1 dB	114.2 dB	-0.13 dB	0.40 dB

Sound Level Calibration @ Frequency 1 kHz Select : C

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	87.6 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	108.0 dB	114.3 dB	-0.23 dB	0.40 dB
SLOW	94.09 dB	87.6 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	108.0 dB	114.2 dB	-0.13 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -



Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
L _{Aeq,T}	103.2	103.2	0.0
L _S	110.8	110.8	0.0
L ₁₀	108.8	108.8	0.0
L ₅₀	92.9	92.8	0.1
L ₉₀	76.9	76.8	0.1
L ₉₅	75.0	74.9	0.1

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

Environment conditions:

Air temperature: 25 °C
Relative humidity: 60 %
Static pressure: 101.8 kPa

Reference equipment used in the calibration:

Description:	Model	Serial No.	Expiry Date	Traceable To
Microphone	B&K 4191	2929405	2025-12-15	NML
Multi function sound calibrator	B&K 4226	2288444	2025-10-15	CIGISMEC
Signal generator	DS 360	33873	2025-10-15	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 ±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

6. Self-generated noise

Microphone replaced by electrical input signal device

8.6 dB(A)	8.5 dB(C)	17.7 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			
	L _{Amax} -L _A	L _{A1max} -L _A	L _{A2} -L _A	L _{Aavg} -L _A
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-7.4	-6.9	-7.0
2	-17.9	-26.9	-26.9	-7.0
0.25	-27.1	/	-36.0	-7.0

10. Peak C sound level (500Hz) :

Cycle	One cycle	nominal value	Positive half	nominal value	Negative half	nominal value
L _{Cpeak} -L _C (dB)	3.4	3.5	2.4	2.4	2.4	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.

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในบรรยากาศ



Certificate of Analyzer Performance Testing

Calibrated Date : 20-Aug-25 Certificate No. : 0825-007
Page : 1/1

Analyzer Instruments

Analyzer Type : CO Analyzer Manufacturer : Thermo Environmental
Model : 48C Serial No. : 508011064

Environmental

Temperature : 22.4 °C
Humidity : 40.5 %RH

Calibration System

Calibrator Units

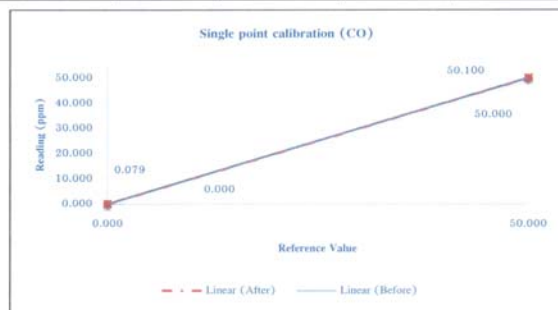
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514811458 Serial No. : 179

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	0.079	0.000	0.08	50.1	50.000	0.20
After						
CO	0.000	0.000	0.00	50.0	50.000	0.00



Certificate of Analyzer Performance Testing

Calibrated Date : 18-Aug-25 Certificate No. : 0825-005
Page : 1/1

Analyzer Instruments

Analyzer Type : CO Analyzer Manufacturer : Thermo Environmental
Model : 48C Serial No. : 508011061

Environmental

Temperature : 26.5 °C
Humidity : 36.4 %RH

Calibration System

Calibrator Units

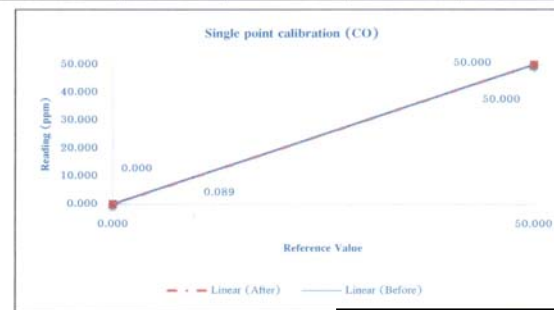
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514811458 Serial No. : 179

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						
CO	0.089	0.000	0.09	50.0	50.000	0.00
After						
CO	0.000	0.000	0.00	50.0	50.000	0.00





Certificate of Analyzer Performance Testing

Calibrated Date : 18-Jul-24 Certificate No. : 0724-001
Page : 1/1

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

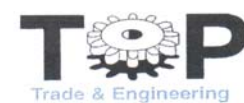
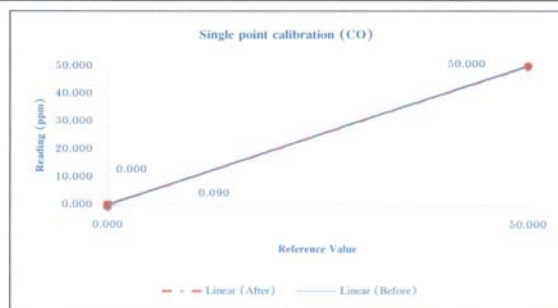
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514811458 Serial No. : 179

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



Certificate of Analyzer Performance Testing

Calibrated Date : 20-Aug-25 Certificate No. : 0825-008
Page : 1/1

Analyzer Instruments

Analyzer Type : CO Analyzer Manufacturer : Thermo Environmental
Model : 48C Serial No. : 508011064

Environmental

Temperature : 25.7 °C
Humidity : 38.7 %RH

Calibration System

Calibrator Units

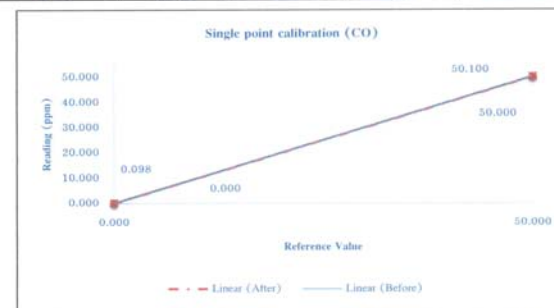
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514811458 Serial No. : 179

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	0.098	0.000	0.10	50.1	50.000	0.20
After						
CO	0.000	0.000	0.00	50.0	50.000	0.00





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

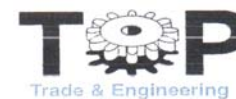
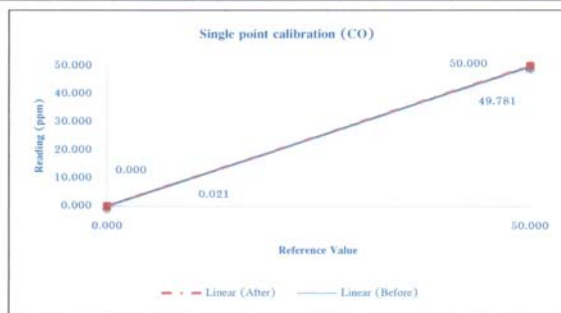
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514811458 Serial No. : 179

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



Certificate of Analyzer Performance Testing

Calibrated Date : 3-Mar-25 Certificate No. : 0325-001
Page : 1/1

Analyzer Instruments

Analyzer Type : CO Analyzer Manufacturer : Thermo Environmental
Model : 48C Serial No. : 65775350

Environmental

Temperature : 25.6 °C
Humidity : 42.3 %RH

Calibration System

Calibrator Units

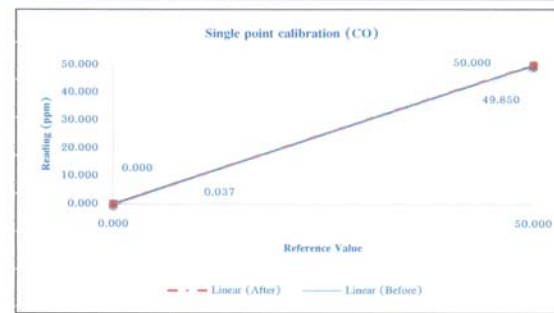
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514811458 Serial No. : 179

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	0.037	0.000	0.04	49.850	50.000	-0.30
After						
CO	0.000	0.000	0.00	50.000	50.000	0.00





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

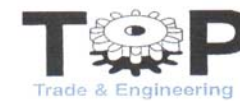
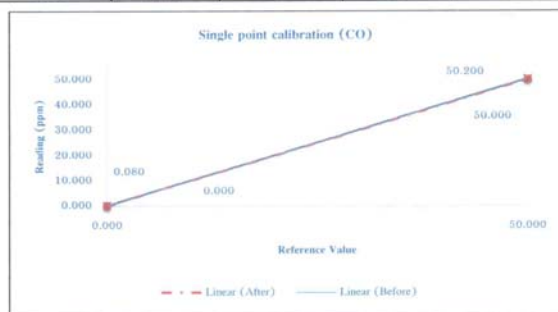
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514811458 Serial No. : 179

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



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. : 508011069

Environmental

Temperature : 26.2 °C
Humidity : 51.8 %RH

Calibration System

Calibrator Units

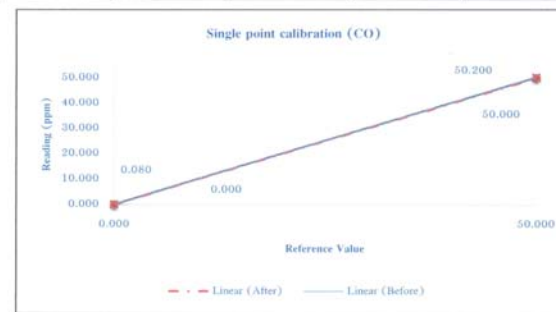
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514811458 Serial No. : 179

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





Certificate of Analyzer Performance Testing

Calibrated Date : 29-Jan-25 Certificate No. : 0125-013
Page : 1/1

Analyzer Instruments

Analyzer Type : CO Analyzer Manufacturer : Thermo Environmental
Model : 48i Serial No. : 1172750062

Environmental

Temperature : 25.2 °C
Humidity : 47.0 %RH

Calibration System

Calibrator Units

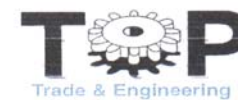
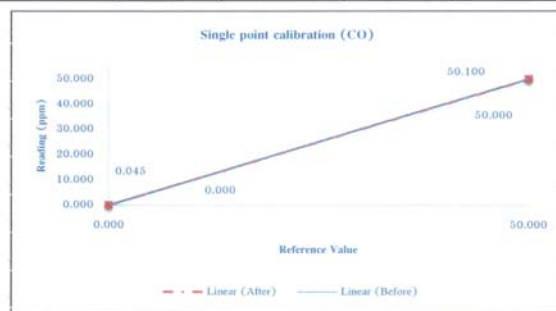
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514811458 Serial No. : 179

Standard Gas

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	0.045	0.000	0.05	50.1	50.0	0.20
After						
CO	0.000	0.000	0.00	50.0	50.0	0.00



Certificate of Analyzer Performance Testing

Calibrated Date : 13-Jan-25 Certificate No. : 0125-012
Page : 1/1

Analyzer Instruments

Analyzer Type : CO Analyzer Manufacturer : Thermo Environmental
Model : 48C Serial No. : 71021-367

Environmental

Temperature : 25.1 °C
Humidity : 46.2 %RH

Calibration System

Calibrator Units

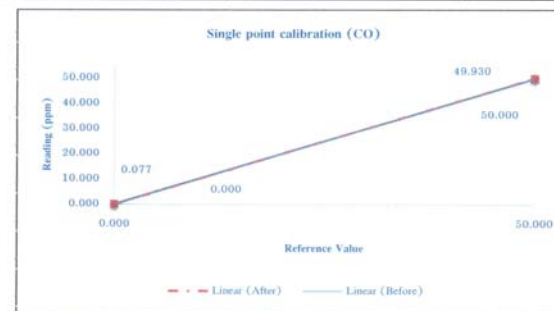
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514811458 Serial No. : 179

Standard Gas

NO Conc. : 2 ppm Cylinder No. : 307199
SO2 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	0.077	0.000	0.08	49.930	50.000	-0.14
After						
CO	0.000	0.000	0.00	50.000	50.000	0.00





PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 23 December 2024
Sampler: TE-6070 PM10 Serial No: 1313 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 28.20 Corrected Pressure (mm Hg): 716.3
Temperature (deg F): 76.1 Temperature (deg K): 297.5
Average Press. (in Hg): 27.30 Corrected Average (mm Hg): 693.4
Average Temp. (deg F): 75.3 Average Temp. (deg K): 297.1

Calibration Orifice

Make: Tisch Environmental, Inc. Qstd Slope: 1.58407
Model: TE-5028A Qstd Intercept: -0.01510
Serial#: 1179 Calibration Due Date: 22 Oct 25

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.70	1.210	60.2	38.80	Slope 34.7912
2	7.20	1.101	55.3	35.64	Intercept -3.1851
3	6.10	1.014	49.9	32.16	Corr. Coeff 0.9950
4	5.30	0.946	44.8	28.87	SFR 1.096
5	3.80	0.803	39.0	25.13	SSP 54.20
# of Observations:					5

Calculations

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

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

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): 49.8
Average Flow over Sample (m3/min)
1.029172473
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min)
1482.008362
Total flow over sample (CFM)
52329.71525



PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 23 December 2024
Sampler: TE-6070 PM10 Serial No: 1629 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 28.90 Corrected Pressure (mm Hg): 734.1
Temperature (deg F): 75.5 Temperature (deg K): 297.2
Average Press. (in Hg): 28.00 Corrected Average (mm Hg): 711.2
Average Temp. (deg F): 75.5 Average Temp. (deg K): 297.2

Calibration Orifice

Make: Tisch Environmental, Inc. Qstd Slope: 1.58407
Model: TE-5028A Qstd Intercept: -0.01510
Serial#: 1179 Calibration Due Date: 22 Oct 25

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	7.90	1.138	60.2	38.30	Slope 34.6406
2	6.50	1.034	55.3	35.19	Intercept -0.9094
3	5.10	0.917	49.4	31.43	Corr. Coeff 0.9947
4	4.30	0.842	43.0	27.36	SFR 1.095
5	3.10	0.717	38.0	24.18	SSP 58.18
# of Observations:					5

Calculations

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

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

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): 49.2
Average Flow over Sample (m3/min)
0.943968028
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min)
1359.31396
Total flow over sample (CFM)
47997.37592



PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 23 December 2024
Sampler: TE-6070 PM10 Serial No: 3260 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 27.10 Corrected Pressure (mm Hg): 688.3
Temperature (deg F): 75.6 Temperature (deg K): 297.2
Average Press. (in Hg): 26.30 Corrected Average (mm Hg): 668.0
Average Temp. (deg F): 75.4 Average Temp. (deg K): 297.1

Calibration Orifice

Make: Tisch Environmental, Inc. Qstd Slope: 1.58407
Model: TE-5028A Qstd Intercept: -0.01510
Serial#: 1179 Calibration Due Date: 22 Oct 25

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.30	1.205	60.3	39.62	Slope 33.8101
2	6.10	1.034	54.5	35.81	Intercept -0.3918
3	5.20	0.955	49.6	32.59	Corr. Coeff 0.9851
4	4.40	0.880	42.7	28.06	SFR 1.097
5	3.10	0.740	37.6	24.71	SSP 55.85
# of Observations:					5

Calculations

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

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

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)

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

Average I(chart): 48.9
Average Flow over Sample (m3/min)
0.976931015
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min)
1406.780661
Total flow over sample (CFM)
49673.42514

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



PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 23 December 2024
Sampler: TE-6070 PM10 Serial No: 1239 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 27.20 Corrected Pressure (mm Hg): 690.9
Temperature (deg F): 75.4 Temperature (deg K): 297.1
Average Press. (in Hg): 26.40 Corrected Average (mm Hg): 670.6
Average Temp. (deg F): 75.1 Average Temp. (deg K): 296.9

Calibration Orifice

Make: Tisch Environmental, Inc. Qstd Slope: 1.58407
Model: TE-5028A Qstd Intercept: -0.01510
Serial#: 1179 Calibration Due Date: 22 Oct 25

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.60	1.224	60.3	39.54	Slope 33.6911
2	6.80	1.089	55.3	36.26	Intercept -1.1094
3	5.40	0.972	49.7	32.59	Corr. Coeff 0.9886
4	4.80	0.917	43.8	28.72	SFR 1.097
5	3.60	0.795	39.1	25.64	SSP 54.69
# of Observations:					5

Calculations

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

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

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)

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

Average I(chart): 49.6
Average Flow over Sample (m3/min)
1.013400658
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min)
1459.296947
Total flow over sample (CFM)
51527.77521

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



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

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

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

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

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



PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 20 September 2024
Sampler: TE-6070 PM10 Serial No: 3183 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 27.03 Corrected Pressure (mm Hg): 686.6
Temperature (deg F): 75.4 Temperature (deg K): 297.1
Average Press. (in Hg): 26.73 Corrected Average (mm Hg): 678.9
Average Temp. (deg F): 75.9 Average Temp. (deg K): 297.4

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	1.287	60.0	39.47	Slope 30.7100
2	7.80	1.173	57.3	37.69	Intercept 0.7813
3	6.50	1.072	52.9	34.80	Corr. Coeff 0.9489
4	5.80	1.037	50.3	33.09	SFR 1.116
5	5.05	1.006	45.7	30.06	SSP 53.31
# of Observations:					5

Calculations

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

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

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

Average I(chart): 53.2
Average Flow over Sample (m3/min)
1.121929464
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min)
1615.578428
Total flow over sample (CFM)
57046.0743



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

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

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:

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

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



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

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

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:

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

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

T**P**
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: 3262 Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 27.90 Corrected Pressure (mm Hg): 708.7
Temperature (deg F): 75.4 Temperature (deg K): 297.3
Average Press. (in Hg): 26.00 Corrected Average (mm Hg): 660.4
Average Temp (Deg F): 74.6 Average Temp: (Deg K): 296.8

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	8.20	1.759	62.9	60.81	Slope: 41.1217
2	6.60	1.579	56.0	54.14	Intercept: -11.0896
3	5.00	1.375	47.8	46.21	Corr. Coeff: 0.9983
4	4.50	1.305	43.9	42.44	
5	3.90	1.216	39.7	38.38	

of Observations: 5

Calculations

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

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:
 $1/m((I)[\text{Sqrt}(298/\text{Tav})(\text{Pav}/760)] - b)$

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

Enter Average I (chart): 50.1
Average Flow Calculation m3/min
1.406730656
Average Flow Calculation in cfm
49.67269199
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min
2025.692144
Total flow in 24 hours cfm
71528.67647

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

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T**P**
Trade & Engineering
PM10 High Volume Sampler Verification

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 Corrected Pressure (mm Hg): 673.1
Temperature (deg F): 76.0 Temperature (deg K): 297.4
Average Press. (in Hg): 26.50 Corrected Average (mm Hg): 673.1
Average Temp. (deg F): 76.8 Average Temp. (deg K): 297.9

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	9.30	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

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

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

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)

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

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

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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

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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

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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: 3266	Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 28.00	Corrected Pressure (mm Hg): 711.2
Temperature (deg F): 76.0	Temperature (deg K): 297.6
Average Press. (in Hg): 28.20	Corrected Average (mm Hg): 716.3
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 12 December 2023

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.30	1.771	65.3	63.21	Slope: 39.0547
2	6.60	1.581	58.2	56.34	Intercept: -5.5552
3	4.80	1.349	49.9	48.30	Corr. Coeff: 0.9965
4	4.30	1.278	45.8	44.34	
5	3.80	1.202	41.8	40.46	
# 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:
 $1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)] - b)$

Enter Average I (chart):	52.2
Average Flow Calculation m3/min	1.441912875
Average Flow Calculation in cfm	50.91500199
Sample Time (Hrs):	24.0
Total flow in 24 hours m3/min	2076.354541
Total flow in 24 hours cfm	73317.60287

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

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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: 3265	Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 28.00	Corrected Pressure (mm Hg): 711.2
Temperature (deg F): 76.0	Temperature (deg K): 297.6
Average Press. (in Hg): 27.00	Corrected Average (mm Hg): 685.8
Average Temp (Deg F): 75.1	Average Temp: (Deg K): 297.1

Calibration Orifice

Make: Tisch	Qstd Slope: 1.58304
Model: TE-5028A	Qstd Intercept: -0.01520
Serial#: 1179	Calibration Due Date 12 December 2023

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	9.70	1.914	65.3	63.21	Slope: 41.3806
2	8.30	1.771	58.3	56.44	Intercept: -16.1807
3	6.40	1.557	50.7	49.08	Corr. Coeff: 0.9962
4	6.00	1.507	48.2	46.66	
5	5.40	1.431	43.6	42.21	
# 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:
 $1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)] - b)$

Enter Average I (chart):	44.0
Average Flow Calculation m3/min	1.402620302
Average Flow Calculation in cfm	49.52755238
Sample Time (Hrs):	24.0
Total flow in 24 hours m3/min	2019.773235
Total flow in 24 hours cfm	71319.67543

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

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TE-5000 TSP Sampler Verification

Site Information

Location: - Site ID: - Date: 10 Oct 24
 Sampler: TE-5000 TSP Serial No: 3277 Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 28.60 Corrected Pressure (mm Hg): 726.4
 Temperature (deg F): 75.4 Temperature (deg K): 297.3
 Average Press. (in Hg): 27.25 Corrected Average (mm Hg): 692.2
 Average Temp (Deg F): 75.1 Average Temp: (Deg K): 297.1

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	8.35	1.801	62.1	60.79	Slope: 36.7006
2	6.45	1.584	55.9	54.72	Intercept: -4.6078
3	5.30	1.437	50.3	49.24	Corr. Coeff: 0.9911
4	4.70	1.354	44.2	43.27	
5	4.30	1.112	37.2	36.41	# 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:
 $1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)] - b)$

Enter Average I (chart): 49.9
 Average Flow Calculation m3/min
 1.426108556
 Average Flow Calculation in cfm
 50.35693987
 Sample Time (Hrs): 24.0
 Total flow in 24 hours m3/min
 2053.59632
 Total flow in 24 hours cfm
 72513.99341

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

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TE-5000 TSP Sampler Verification

Site Information

Location: - Site ID: - Date: 21 Dec 24
 Sampler: TE-5000 TSP Serial No: 3267 Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 28.00 Corrected Pressure (mm Hg): 711.2
 Temperature (deg F): 76.0 Temperature (deg K): 297.6
 Average Press. (in Hg): 27.80 Corrected Average (mm Hg): 706.1
 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 12 December 2023

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	6.80	1.604	62.1	60.11	Slope: 37.2994
2	5.30	1.417	56.4	54.60	Intercept: 0.9694
3	3.90	1.217	48.2	46.66	Corr. Coeff: 0.9946
4	3.30	1.120	45.0	43.56	
5	2.90	1.051	40.3	39.01	# 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:
 $1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)] - b)$

Enter Average I (chart): 50.4
 Average Flow Calculation m3/min
 1.27856642
 Average Flow Calculation in cfm
 45.14711877
 Sample Time (Hrs): 24.0
 Total flow in 24 hours m3/min
 1841.135645
 Total flow in 24 hours cfm
 65011.85103

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

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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: 3279	Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 28.70	Corrected Pressure (mm Hg): 729.0
Temperature (deg F): 75.2	Temperature (deg K): 297.2
Average Press. (in Hg): 27.25	Corrected Average (mm Hg): 692.2
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	8.30	1.799	61.5	60.32	Slope: 34.9286
2	6.45	1.587	56.7	55.61	Intercept: -1.5157
3	5.30	1.440	50.7	49.73	Corr. Coeff: 0.9883
4	4.75	1.363	45.3	44.43	
5	4.20	1.112	38.1	37.37	
# 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):	50.5
Average Flow Calculation m3/min	1.424418332
Average Flow Calculation in cfm	50.29725684
Sample Time (Hrs):	24.0
Total flow in 24 hours m3/min	2051.162399
Total flow in 24 hours cfm	72428.04985

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: 3278	Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 28.70	Corrected Pressure (mm Hg): 729.0
Temperature (deg F): 75.3	Temperature (deg K): 297.2
Average Press. (in Hg): 27.20	Corrected Average (mm Hg): 690.9
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	8.35	1.804	61.8	60.61	Slope: 35.5972
2	6.40	1.581	56.2	55.11	Intercept: -2.8685
3	5.35	1.446	50.2	49.23	Corr. Coeff: 0.9887
4	4.75	1.363	44.6	43.74	
5	4.25	1.112	37.8	37.07	
# of Observations: 5					

Calculations

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

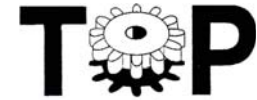
$$IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

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):	50.1
Average Flow Calculation m3/min	1.425179037
Average Flow Calculation in cfm	50.32411789
Sample Time (Hrs):	24.0
Total flow in 24 hours m3/min	2052.257814
Total flow in 24 hours cfm	72466.72976

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: 3280	Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 28.68	Corrected Pressure (mm Hg): 728.5
Temperature (deg F): 75.3	Temperature (deg K): 297.2
Average Press. (in Hg): 27.30	Corrected Average (mm Hg): 693.4
Average Temp (Deg F): 75.2	Average Temp (Deg K): 297.2

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	8.35	1.804	61.6	60.39	Slope: 34.2638
2	6.30	1.568	56.8	55.68	Intercept: -0.1420
3	5.35	1.446	51.2	50.19	Corr. Coeff: 0.9862
4	4.70	1.356	45.8	44.90	
5	4.25	1.112	38.5	37.74	# of Observations: 5

Calculations

$Qstd = 1/m[\text{Sqrt}(H_2O(Pa/Pstd)(Tstd/Ta)) - b]$
 $IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$

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):	50.8
Average Flow Calculation m3/min	1.42179501
Average Flow Calculation in cfm	50.20462541
Sample Time (Hrs):	24.0
Total flow in 24 hours m3/min	2047.384815
Total flow in 24 hours cfm	72294.66059

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

เอกสารการสอบเทียบเครื่องมือตรวจวัดความชื้นสะท้อน



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240325EA

Calibration Report

Equipment: Vibration Meter
Manufacturer: InstanTEL
Model: Micromate
Serial No.: UM20454
ID No.: VB-01-008
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 :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard Accelerometer	8305-001	30120	AV-0028-24	23-Jun-2025
2) Measuring Amplifier	2525	3016651	AV-0029-24	23-Jun-2025
3) PULSE Multi-analyzer system	3050-A-060	3050-110127	CQ20230024EA	5-Nov-2024
4) PULSE Multi-analyzer system	3160-4-042	3060-106135	CQ20230025EA	5-Nov-2024
5) 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)



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FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

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

Certificate No.: CP20240325EA

Operation No.: CP2024080270

Certificate of Calibration

Equipment: Vibration Meter
Manufacturer: InstanTEL
Model/Type: Micromate
Serial No.: UM20454
ID No.: VB-01-008
Customer: C.E.M. Technology (Thailand) Co.,Ltd.

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

Received Date: 2 August 2024

Calibrated Date: 28 - 29 August 2024

Issued Date: 2 September 2024

Calibrated by: Ms. Juntaporn Kunhakom

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Certificate No.: CP20240325EA

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	10.428	0.425	1.50	Transverse (T)
5.0	10.000	10.001	10.483	0.482	1.50	
6.3	10.000	10.020	10.885	0.865	1.50	
8.0	10.000	9.987	10.530	0.543	1.50	
10.0	10.000	9.997	10.609	0.612	1.50	
12.5	10.000	10.000	10.530	0.530	1.50	
16.0	10.000	10.001	10.372	0.371	1.50	
	20.000	19.997	20.769	0.772	1.50	
	30.000	29.995	31.133	1.138	1.50	
	50.000	49.992	51.721	1.729	1.50	
20.0	10.000	10.003	10.420	0.417	1.50	
25.0	10.000	10.013	10.380	0.367	1.50	
31.5	10.000	9.994	10.309	0.315	1.50	
40.0	10.000	10.003	10.254	0.251	1.50	
50.0	10.000	10.006	10.349	0.343	1.50	
52.0	10.000	9.996	10.412	0.416	1.50	
63.0	10.000	10.006	10.467	0.461	1.50	
80.0	10.000	9.987	10.459	0.472	1.50	

Certificate No.: CP20240325EA

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 ± (%)	Direction
4.0	10.000	10.006	10.546	0.540	1.50	Longitudinal (L)
5.0	10.000	9.998	10.585	0.587	1.50	
6.3	10.000	9.998	10.806	0.808	1.50	
8.0	10.000	10.008	10.499	0.491	1.50	
10.0	10.000	9.998	10.483	0.485	1.50	
12.5	10.000	10.020	10.467	0.447	1.50	
16.0	10.000	10.004	10.309	0.305	1.50	
	20.000	19.997	20.706	0.709	1.50	
	30.000	30.010	31.031	1.021	1.50	
	50.000	49.992	51.484	1.492	1.50	
20.0	10.000	10.003	10.428	0.425	1.50	
25.0	10.000	10.007	10.420	0.413	1.50	
31.5	10.000	10.013	10.380	0.367	1.50	
40.0	10.000	10.001	10.341	0.340	1.50	
50.0	10.000	10.013	10.428	0.415	1.50	
52.0	10.000	10.001	10.502	0.501	1.50	
63.0	10.000	9.991	10.546	0.555	1.50	
80.0	10.000	9.998	10.522	0.524	1.50	



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

Certificate No.: CP20240107EA
Operation No.: CP2024020076

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: 19 February 2024
Calibrated Date: 5 - 8 March 2024
Issued Date: 11 March 2024
Calibrated by: Ms. Juntaporn Kunhakom

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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.



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FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240325EA

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 $\pm$ (%)	Direction
4.0	10.000	10.008	9.742	-0.266	1.50	Vertical (V)
5.0	10.000	10.020	9.710	-0.310	1.50	
6.3	10.000	10.008	9.931	-0.077	1.50	
8.0	10.000	10.003	9.632	-0.371	1.50	
10.0	10.000	10.000	9.703	-0.297	1.50	
12.5	10.000	10.001	9.710	-0.291	1.50	
16.0	10.000	10.003	9.758	-0.245	1.50	
	20.000	19.997	19.705	-0.292	1.50	
	30.000	29.995	29.549	-0.446	1.50	
	50.000	49.978	49.127	-0.851	1.50	
20.0	10.000	10.008	9.860	-0.148	1.50	
25.0	10.000	9.997	9.513	-0.484	1.50	
31.5	10.000	9.995	9.915	-0.080	1.50	
40.0	10.000	9.993	10.041	0.048	1.50	
50.0	10.000	9.993	10.207	0.214	1.50	
52.0	10.000	9.984	10.246	0.262	1.50	
63.0	10.000	9.983	10.404	0.421	1.50	
80.0	10.000	10.025	10.720	0.695	1.50	

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

-- End of Report --

Certificate No.: CP20240107EA

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	10.003	9.947	-0.056	1.50	Longitudinal (L)
5.0	10.000	10.006	9.931	-0.075	1.50	
6.3	10.000	9.996	10.175	0.179	1.50	
8.0	10.000	10.004	9.971	-0.033	1.50	
10.0	10.000	10.017	9.986	-0.031	1.50	
12.5	10.000	10.008	9.994	-0.014	1.50	
16.0	10.000	10.021	10.041	0.020	1.50	
	20.000	19.997	20.075	0.078	1.50	
	30.000	29.995	29.990	-0.005	1.50	
	50.000	49.992	50.042	0.050	1.50	
20.0	10.000	10.000	10.104	0.104	1.50	
25.0	10.000	9.998	10.160	0.162	1.50	
31.5	10.000	10.007	10.175	0.168	1.50	
40.0	10.000	10.000	10.215	0.215	1.50	
50.0	10.000	10.003	10.396	0.393	1.50	
52.0	10.000	10.006	10.404	0.398	1.50	
63.0	10.000	10.011	10.640	0.629	1.50	
80.0	10.000	10.003	10.861	0.858	1.50	

Certificate No.: CP20240107EA

Calibration Report

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

Method of Calibration :-

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

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard Accelerometer	8305	2708237	AV-0001-23	20-Jul-2024
2) Measuring Amplifier	2525	2685967	AV-0044-23	20-Jul-2024
3) PULSE Multi-analyzer system	3050-A-060	3050-110127	CQ20230024EA	5-Nov-2024
4) PULSE Multi-analyzer system	3160-4-042	3060-106135	CQ20230025EA	5-Nov-2024
5) Humidity and Temperature Transmitter	HMT331	K3810009	CD20230166EA	14-Jun-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 :-
 - National Institute of Metrology (Thailand)

Certificate No.: CP20240107EA

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	9.997	9.482	-0.515	1.50	Vertical (V)
5.0	10.000	9.996	9.576	-0.420	1.50	
6.3	10.000	10.013	9.821	-0.192	1.50	
8.0	10.000	10.000	9.734	-0.266	1.50	
10.0	10.000	9.997	9.789	-0.208	1.50	
12.5	10.000	10.014	9.978	-0.036	1.50	
16.0	10.000	9.997	10.081	0.084	1.50	
	20.000	19.997	20.177	0.180	1.50	
	30.000	29.995	30.219	0.224	1.50	
	50.000	49.978	50.586	0.608	1.50	
20.0	10.000	10.001	10.207	0.206	1.50	
25.0	10.000	10.003	10.065	0.062	1.50	
31.5	10.000	10.001	10.302	0.301	1.50	
40.0	10.000	9.997	10.467	0.470	1.50	
50.0	10.000	10.001	10.664	0.663	1.50	
52.0	10.000	9.996	10.830	0.834	1.50	
63.0	10.000	10.004	10.869	0.865	1.50	
80.0	10.000	9.997	11.515	1.518	1.50	

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

-- End of Report --

Certificate No.: CP20240107EA

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	9.766	-0.240	1.50	Transverse (T)
5.0	10.000	10.006	9.805	-0.201	1.50	
6.3	10.000	10.008	10.002	-0.006	1.50	
8.0	10.000	10.015	9.844	-0.171	1.50	
10.0	10.000	10.017	9.923	-0.094	1.50	
12.5	10.000	10.014	9.860	-0.154	1.50	
16.0	10.000	10.015	9.907	-0.108	1.50	
	20.000	19.997	19.933	-0.064	1.50	
	30.000	30.010	29.880	-0.130	1.50	
	50.000	49.992	49.837	-0.155	1.50	
20.0	10.000	9.998	9.971	-0.027	1.50	
25.0	10.000	10.011	10.049	0.038	1.50	
31.5	10.000	10.017	10.104	0.087	1.50	
40.0	10.000	10.018	10.215	0.197	1.50	
50.0	10.000	9.991	10.231	0.240	1.50	
52.0	10.000	10.023	10.317	0.294	1.50	
63.0	10.000	10.006	10.538	0.532	1.50	
80.0	10.000	10.013	10.822	0.809	1.50	



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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 :-

Instrument	Model	Serial No.	Cert. No.	Due Date
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



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FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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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

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Certificate No.: CP20240388EA

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	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

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 ± (%)	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	



ELECTRICAL AND ELECTRONICS INSTITUTE
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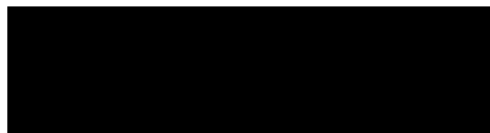
Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

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



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Certificate No.: CP20240388EA

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 $\pm$ (%)	Direction
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

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 ± (%)	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	



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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 :-

Instrument	Model	Serial No.	Cert. No.	Due Date
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



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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 --



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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	



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20250114EA

Calibration Report

Equipment: Vibration Meter
Manufacturer: InstanTel
Model: Micromate
Serial No.: UM16048
ID No.: VB-01-003
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 :-

Instrument	Model	Serial No.	Cert. No.	Due Date
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



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Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

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

Certificate No.: CP20250114EA

Operation No.: CP2025030100

Certificate of Calibration

Equipment: Vibration Meter

Manufacturer: InstanTel

Model/Type: Micromate

Serial No.: UM16048

ID No.: VB-01-003

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

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

Received Date: 18 March 2025

Calibrated Date: 9 - 10 April 2025

Issued Date: 11 April 2025

Calibrated by: Ms. Juntaporn Kunhakom

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FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20250114EA

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	9.997	10.104	0.107	1.50	Transverse (T)
5.0	10.000	9.996	10.089	0.093	1.50	
6.3	10.000	10.013	10.302	0.289	1.50	
8.0	10.000	9.998	10.081	0.083	1.60	
10.0	10.000	9.998	10.089	0.091	1.60	
12.5	10.000	10.003	10.081	0.078	1.60	
16.0	10.000	9.996	10.059	0.063	1.60	
	20.000	19.983	20.041	0.058	1.60	
	30.000	29.995	29.939	-0.056	1.60	
	50.000	49.992	49.868	-0.124	1.50	
20.0	10.000	9.998	10.097	0.099	1.50	
25.0	10.000	10.006	10.112	0.106	1.50	
31.5	10.000	9.998	10.128	0.130	1.50	
40.0	10.000	10.003	10.207	0.204	1.50	
52.0	10.000	10.006	10.278	0.272	1.50	
63.0	10.000	10.001	10.467	0.466	1.50	
80.0	10.000	9.998	10.648	0.650	1.50	



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20250114EA

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 ± (%)	Direction
4.0	10.000	10.001	9.860	-0.141	1.50	Longitudinal (L)
5.0	10.000	9.998	9.886	-0.112	1.50	
6.3	10.000	9.994	10.059	0.065	1.60	
8.0	10.000	10.006	9.915	-0.091	1.50	
10.0	10.000	10.008	9.923	-0.085	1.50	
12.5	10.000	10.006	9.900	-0.106	1.50	
16.0	10.000	10.001	9.923	-0.078	1.50	
	20.000	19.997	19.878	-0.119	1.50	
	30.000	29.970	29.754	-0.216	1.50	
	50.000	49.992	49.567	-0.426	1.50	
20.0	10.000	10.010	9.956	-0.054	1.60	
25.0	10.000	9.996	10.046	0.050	1.60	
31.5	10.000	9.998	10.049	0.051	1.60	
40.0	10.000	10.006	10.089	0.083	1.50	
52.0	10.000	10.008	10.128	0.120	1.50	
63.0	10.000	9.991	10.262	0.271	1.50	
80.0	10.000	9.994	10.428	0.434	1.50	



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Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

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

Certificate No.: CP20250269EA
Operation No.: CP2025060184

Certificate of Calibration

Equipment: Vibration Meter
Manufacturer: Instantel
Model/Type: Micromate
Serial No.: UM20453 (Meter), UM6231 (Micromate Geophone)
ID No.: VB-01-007
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13, T.Rai Khing, A.Sam Phran,
Nakhon Pathom 73210
Received Date: 24 June 2025
Calibrated Date: 25 - 30 September 2025
Issued Date: 1 October 2025
Calibrated by: Ms. Juntaporn Kunhakom

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Certificate No.: CP20250114EA

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 $\pm$ (%)	Direction
4.0	10.000	10.006	10.104	0.098	1.50	Vertical (V)
5.0	10.000	9.990	10.057	0.067	1.60	
6.3	10.000	9.998	10.262	0.264	1.50	
8.0	10.000	10.010	10.112	0.102	1.50	
10.0	10.000	9.998	10.144	0.146	1.50	
12.5	10.000	10.000	10.168	0.168	1.50	
16.0	10.000	9.994	10.191	0.197	1.50	
	20.000	19.997	20.288	0.291	1.50	
	30.000	29.995	30.290	0.295	1.50	
	50.000	49.992	50.459	0.467	1.50	
20.0	10.000	10.003	10.278	0.275	1.50	
25.0	10.000	10.001	10.570	0.569	1.50	
31.5	10.000	9.994	10.144	0.150	1.50	
40.0	10.000	10.006	10.286	0.280	1.50	
52.0	10.000	9.994	10.491	0.497	1.50	
63.0	10.000	10.013	10.585	0.572	1.50	
80.0	10.000	10.006	10.790	0.784	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

Certificate No.: CP20250269EA

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 ± (%)	Direction
4.0	10.000	10.001	11.145	1.144	1.5	Longitudinal (L)
5.0	10.000	10.007	11.038	1.031	1.5	
6.3	10.000	10.000	11.179	1.179	1.5	
8.0	10.000	9.997	10.801	0.804	1.5	
10.0	10.000	10.001	10.779	0.778	1.5	
12.5	10.000	10.003	10.785	0.782	1.5	
16.0	10.000	10.001	10.493	0.492	1.5	
	20.000	19.997	21.134	1.137	1.5	
	30.000	29.970	31.747	1.777	1.5	
	50.000	49.992	52.787	2.795	1.5	
20.0	10.000	10.003	10.696	0.693	1.5	
25.0	10.000	10.006	10.719	0.713	1.5	
31.5	10.000	10.003	10.625	0.622	1.5	
40.0	10.000	10.006	10.609	0.603	1.5	
52.0	10.000	9.994	10.814	0.820	1.5	
63.0	10.000	9.987	10.893	0.906	1.5	
80.0	10.000	9.987	11.169	1.182	1.5	



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20250269EA

Calibration Report

Equipment: Vibration Meter
Manufacturer: Instantel
Model: Micromate
Serial No.: UM20453 (Meter), UM6231 (Micromate Geophone)
ID No.: VB-01-007
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 :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard Accelerometer	8305-001	30120	AV-0028-25	3-Jul-2026
2) Measuring Amplifier	2525	3016651	AV-0025AA-25	15-Aug-2026
3) LAN XI Analyzer	3160-4-042	3060-106135	CQ20240016EA	1-Dec-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



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20250269EA

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	10.097	0.091	1.5	Vertical (V)
5.0	10.000	9.997	10.112	0.115	1.5	
6.3	10.000	10.006	10.349	0.343	1.5	
8.0	10.000	10.006	10.097	0.091	1.5	
10.0	10.000	9.998	10.199	0.201	1.5	
12.5	10.000	10.000	10.238	0.238	1.5	
16.0	10.000	9.994	10.136	0.142	1.5	
	20.000	19.997	20.256	0.259	1.5	
	30.000	29.995	30.392	0.397	1.5	
	50.000	49.992	50.770	0.778	1.5	
20.0	10.000	10.003	10.349	0.346	1.5	
25.0	10.000	10.001	10.320	0.319	1.5	
31.5	10.000	10.013	10.451	0.438	1.5	
40.0	10.000	10.006	10.380	0.374	1.5	
52.0	10.000	10.021	10.706	0.685	1.5	
63.0	10.000	10.013	10.893	0.880	1.5	
80.0	10.000	10.006	11.239	1.233	1.5	

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

-- End of Report --



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20250269EA

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	10.015	11.237	1.222	1.5	Transverse (T)
5.0	10.000	10.004	11.329	1.325	1.5	
6.3	10.000	10.007	11.426	1.419	1.5	
8.0	10.000	10.003	11.066	1.063	1.5	
10.0	10.000	10.013	11.084	1.071	1.5	
12.5	10.000	10.010	10.995	0.985	1.5	
16.0	10.000	10.001	10.475	0.474	1.5	
	20.000	19.997	20.910	0.913	1.5	
	30.000	30.010	31.299	1.289	1.5	
	50.000	49.992	51.941	1.949	1.5	
20.0	10.000	10.006	10.577	0.571	1.5	
25.0	10.000	10.004	10.538	0.534	1.5	
31.5	10.000	10.006	10.388	0.382	1.5	
40.0	10.000	9.998	10.365	0.367	1.5	
52.0	10.000	9.998	10.617	0.619	1.5	
63.0	10.000	10.011	10.577	0.566	1.5	
80.0	10.000	10.013	10.867	0.854	1.5	

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพน้ำ



Certificate of Calibration

Certificate No. : 68-430004-1

Page : 1 of 2

Submitted by :

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

Equipment :

Digital Conductivity meter (Pocket)

Manufacturer : XS Instruments Model : PC 5

Serial No. : GB 0706/024 ID No. : WW-23-001

Environment :

On site calibration was carried out at the Laboratory.

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

Ambient Temperature (26.0 to 27.0) °C

Relative Humidity (45 to 50) %

Date of Received :

11 February 2025

Date of Calibration :

11 February 2025

Date of Issue :

17 February 2025

Calibrated by :

Pernpon Chanpu

Calibration Method :

In-house method CAL-M4301 direct measurement by conductivity buffer solution

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

Standard Buffer Solution

Material	Lot No.	Exp.Date	Traceability
84 µS/cm	0300	01 June 2027	National Institute of Standards and Technology (NIST), U.S.A., S.R.M.
1413 µS/cm	970986	25 April 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
12.88 mS/cm	970987	25 April 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 68-430004-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Conductivity measurement

Before Adjustment

Standard Conductivity Solution	UUC Reading	Correction	Uncertainty (±)	Unit
84*	79.7	4.3	1.1	µS/cm
1413	1602	-189	9.0	µS/cm
12.88	12.81	0.07	0.082	mS/cm

After Adjustment : at 84, 1413 µS/cm 12.880 mS/cm

Standard Conductivity Solution	UUC Reading	Correction	Uncertainty (±)	Unit
84*	84.0	0.0	1.1	µS/cm
1413	1413	0	9.0	µS/cm
12.88	12.88	0.00	0.082	mS/cm

Remark

UUC : Unit Under Calibration

* This parameter are out of accreditation's scope.

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

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



Certificate of Calibration

Page : 1 of 2

Certificate No. : 68-400172-1

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

219/43 Moo.12 Petchkasem Rd. Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

Equipment : Temperature controlled enclosure (Refrigerator)

Manufacturer : Samchai

Range : N/A °C

Serial No. : 85545

Model : LD2 DC 70

Resolution : 1 °C

ID No. : N/A

Environment : On site calibration was carried out at the Laboratory.

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

Ambient Temperature : (27.0 to 28.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (223.0 to 225.0) V

Date of Received : 21 March 2025

Date of Calibration : 21 March 2025

Date of Issue : 22 March 2025

Calibrated by : Permpoon Champu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with RTD Probe

ID No. Cert. No. Due Date Traceability

400046 & 400047 68-400007-2 29 Jul 2025 National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Page : 2 of 2

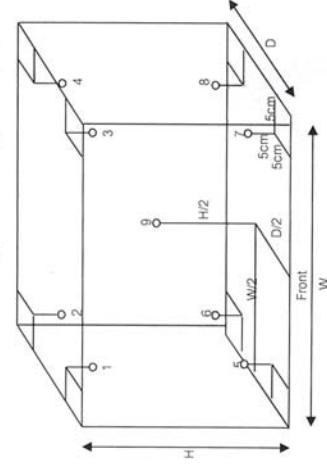
Certificate No. : 68-400172-1

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 1.13 m

D = 0.51 m

H = 1.34 m

Capacity = 0.77 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
4	4	4	5.13	4.85	3.25	3.11	4.43	4.77	2.75	2.77	4.01	0.73

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)		Measured Stability (°C)		Overall Variation (°C)
			1,2,3,4	5,6,7,8,9	1,2,3,4	5,6,7,8,9	
4	4	4	1.29	0.08	0.08	0.08	2.55

Remark The uncertainty is not combine uniformity of the air chamber

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

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

-o0o-



Certificate of Calibration

Certificate No. : 68-400089-2

Page : 1 of 2

Submitted by :

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

219/43 Moo.12 Petchkasem Rd. Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

Equipment :

Temperature Indicator with Thermistor Probe

Temperature Indicator

Manufacturer : XS Instruments Model : PC 5

Range : N/A °C Resolution : 0.1 °C

Serial No. : GB 0706/024 ID No. : WW-23-001

Thermistor probe

Model : N/A

Sheath Material : Plastic

Diameter : 10 mm. Length : 65 mm.

Serial No. : GB 0706/024 ID No. : WW-23-001

Environment :

On site calibration was carried out at the Laboratory,

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

Ambient Temperature : (26.0 to 27.0) °C

Relative Humidity : (45 to 50) %

Line Voltage : (224.5 to 226.0) VAC

Date of Received :

11 February 2025

Date of Calibration :

11 February 2025

Date of Issue :

17 February 2025

Calibrated by :

Permpoon Chanpu

Calibration Method :

This instrument was calibrated by In-house method comparison technique CAL-M4003

by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

This certification is traceable to the International System of Units

Reference Standard Instruments :

1. Platinum Resistance Thermometer (PRT)

ID No. Cert. No. Due Date Traceability

400002 TT-0095-24 01 Jul 2026 National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No. Cert. No. Due Date Traceability

400033 24E633 21 Feb 2026 National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 68-400089-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
65	15.002	15.1	-0.1	0.19
65	30.005	30.0	0.0	0.19
65	45.004	44.9	0.1	0.19

Remark

UUC : Unit Under Calibration

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

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

- 0.0 -



การดูแลบำรุงรักษาเชิงป้องกัน Preventive Maintenance



บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

ฝ่ายบริการหลังการขาย

โทร 0 2 639 7000 E-mail: service.tec.th@dksh.com

ฝ่ายขายและการตลาด

โทร 0 2 639 7000 E-Mail : marketing.tec.th@dksh.com

Website : www.dksh.co.th/technology/scientific-thailand

เงื่อนไขการให้บริการ Preventive Maintenance

บริษัทฯ จะส่งวิศวกรผู้ชำนาญ เพื่อให้บริการตรวจซ่อมบำรุงของอุปกรณ์บริการ เฉพาะ ในวันและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากวัน เวลา ราชการ (วันหยุดเสาร์ – อาทิตย์ หรือวันหยุด นักชดถุณ) บริษัทฯ จะคิดค่าบริการเพิ่มเติมตามอัตราที่กฎหมายแรงงานกำหนดไว้

ขอบข่ายบริการ

- ตรวจทดสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายการผลการตรวจสอบเครื่องมือ

หมายเหตุ

- ราคาไม่รวมถึงค่าบริการซ่อมหรือ เปลี่ยนอะไหล่ที่ชำรุดเสียหาย หรือหมดสภาพการใช้งาน
- ในกรณีที่ผู้รับบริการอยู่นอกเขตที่ให้บริการ บริษัทฯ จำเป็นต้องคิดค่าใช้จ่ายเพิ่มเติม ได้แก่ ค่าเดินทาง เป็นต้น
- บริษัทฯ ขอสงวนสิทธิ์ในการเปลี่ยนแปลงราคา โดยไม่แจ้งให้ทราบล่วงหน้า



ช่องทางการติดต่อ

DKSH Technology Limited (บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด)
เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260
เลขประจำตัวผู้เสียภาษี 010-555-001-4547 (สำนักงานใหญ่)



Call center 0 2 639 7000



DKSH Scientific



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@dkshscientific

Preventive Maintenance Contract

จำนวนในการทำสัญญาบริการ ครั้งต่อปี
ครั้งที่ 1. วันที่ 14/05/2025.....

รายละเอียดผู้รับบริการ

หน่วยงาน	บริษัท จี.อี.เอ็ม เทคโนโลยี (ไทยแลนด์) จำกัด		
ที่อยู่	219/43 หมู่ 12 ถนนพหลโยธิน ตำบลอ้อมน้อย อำเภอกระทุ่มแบน จังหวัดสมุทรสาคร 74130		
โทรศัพท์	0869054664	แฟกซ์	-

ผู้ติดต่อ

ชื่อ - นามสกุล	คุณศิริพร พินพา		
ตำแหน่ง	เจ้าหน้าที่ห้องปฏิบัติการ		
โทรศัพท์	0869054664	เบอร์โทร	-
E-mail	lab.cemtech1@gmail.com		

รายละเอียดผู้ให้บริการ

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด (ฝ่ายบริการหลังการขาย) (สำนักงานใหญ่) เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260 โทรศัพท์ 0 2 693 7000 Email: Jirayut.js@dksh.com			
เจ้าหน้าที่ประสานงาน : คุณจิรายุช สดอาด			
เจ้าหน้าที่ผู้ให้บริการ	นายจิรายุช สดอาด		
ตำแหน่ง	Specialist, Technical Service.		
โทรศัพท์	0938138736	แฟกซ์	-
E-mail	Jirayut.js@dksh.com		

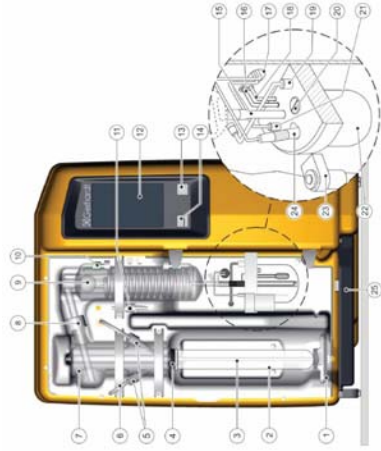
ลงนามผู้รับบริการ	ลงนามผู้ให้บริการ	Jirayut Saky-Aud
ตัวจริง	ตัวจริง	(นายจิรายุช สดอาด)
ตำแหน่ง	ตำแหน่ง	Specialist, Technical Service.
วันที่ / ประทับตราบริษัท	วันที่ / ประทับตราบริษัท	14/05/2025

JOB:W.Q-00070598.....MODEL:VAP.200.....S/N: CER5200180181

Operational Qualification (OQ)

๑๕๖๑๘๐๒๑๗๑๕๑๔

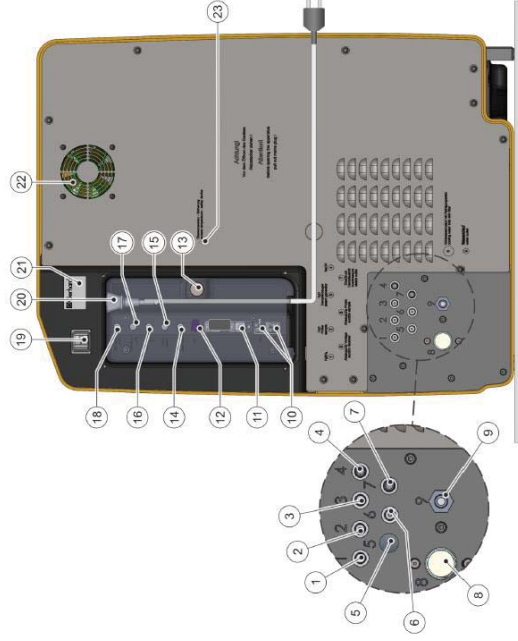
FRONT



No		PASS	FAIL	N/A
1	Quick clamping device with clamping block	☒	☐	☐
2	Digestion tube 250/300 ml	☒	☐	☐
3	PTFE steam inlet tubing	☒	☐	☐
4	Connection stopper , Viton	☒	☐	☐
5	Screw cap GL18	☒	☐	☐
6	PTFE-inlet tubing NaOH	☒	☐	☐
7	Distribution head made of glass	☒	☐	☐
8	Screw cap GL32	☒	☐	☐
9	Distillation condenser made of glass	☒	☐	☐
10	Screw cap GL14	☒	☐	☐
11	Ventilation valve	☒	☐	☐
12	Control panel	☒	☐	☐
13	Operating Button	☒	☐	☐
14	USB interface (with protective cap)	☒	☐	☐
15	Silicone tubing 8/10 for distillate discharge **	☒	☐	☒
16	Verprene tubing 4/8 , receiver suction **	☐	☐	☒
17	Cable duct for electrode cable + titration tube**	☐	☐	☒
18	Silicone tubing 4/7 , boric acid inlet**	☐	☐	☒
19	Sensor for level monitoring including connector**	☐	☐	☒
20	Agitator motor with propeller**	☐	☐	☒
21	Titration acid inlet tube **	☐	☐	☒
22	Receiver glass**	☐	☐	☒
23	Holder for pH electrode , removable**	☐	☐	☒
24	pH electrode (combined electrode)**	☐	☐	☒
25	Drip tray PP	☒	☐	☐

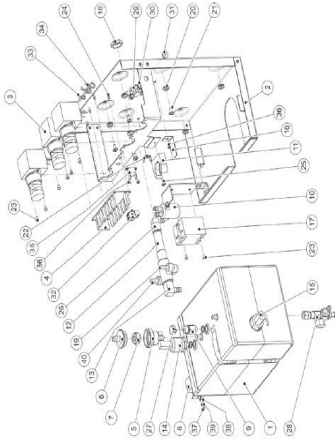
** only VAP 450

REAR



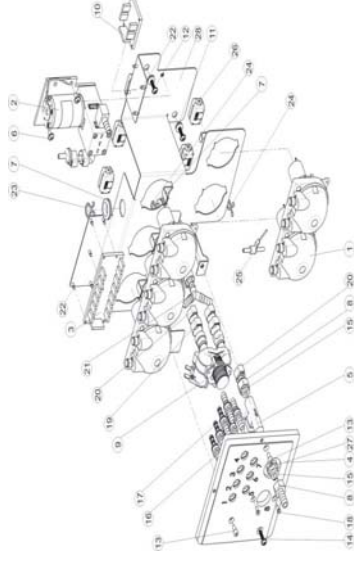
No		PASS	FAIL	N/A
1	Tube connection for sample H3BO3 supply	☐	☐	☒
2	Tube connection for sample H2O supply	☐	☐	☒
3	Tube connection for steam generator H2O supply	☒	☐	☐
4	Tube connection for NaOH supply	☒	☐	☐
5	Tube connection for receiver glass extraction	☒	☐	☐
6	Tube connection for sample waste extraction	☒	☐	☐
7	Tube connection , overpressure steam outlet	☒	☐	☐
8	Connection for cooling water supply (with cleaning sieve)	☒	☐	☐
9	Tube connection for cooling water outlet	☒	☐	☐
10	4 X USB interface	☒	☐	☐
11	1 X RS-232 Interface	☒	☐	☐
12	LAN Interface	☒	☐	☐
13	Screw cap for Perspex cover	☒	☐	☐
14	Connection socket for sample waste tank level monitoring	☒	☐	☐
15	Connection (not used)	☐	☐	☒
16	Connection socket for H2O tank level monitoring	☒	☐	☐
17	Connection socket for H3BO3 tank level monitoring	☒	☐	☐
18	Connection socket for NaOH tank level monitoring	☒	☐	☐
19	Overcurrent circuit breaker	☒	☐	☐
20	Apparatus socket (mains cable connection)	☒	☐	☐
21	Rating plate with serial number	☒	☐	☐
22	Exhaust air fan	☒	☐	☐
23	Excess temperature switch	☒	☐	☐

Inside Steam generator



No		PASS	FAIL	N/A
1	Steam generator	☒	☐	☐
2	Steam generator traverse	☒	☐	☐
3	Pinch valve	☒	☐	☐
4	Circuit board distributor	☒	☐	☐
5	Valve tubing connection	☒	☐	☐
6	Housing safety valve	☒	☐	☐
7	Safety valve SKT	☒	☐	☐
8	Excess temperature protection , steam generator	☒	☐	☐
9	Safety valve G 1/8 0,5 bar	☒	☐	☐
10	Ventilation glass pinch valve VAPODEST	☒	☐	☐
11	Hose clamp for ventilation clamp	☒	☐	☐
12	Distributor PP	☒	☐	☐
13	Angle connection PP	☒	☐	☐
14	Pressure transmitter	☒	☐	☐
15	Level switch	☒	☐	☐
16	Fixing bracket steam generator	☒	☐	☐
17	Relay HT+	☒	☐	☐
18	VA Hexagon nut 1/2"	☒	☐	☐
19	Angle connection 1/8"	☒	☐	☐
20	Bushing nipple 6-10-14	☒	☐	☐
21	VA Lens head screw M5 X 10	☒	☐	☐
22	Grounding connection , 2-pole	☒	☐	☐
23	VA Lens head screw M4 X 6	☒	☐	☐
24	Spacer bolt 5 mm	☒	☐	☐
25	VA Lens head screw M4 X 10	☒	☐	☐
26	Tubing connection	☒	☐	☐
27	Hose clamp 14.5 mm	☒	☐	☐
28	Module ball valve with nozzles	☒	☐	☐
29	Cross manifold with spout	☒	☐	☐
30	Seal copper G 1/8	☒	☐	☐
31	Locking screw 1/8"	☒	☐	☐
32	Pin strip	☒	☐	☐
33	Bundle clamp 12 H 4500	☒	☐	☐
34	Bundle clamp 12 H 4502	☒	☐	☐
35	Temperature switch 80°C	☒	☐	☐
36	VA Lens head screw M3 X 6	☒	☐	☐
37	VA Hexagon nut M4	☒	☐	☐
38	Lins head screw M4 X 8	☒	☐	☐
39	VA Spring washer	☒	☐	☐
40	Angle connection , reduced , 1/8" PP	☒	☐	☐

Module Pump holder VAP200 - 450 V3



No		PASS	FAIL	N/A
1	Peristaltic pump	☒	☐	☐
2	Diaphragm pump NaOH, with non-return valve	☒	☐	☐
3	Circuit board	☒	☐	☐
4	Tubing connection module	☒	☐	☐
5	Flow controller	☒	☐	☐
6	Lens head screw M5 x 10	☒	☐	☐
7	Bushing nozzle	☒	☐	☐
8	Screw in socket	☒	☐	☐
9	Magnetic valve 2/2 way	☒	☐	☐
10	Circuit board distributor	☒	☐	☐
11	Bushing nozzle	☒	☐	☐
12	Screw 5 x 25	☒	☐	☐
13	Cylinder screw	☒	☐	☐
14	Screw 5 x 20	☒	☐	☐
15	Seal EPDM 15 x 4	☒	☐	☐
16	Tubing connection piece 51x10x6,5	☒	☐	☐
17	Tubing connection piece 51x10x10	☒	☐	☐
18	Screw M4x10	☒	☐	☐
19	Clamp	☒	☐	☐
20	Clamp	☒	☐	☐
21	Y-tube connector	☒	☐	☐
22	Spacer bolt 5 mm	☒	☐	☐
23	Bundle clamp	☒	☐	☐
24	Bundle clamp	☒	☐	☐
25	Retrofit earthing pumpv	☒	☐	☐
26	Snap ferrite	☒	☐	☐
27	Nut G 3/8"	☒	☐	☐
28	Pump holder plate	☒	☐	☐

Control panel



No		PASS	FAIL
1	Title bar	☒	☐
2	Status bar	☒	☐
3	Navigation button	☒	☐
4	Smart switch with multiple functions	☒	☐
5	USB interface	☒	☐

รายละเอียดการตรวจสอบ

ขั้นตอนการบริการ

- ตรวจสอบระบบไฟฟ้า (Electrical Test)
- ความต้านทานทางไฟฟ้าของเครื่องกับกราวด์
 - กระแสไฟฟ้าที่ใช้งาน

ตรวจสอบสภาพเครื่อง (Optical Test)

- Main cable
- Electric wiring
- Pumps
- Distribution Head
- Condensor
- Steam generator
- Tubing
- Viton cone

ตรวจสอบ Function การทำงาน (The Function Test)

- ระบบสร้างและควบคุมความดันของ Steam
- ระบบการเติมน้ำเข้าสู่ Sample Tube
- ระบบการเติม Na OH
- ระบบการเติม H3BO3

ข้อมูลสนับสนุนด้านเทคนิค (General Technical Support)

การบำรุงรักษาทั่วไป (Basic maintenance)

Cleaning program

Glass parts and tubes must be cleaned daily before starting analysis in order to prevent clogging by crystallising chemicals.
The following settings are recommended for this:

parameters	Value
H ₂ O addition	150 ml
NaOH addition	0 ml
Distillation time	7 min
Steam power	100 %
Reaction time	0 s
Suction sample	30 s

→ Insert a digestion tube (without sample) and start the program.
→ All liquid carrying parts are cleaned. In the case of strong soiling, approx. 10 ml of sulphuric acid can also be added to the digestion tube.

General error message

Fault description	Cause	Remedy
Flowing water pressure lower than 1 bar	Cooling water pressure lower than 1 bar	Open water tap. Check water pressure. Check coolant tube. Program continues automatically once error has been fixed.
'Sample tube missing'	Sample tube missing	Insert sample tube. Continue program or restart.
'Reaction room protective door open'	Protection door not closed	Close protection door. Program continues automatically once error has been fixed.
'Reagent storage/ waste'	One or more storage tanks are empty The sample waste tank is full.	Fill storage tank. Check correct sealing of the universal sensors. The running program can be continued after rectification of the error. Empty sample waste tank. Check correct sealing of the universal sensors. The running program can be continued after rectification of the error.

Analytical errors

Fault description	Cause	Remedy
Analyte results too high	The chemicals used are contaminated with nitrogen compounds.	Detailed checking of the chemicals. Determination of a blank value. Replace the chemicals if necessary.
	Valent reaction in the digestion tube: sodium hydroxide drops get into the receiver.	Increase of the water addition amount.
	Glass bridges of the condenser is broken or worn out, sodium hydroxide drops get into the receiver.	Replacement of the glass condenser.
	Glass cleaning agents in the digestion tube.	Clean digestion tube in advance with distilled water.
	Entrainment of ammonia from the previous sample.	Increase distillation time. Check whether sample was previously sufficiently alkalinised.
	Incomplete distillation; distillation time too short.	No quantitative explosion of the ammonia content. The distillation amount should be 100 ml.
Analyte result too low or no result	Ammonia escapes at leaking places.	Solled or defective Viton plugs; clean or replace. Check seals (O.L. screw connections) on the condenser and receiver. Check valve at the condenser is gummed up; clean or replace. Digestion tube is damaged at the neck; replace.
	Adding amount of the sodium hydroxide too little; no ammonia development.	Distribution head glass leaks; replace. Check the constant flow rate of the NaOH pump (see technical data).
	Too low boric acid amount in the receiver; escaping ammonia is not completely bonded.	Increase of the boric acid amount.
	Tube not completely immersed in the acid receiver.	Increase of the acid amount.
	Formation of stable ammonia compounds with sodium hydroxide destroyed with sodium hydroxide.	This problem only occurs with catalysts containing phosphorus. Sodium hydroxide destroys these compounds.

การดูแลบำรุงรักษาเชิงป้องกัน Preventive Maintenance



บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

ฝ่ายบริการหลังการขาย

โทร 0 2 639 7000 E-mail: service.tcc.th@dksh.com

ฝ่ายขายและการตลาด

โทร 0 2 639 7000 E-Mail : marketing.tcc.th@dksh.com

Website : www.dksh.co.th/technology/scientific-thailand



เงื่อนไขการให้บริการ Preventive Maintenance

บริษัทฯ จะส่งวิศวกรผู้ชำนาญ เพื่อให้บริการตามขอบข่ายของบริการ เฉพาะ ในวันและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากรัน เวลา ราชการ (วันหยุดเสาร์ – อธิปไตย หรือวันหยุด นักศึกษา) บริษัทฯ จะคิดค่าบริการเพิ่มเติมตามอัตราที่กฎหมายแรงงานกำหนดไว้

ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายการผลการตรวจสอบเครื่องมือ

หมายเหตุ

- ราคานี้ ไม่รวมถึงค่าบริการซ่อม หรือ เปลี่ยนอะไหล่ที่ชำรุดเสียหาย หรือหมดสภาพการใช้งาน
- ในกรณีที่ผู้รับบริการอยู่นอกเขตพื้นที่ให้บริการ บริษัทฯ จำเป็นต้องคิดค่าใช้จ่ายเพิ่มเติม ได้แก่ ค่าเดินทาง เป็นต้น
- บริษัทฯ ขอสงวนสิทธิ์ในการเปลี่ยนแปลงราคา โดยไม่แจ้งให้ทราบล่วงหน้า



ช่องทางการติดต่อ

DKSH Technology Limited (บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด)
เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260
เลขประจำตัวผู้เสียภาษี 010-555-001-4547 (สำนักงานใหญ่)



Call center 0 2 639 7000



DKSH Scientific



www.dksh.com/scientific-thailand



marketing.tec.th@dksh.com



@dkshscientific

Preventive Maintenance Contract

จำนวนใบการทำสัญญาบริการ ...๑...ครั้งต่อปี
ครั้งที่ ๑..วันที่ 14/05/2025.....

รายละเอียดผู้รับบริการ

หน่วยงาน	บริษัท ซี.อี.เอ็ม เทคโนโลยี (ไทยแลนด์) จำกัด		
ที่อยู่	219/43 หมู่ 12 ถนนเพชรเกษม ตำบลอ้อมน้อย อำเภอกะทุ่มแบน จังหวัดสมุทรสาคร 74130		
โทรศัพท์	0869054664	แฟกซ์	-

ผู้ติดต่อ

ชื่อ - นามสกุล	คุณศิริพร พิมพ์า				
ตำแหน่ง	เจ้าหน้าที่ห้องปฏิบัติการ				
โทรศัพท์	0869054664		เบอร์มือถือ	-	แฟกซ์
E-mail	lab.cemtech1@gmail.com				

รายละเอียดผู้ให้บริการ

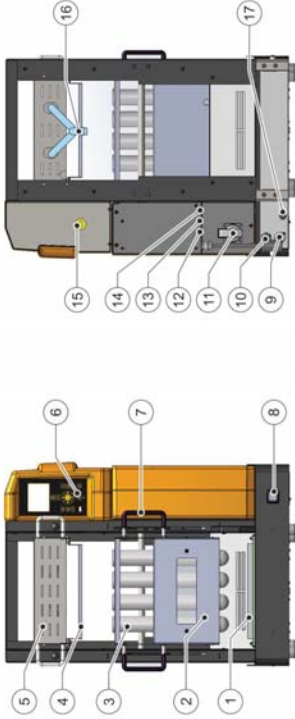
บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด (ฝ่ายบริการหลังการขาย) (สำนักงานใหญ่)			
เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260			
โทรศัพท์ 0 2 693 7000 Email: jirayut.js@dksh.com			
เจ้าหน้าที่ประสานงาน : คุณจิรายุ พนม สดอด			
เจ้าหน้าที่ผู้ให้บริการ	นายจิรายุ พนม สดอด		
ตำแหน่ง	Specialist, Technical Service.		
โทรศัพท์	0938138736	แฟกซ์ -	
E-mail	Jirayut.js@dksh.com		

ลงนามผู้รับบริการ		ลงนามผู้ให้บริการ	
ตัวจริง	(.....)	ตัวจริง	(นาย จิรายุ ฐิตธาด)
ตำแหน่ง		ตำแหน่ง	Specialist, Technical Service.
วันที่ / ประทับตราบริษัท		วันที่ / ประทับตราบริษัท	14/05/2025

JOB No: WQ-00070598.....MODEL: KT.20s..... S/N: GER5720180118

Part 3: ตรวจสอบสภาพเครื่อง

Front and rear view of KT-L version



No.		PASS	Fail	N/A	Remark
1	KJELDATHERM digestion block	☒	☐	☐	เสื่อมสภาพ
2	Insert rack	☒	☐	☐	
3	Digestion tube	☒	☐	☐	
4	Stainless steel drip tray	☒	☐	☐	
5	Exhaust manifold	☒	☐	☐	
6	Controls module, removable	☒	☐	☐	
7	Handle for insert rack	☒	☐	☐	
8	Mains switch with overcurrent protection function	☒	☐	☐	
9	Connection for lift unit	☒	☐	☐	
10	Mains cable with plug	☒	☐	☐	
11	Power supply for TURBOSOG	☒	☐	☐	
12	Connects controller module to block	☒	☐	☐	
13	Connection for fan for cooling samples (optional)	☐	☐	☒	
14	Connection for external cooling water valve (optional)	☐	☐	☒	
15	Connects controller module to block	☒	☐	☐	
16	Connection for Iso-Versinic hose (extraction)	☒	☐	☐	
17	Excess temperature fuse	☒	☐	☐	
18	Lift	☒	☐	☐	

Part 4: จะเขียนและรายงานผลการให้บริการ Preventive Maintenance

4.1 ตรวจสอบระบบไฟฟ้า

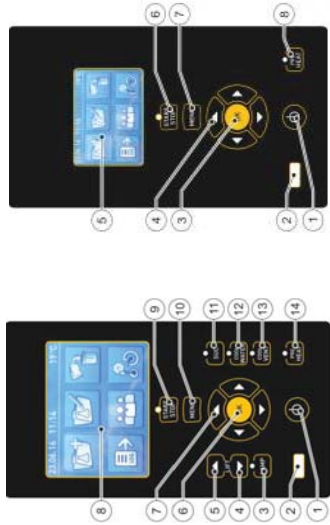
ใช้ไฟ 220 V 50 Hz
กระแสไฟฟ้าตามพิกัดเครื่อง

4.2 ตรวจสอบสภาพอุปกรณ์ภายนอก

สายไฟของเครื่อง
ท่อแก๊วรวมไอกรด
สายขมวดึงกับท่อแก๊วรวมไอกรด
สภาพของ Aluminum block
การขึ้นลงของ Lift
Light
Current Switch
Thermostat

Pass	☒	Fail	☐	N/A	☐	Remark	
	☒	☐	☐	☐	☐		
Pass	☒	Fail	☐	N/A	☐	Remark	
	☒	☐	☐	☐	☐		
	☒	☐	☐	☐	☐		
	☒	☐	☐	☐	☒		เสื่อมสภาพ
	☐	☐	☐	☐	☒		
	☐	☐	☐	☐	☒		
	☒	☐	☐	☐	☐		
	☒						

4.ตรวจเช็คระบบการทำงาน



☐ KT-L

☒ KT

	Pass	Fail	N/A	Remark
Switch controller on or off:	☒	☐	☐	
USB port	☒	☐	☐	
LAMP button	☐	☐	☒	
LIFT down button	☐	☐	☒	
LIFT up button	☐	☐	☒	
OK button	☒	☐	☐	
Navigation buttons	☒	☐	☐	
Display	☒	☐	☐	
START/STOP button	☒	☐	☐	
MENU button	☒	☐	☐	
SUC button	☐	☐	☒	
COOL/WATER button (optional)	☐	☐	☒	
COOL / FENT" button (optional)	☐	☐	☒	
PRE HEAT" button	☒	☐	☐	
การขึ้นของอุณหภูมิมากกว่า10องศาต่อนาทีที่25องศา	☒	☐	☐	
การทำงานของตัวป้องกันอุณหภูมิสูงเกิน	☒	☐	☐	
การทำงานของระบบควบคุมอุณหภูมิ	☒	☐	☐	

การบำรุงรักษาทั่วไป (Basic maintenance)

- การย้อยตัวอย่างเกิดจากการเค็ดที่รุนแรงอันเนื่องจากตัวอย่างนั้นสามารถป้องกันได้โดยแนะนำให้ย้อยตัวด้วยการตั้งการเพิ่มอุณหภูมิเป็นระดับเช่น ย้อยที่ระดับอุณหภูมิ 250 C ครบเวลา 15 นาทีจึงเปลี่ยนเป็นอุณหภูมิ 380 C เพื่อป้องกันการสั่นออกมา
- เมื่อใช้เสร็จ ไม่ควรปล่อยให้ Tube เย็นกับตัวเครื่อง
- ต้องนำเอาคาลองไอการใส่ทุกครั้งหลังจากใช้งานเสร็จ เพื่อป้องกันการหยดของไอกรดที่จะหยดลงมาถึงตัวเครื่อง
- ทำความสะอาดตัวหลุมย้อยด้วยน้ำหรือผ้าชุบน้ำในกรณีที่มีคราบกรดลงมาถึงตัวอยู่ในหลุม

เพื่อป้องกันไม่ให้เกิดราบบังกล่าวไปกับการแผ่อุณหภูมิ



Certificate of Calibration

Equipment: Cooled Incubator
Model: KB 240
Serial No. (or ID): 20180000012164 (WW-16-001)
Manufacturer: Binder
Condition: In Condition
Shelves(pc.): 3

Customer: C.E.M Technology (Thailand) Co., Ltd.
219/43 Moo 12 Petchkasem Road,
Omnoi Krathum Baen, Samut Sakhon 74130 Thailand

Environment Condition: Temperature: 22 °C ± 1.8 °C
Humidity: 61 %RH ± 5.3 %RH
Voltage: 230 VAC ± 1.5 VAC

Calibration Place: C.E.M Technology (Thailand) Co., Ltd. (Laboratory Room)
219/43 Moo 12 Petchkasem Road,
Omnoi Krathum Baen, Samut Sakhon 74130 Thailand

Calibration By: Mr. Tweewong Thaitiang
Calibration Date: 10 February 2025
The Method used: In house method, CAL-WI-16, base on TLAS-G20
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10240018

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories. The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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2533 Sukhumvit Road, Bangkok, Prachinon, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

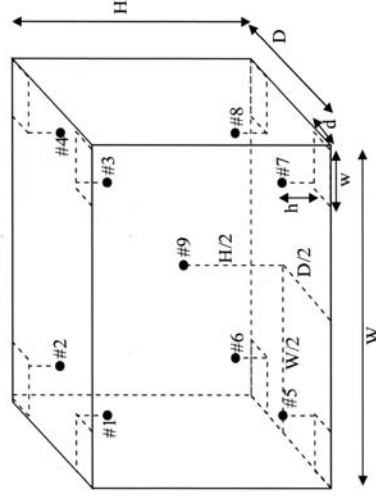
Delivering Growth - in Asia and Beyond.

CAL-FM-C31-10: 12 Sep 2022



Certificate No.: C31250348

Page: 2 of 3



Standard Installation Locations

Volume (Calibration Zone) = 122 (Liters)

Inside chamber: W = 65 (cm) D = 50 (cm) H = 76 (cm)
Standard Locations (#1, #2, #3, #4): w = 7 (cm) d = 5 (cm) h = 8 (cm)
Standard Locations (#5, #6, #7, #8): w = 7 (cm) d = 5 (cm) h = 8 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	201	202	203	204	205	206	207	208	209

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prachinon, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-10: 12 Sep 2022



Statements of conformity:

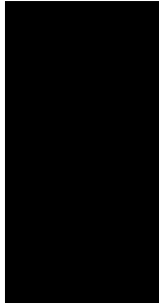
This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, TLAS-G20. Therefore, those parameters have not been assessed separately.

Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule :** ☐ Choice A Binary Statement for Simple Acceptance Rule ($w = 0$), Specific Risk < 50% PFA.
- ☒ Choice B Non-binary statement with guard band ($w = 1$ U), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.
- ☐ Choice C Customer defined, Customers may define arbitrary multiple of r to have applied as guard band ($w = r$ U).
- ; PFA – Probability of False Accept



Without adjustment

Desired Temperature : 20.0°C Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 20.0 °C

Locations	Measured (°C)	Correction* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	20.14	0.14	0.33	1.0	Pass
#2	20.14	0.14	0.34	1.0	Pass
#3	19.96	-0.04	0.38	1.0	Pass
#4	20.14	0.14	0.35	1.0	Pass
#5	20.11	0.11	0.33	1.0	Pass
#6	20.17	0.17	0.34	1.0	Pass
#7	20.00	0.00	0.37	1.0	Pass
#8	20.06	0.06	0.35	1.0	Pass
#9	20.38	0.38	0.33	1.0	Pass

Correction* = Measured Temperature - Desired Temperature

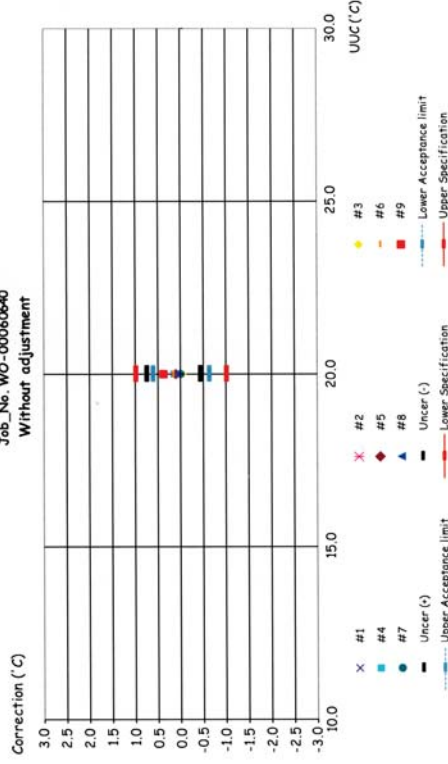
The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

The End of Statements of Conformity

Corr_Distribution & Max_Measurement Uncertainty

Job_No. WO-00060640

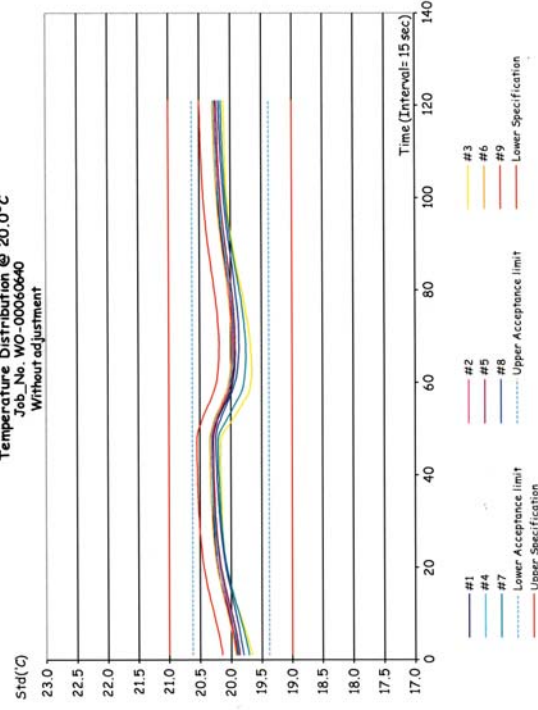
Without adjustment



Temperature Distribution @ 20.0°C

Job_No. WO-00060640

Without adjustment





ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00060640

ชนิดเครื่องมือ: Cooled Incubator
รุ่น: KB 240
หมายเลขเครื่อง: 2018000012164 (WW-16-001)

ตรวจสอบ (รับ)	ผลการตรวจสอบ	ตรวจสอบ (ส่ง)		หมายเหตุ
		10 Feb 2025	ไม่มีกีด	
ปกติ	ไม่มีกีด	ปกติ	ไม่มีกีด	
General				
☒	1. สายไฟ	☒	☐	
☒	2. การทำงาน Main Switch	☒	☐	
☒	3. การทำงาน Selector Key	☒	☐	
☒	4. การแสดงผล Display	☒	☐	
☒	5. การทำงาน ฟัดลม	☒	☐	
☐	6. สวิทช์ Lever of Ventilation valve	☐	☐	ไม่มี
☒	7. สวิทช์ Lever door open / close	☒	☐	
☒	8. สวิทช์ Door seal	☒	☐	
☒	9. การทำงานของระบบ Safety	☒	☐	
☒	10. การทำงานของระบบทำความเย็น	☒	☐	
☐	11. การทำงานของระบบทำความร้อน	☐	☐	ไม่มี
☒	12. สวิทช์ตัวเครื่อง	☒	☐	
☒	13. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	☒	☐	

ข้อแนะนำ:

Mr. Tiewwong Thaihiang
Service Engineer

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 หมู่ที่ 8 ตำบลบางจาก อำเภอพระประแดง จังหวัดสมุทรปราการ 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.



Certificate No.: C31250348

Page: 3 of 3

Calibration Results: Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 20.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	20.14	0.14	0.33
#2	20.14	0.14	0.34
#3	19.96	-0.04	0.38
#4	20.14	0.14	0.35
#5	20.11	0.11	0.33
#6	20.17	0.17	0.34
#7	20.00	0.00	0.37
#8	20.06	0.06	0.35
#9	20.38	0.38	0.33

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
20.0	20.0	20.0	20.14	20.14	19.96	20.14	20.11	20.17	20.00	20.06	20.38	0.38

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
20.0	0.57	0.26	0.89

Note: * Maximum uncertainty of the each position

The End of Certificate

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 หมู่ที่ 8 ตำบลบางจาก อำเภอพระประแดง จังหวัดสมุทรปราการ 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

CAL-FM-C31-10-12 Sep 2022



Certificate of Calibration

Equipment: Hot Air Oven
Model: UF 55
Serial No.(or ID): B219.0142 (WW-05-002)
Manufacturer: Memmert
Condition: In Condition
Shelves(pc.): 2

Customer: C.E.M Technology (Thailand) Co., Ltd.
219/43 Moo 12 Petchkasem Road,
Omnoi Krathum Baen, Samut Sakhon 74130 Thailand

Environment Condition: Temperature: 28 °C ± 1.0 °C
Humidity: 61 %RH ± 5.3 %RH
Voltage: 230 VAC ± 1.5 VAC

Calibration Place: C.E.M Technology (Thailand) Co., Ltd. (Laboratory Room)
219/43 Moo 12 Petchkasem Road,
Omnoi Krathum Baen, Samut Sakhon 74130 Thailand

Calibration By: Mr. Tiewwong Thaitiang
Calibration Date: 10 February 2025
The Method used: In house method, CAL-WI-16, base on TLAS-G20
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10240018

This certificate is issued in the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

DKSH Technology (Thailand) Co., Ltd.
2533 Muangphra Udonrath Road, Udon Thani 41100
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

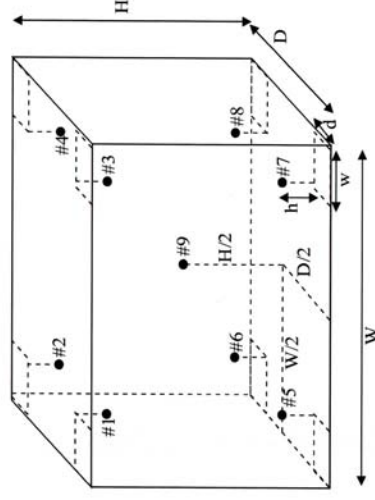
Delivering Growth - In Asia and Beyond.

CAL-FM-C31-10: 12 Sep 2022



Certificate No.: C31250347

Page: 2 of 4



Standard Installation Locations

Volume (Calibration Zone) = 21 (Liters)

Inside chamber: W = 40 (cm) D = 33 (cm) H = 40 (cm)

Standard Locations (#1, #2, #3, #4): w = 5 (cm) d = 5 (cm) h = 5 (cm)

Standard Locations (#5, #6, #7, #8): w = 5 (cm) d = 5 (cm) h = 5 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	101	102	103	104	105	106	107	108	109

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the

measured temperature at the reference location which are observed at same time or at close observation time as

possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference

probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

DKSH Technology (Thailand) Co., Ltd.
2533 Muangphra Udonrath Road, Udon Thani 41100
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-C31-10: 12 Sep 2022



Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
#1	104.29	0.29	0.40
#2	104.01	0.01	0.40
#3	104.34	0.34	0.40
#4	104.23	0.23	0.39
#5	104.43	0.43	0.40
#6	104.19	0.19	0.40
#7	103.78	-0.22	0.40
#8	104.21	0.21	0.40
#9	104.47	0.47	0.41

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.0	104.0	104.29	104.01	104.34	104.23	104.43	104.19	103.78	104.21	104.47	0.41

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	0.76	0.18	1.04

Note: * Maximum uncertainty of the each position



Without adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

Locations	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
#1	180.20	0.20	0.43
#2	179.54	-0.46	0.43
#3	180.39	0.39	0.43
#4	180.09	0.09	0.43
#5	180.62	0.62	0.43
#6	179.97	-0.03	0.43
#7	179.53	-0.47	0.48
#8	180.27	0.27	0.43
#9	180.57	0.57	0.43

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
180.0	xxx	180.0	180.20	179.54	180.39	180.09	180.62	179.97	179.53	180.27	180.57	0.48

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180.0	1.26	0.19	1.39

Note: * Maximum uncertainty of the each position

The End of Certificate



Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, TLAS-G20. Therefore, those parameters have not been assessed separately.

Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule:**
- ☐ Choice A Binary Statement for Simple Acceptance Rule ($w = 0$). Specific Risk < 50% PFA.
 - ☒ Choice B Non-binary statement with guard band ($w = 1$ U). Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.
 - ☐ Choice C Customer defined. Customers may define arbitrary multiple of r to have applied as guard band ($w = r$ U).
: PFA – Probability of False Accept



Without adjustment

Desired Temperature : 104.0°C Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured (°C)	Correction* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	104.29	0.29	0.40	1.0	Pass
#2	104.01	0.01	0.40	1.0	Pass
#3	104.34	0.34	0.40	1.0	Pass
#4	104.23	0.23	0.39	1.0	Pass
#5	104.43	0.43	0.40	1.0	Pass
#6	104.19	0.19	0.40	1.0	Pass
#7	103.78	-0.22	0.40	1.0	Pass
#8	104.21	0.21	0.40	1.0	Pass
#9	104.47	0.47	0.41	1.0	Pass

Correction* = Measured Temperature - Desired Temperature

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.



Statements of conformity:(Cont.) Without adjustment (Cont.)

Desired Temperature : 180.0°C Tolerances : 2.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

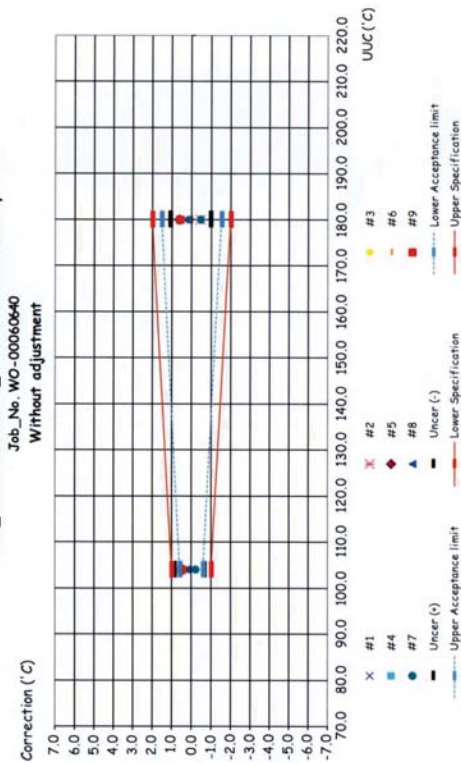
Locations	Measured (°C)	Correction* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	180.20	0.20	0.43	2.0	Pass
#2	179.54	-0.46	0.43	2.0	Pass
#3	180.39	0.39	0.43	2.0	Pass
#4	180.09	0.09	0.43	2.0	Pass
#5	180.62	0.62	0.43	2.0	Pass
#6	179.97	-0.03	0.43	2.0	Pass
#7	179.53	-0.47	0.48	2.0	Pass
#8	180.27	0.27	0.43	2.0	Pass
#9	180.57	0.57	0.43	2.0	Pass

Correction* = Measured Temperature - Desired Temperature

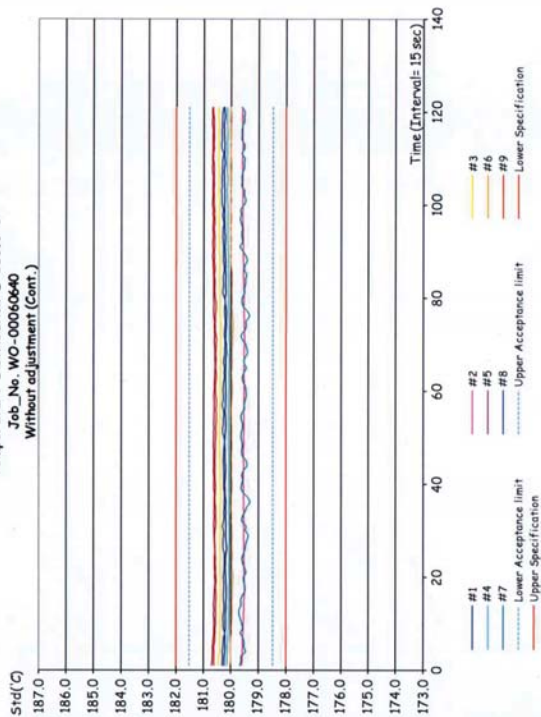
The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

The End of Statements of Conformity

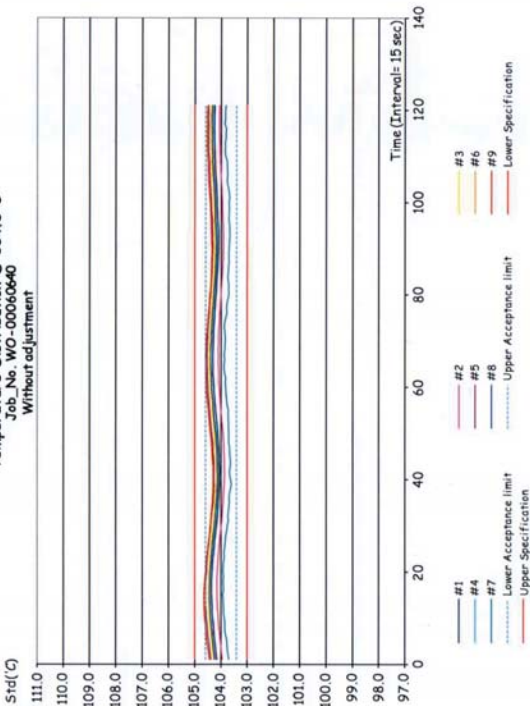
Corr_Distribution & Max_Measurement Uncertainty



Temperature Distribution @ 180.0°C



Temperature Distribution @ 104.0°C





ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00060640

ชนิดเครื่องมือ: Hot Air Oven รุ่น: UF 55

หมายเลขเครื่อง: B219.0142 (WW-05-002)

ตรวจสอบ (รุ่น)		รายการตรวจเช็ค	ตรวจสอบ (สัปดาห์)		หมายเหตุ
10 Feb 2025			10 Feb 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
☒	☐	1. สายไฟ	☒	☐	
☒	☐	2. การทำงาน Main Switch	☒	☐	
☒	☐	3. การทำงาน Selector Key	☒	☐	
☒	☐	4. การแสดงผล Display	☒	☐	
☒	☐	5. การทำงาน ฟัดลม	☒	☐	
☒	☐	6. สวิทช์ Lever of Ventilation valve	☒	☐	
☒	☐	7. สวิทช์ Lever door open / close	☒	☐	
☒	☐	8. สวิทช์ Door seal	☒	☐	
☒	☐	9. การทำงานของระบบ Safety	☒	☐	
☐	☐	10. การทำงานของระบบทำความเย็น	☐	☐	ไม่มี
☐	☐	11. การทำงานของระบบทำความร้อน	☐	☐	ไม่มี
☒	☐	12. สภาพตัวเครื่อง	☒	☐	
☒	☐	13. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	☒	☐	

ข้อแนะนำ:

Mr. Tweewong Thaitiang
Service Engineer

บริษัท ดีเคเอส อีเซีย แอนด์ บายอนด์ จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road Bangkok 10260
Phone: +66 2039 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasan 3 Rd., Banggood, Pakkred, Northaburi 11120
Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail: calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



NSG-TSI-ITS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 68-400089-3

Page : 1 of 2

Submitted by :

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

219/43 Moo.12 Petchkasem Rd. Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

Equipment :

Temperature Indicator with Thermistor Probe

Temperature Indicator

Manufacturer : Apera Model : PC 910

Range : N/A °C Resolution : 0.1 °C

Serial No. : PC910X1220811001 ID No. : WW-03-002

Thermistor probe

Model : N/A

Diameter : 4.8 mm.

Serial No. : N/A ID No. : WW-03-002

On site calibration was carried out at the Laboratory,

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

Ambient Temperature : (26.0 to 27.0) °C

Relative Humidity : (45 to 50) %

Line Voltage : (224.5 to 226.0) VAC

Date of Received : 11 February 2025

Date of Calibration : 11 February 2025

Date of Issue : 17 February 2025

Calibrated by : Pernpon Chaupru

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003

by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

ID No. Cert. No. Due Date

400002 TT-0095-24 01 Jul 2026

2. Standard Digital Thermometer

ID No. Cert. No. Due Date

400033 24F633 21 Feb 2026

Traceability

National Institute of Metrology Thailand (NIMT)

Traceability

National Institute of Metrology Thailand (NIMT)

Traceability

National Institute of Metrology Thailand (NIMT)

Traceability

National Institute of Metrology Thailand (NIMT)

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National Institute of Metrology Thailand (NIMT)

Traceability

National Institute of Metrology Thailand (NIMT)

Traceability

National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



Certificate of Calibration

Certificate No. : 68-400089-3

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
100	25.003	25.2	-0.2	0.19

Remark

UUC : Unit Under Calibration

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

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

- 0.00 -



Certificate of Calibration

Certificate No. : 68-420017-3

Page : 1 of 2

Submitted by :

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

219/43 Moo.12 Petchkasem Rd, Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

Equipment :

pH Meter with electrode

pH meter

Manufacturer : Apera

Model : PC 910

Range : N/A pH

Resolution : 0.01 pH

Serial No. : PC910X1220811001

ID No. : WW-03-002

Electrode

Model : LabSen 211

Serial No. : 2110009/213

ID No. : WW-03-002

Environment :

On site calibration was carried out at the Laboratory,

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

Ambient Temperature : (26.0 to 27.0) °C

Relative Humidity : (45 to 50) %

Date of Received : 11 February 2025

Date of Calibration : 11 February 2025

Date of Issue : 17 February 2025

Calibrated by : Pernpon Chanpu

Calibration Method : In-house method CAL-M4201 direct measurement by using standard voltage calibrator and using certified reference material (CRM)

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

1. Multiproduct Calibrator

ID No.	Cert.No.	Due Date	Traceability
400005	SG-E-00307/66	23 Aug 2025	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert.No.	Lot No.	Exp. Date	Traceability
4.008	61293328	1027612	15 Sep 2026	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.987	61297593	1027614	15 Sep 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
10.010	61306165	1027613	15 Sep 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

The Uncertainties are for a confidence probability of approximately 95%

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Certificate No. : 68-420017-3

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

Performing standard curve by Multiproduct Calibrator at pH (4,7,10)

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading (pH) (mV)	Correction (mV)	Uncertainty ($\pm$ mV)
4, 7, 10	177.4800	4	4.00 177	0	0.59
	0.0000	7	7.00 0	0	0.58
	-177.4800	10	10.00 -178	1	0.59

Function :

pH meter with electrode

Performing a three - buffer standard curve using buffer nominal pH (4,7,10)

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty ($\pm$ pH)
4, 7, 10	4.008	4.00	0.01	0.0097
	6.987	7.00	-0.01	0.011
	10.010	10.01	0.00	0.014

Remark

UUC : Unit Under Calibration

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

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

- 0.010 -

Certificate No. : 68-430004-2

Page : 1 of 2

Submitted by :

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

21943 Moo.12 Petchkasem Rd. Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

Equipment :

Digital Conductivity meter with probe

Manufacturer : Apera Model : PC 910

Serial No. : PC910X1220811001 ID No. : WW-03-002

Electrode

Model : N/A Serial No. N/A

ID No. : WW-03-002

Environment :

On site calibration was carried out at the Laboratory.

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

Ambient Temperature (26.0 to 27.0) °C

Relative Humidity (45 to 50) %

Date of Received :

11 February 2025

Date of Calibration :

11 February 2025

Date of Issue :

17 February 2025

Calibrated by :

Permpoon Chanpu

Calibration Method : In-house method CAL-M4301 direct measurement by conductivity buffer solution

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

Standard Buffer Solution

Material	Lot No.	Exp. Date	Traceability
84 μ S/cm	0300	01 June 2027	National Institute of Standards and Technology (NIST), U.S.A., S.R.M
1413 μ S/cm	970986	25 April 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
12.88 mS/cm	970987	25 April 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 68-430004-2

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Conductivity measurement

Before Adjustment

Standard	UUC Reading	Correction	Uncertainty (±)	Unit
Conductivity Solution				
84*	81.9	2.1	1.1	µS/cm
1413	1444	-31	9.0	µS/cm
12.88	12.41	0.47	0.082	mS/cm

After Adjustment : at 25.000, 84, 147, 1413 µS/cm 12.880, 80, 111.80 mS/cm

Standard	UUC Reading	Correction	Uncertainty (±)	Unit
Conductivity Solution				
84*	84.0	0.0	1.1	µS/cm
1413	1413	0	9.0	µS/cm
12.88	12.88	0.00	0.082	mS/cm

Remark

UUC : Unit Under Calibration

* This parameter is out of accreditation's scope.

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

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

Certificate of Calibration

Certificate No. : 68-400089-1

Page : 1 of 2

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

219/43 Moo.12 Petchkasem Rd. Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

Equipment :

Temperature Indicator with Thermistor Probe

Temperature Indicator

Manufacturer : Thermo Scientific Model : VERSA STAR PRO

Range : N/A °C Resolution : 0.1 °C

Serial No. : 12260 ID No. : WW-03-001

Thermistor probe

Model : N/A

Sheath Material : Stainless

Diameter : 6.5 mm.

Length : 120 mm.

Serial No. : PT1-18812 ID No. : WW-03-001

Environment :

On site calibration was carried out at the Laboratory,

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

Ambient Temperature : (26.0 to 27.0) °C

Relative Humidity : (45 to 50) %

Line Voltage : (224.5 to 226.0) VAC

Date of Received : 11 February 2025

Date of Calibration : 11 February 2025

Date of Issue : 17 February 2025

Calibrated by : Pernpon Chanpu

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003 by compared with PRT in the dry-well calibrator at the constant controlled temperature.

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

ID No. Cert. No. Due Date Traceability

400002 TT-0095-24 01 Jul 2026 National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No. Cert. No. Due Date Traceability

400033 24E633 21 Feb 2026 National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 68-400089-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
130	25.004	25.1	-0.1	0.19

Remark

UUC : Unit Under Calibration

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

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

- 010 -

Certificate of Calibration

Certificate No. : 68-420017-1

Page : 1 of 2

Submitted by :

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

219/43 Moo.12 Petchkasem Rd, Onnnoi, Krathumban, Samutsakorn 74130 (Head Office)

Equipment :

pH Meter with electrode

pH meter

Manufacturer : Thermo Scientific

Model : VERSA STAR PRO

Range : N/A

Resolution : 0.01 pH

Serial No. : 12260

ID No. : WW-03-001

Electrode

Model : 9156BNWP

Serial No. : VV1-15843

ID No. : WW-03-001

Environment :

On site calibration was carried out at the Laboratory,

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

Ambient Temperature : (26.0 to 27.0) °C

Relative Humidity : (45 to 50) %

Date of Received : 11 February 2025

Date of Calibration : 11 February 2025

Date of Issue : 17 February 2025

Calibrated by : Pernnon Champu

Calibration Method : In-house method CAL-M4201 direct measurement by using standard voltage calibrator

and using certified reference material (CRM)

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

1. Multiproduct Calibrator

ID No.	Cert. No.	Due Date	Traceability
400005	SG-E-00307/66	23 Aug 2025	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61293328	1027612	15 Sep 2026	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.987	61297593	1027614	15 Sep 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
10.010	61306165	1027613	15 Sep 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.

Certificate No. : 68-420017-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

Performing standard curve by Multiproduct Calibrator at pH (4,7,10)

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading (pH) (mV)	Correction (mV)	Uncertainty ($\pm$ mV)
4, 7, 10	177.4800	4	4.00 177.4	0.1	0.12
	0.0000	7	7.00 0.0	0.0	0.086
	-177.4800	10	10.00 -177.4	-0.1	0.12

Function : pH meter with electrode

Performing a three - buffer standard curve using buffer nominal pH (4,7,10)

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty ($\pm$ pH)
4, 7, 10	4.008	4.01	0.00	0.0097
	6.987	7.00	-0.01	0.011
	10.010	10.01	0.00	0.014

Remark

UUC : Unit Under Calibration

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

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

-oOo-

Certificate No. : 68-400089-1

Page : 1 of 2

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

219/43 Moo.12 Petchkasem Rd. Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

Equipment :

Temperature Indicator with Thermistor Probe

Temperature Indicator

Manufacturer : Thermo Scientific Model : VERSA STAR PRO

Range : N/A $^{\circ}$ C Resolution : 0.1 $^{\circ}$ C

Serial No. : 12260 ID No. : WW-03-001

Thermistor probe

Model : N/A Sheath Material : Stainless

Diameter : 6.5 mm. Length : 120 mm.

Serial No. : PT1-18812 ID No. : WW-03-001

Environment : On site calibration was carried out at the Laboratory,

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

Ambient Temperature : (26.0 to 27.0) $^{\circ}$ C

Relative Humidity : (45 to 50) %

Line Voltage : (224.5 to 226.0) VAC

Date of Received : 11 February 2025

Date of Calibration : 11 February 2025

Date of Issue : 17 February 2025

Calibrated by : Pernnon Chanpu

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003 by compared with PRT in the dry-well calibrator at the constant controlled temperature.

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

ID No. Cert.No. Due Date Traceability

400002 TT-0095-24 01 Jul 2026 National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No. Cert.No. Due Date Traceability

400033 24E633 21 Feb 2026 National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.

Certificate No. : 68-400089-1

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
130	25.004	25.1	-0.1	0.19

Remark

UUC : Unit Under Calibration

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

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

- 010 -



THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Ralking 30 Puttamonthon 5 Rd., Sampran, Nakornpatom 73210
Tel. 0-3439-7682-5 Fax: 0-3439-7687
www.thaicai.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com

CALIBRATION CERTIFICATE

Certificate No.S2503003S

page 1 of 2

Customer :

C.E.M TECHNOLOGY (THAILAND) CO., LTD.

219/43 Moo 12 Petchkasem Road, Omnoi,

Kraihumbun, Samutsakorn 74130

Equipment :

Non-automatic weighing instrument (Electronic instrument)

Manufacturer :

Sartorius

Model :

BSA224S-CW

Accuracy class :

-

Capacity :

220 g

Resolution :

0.0001 g

Serial No. :

3139614148

ID No. :

CL-01-003

Place of calibration : กรุงเทพมหานคร

Order No. :

68S0877-1

Ambient temperature :

(20.2 ± 5.0) °C

Relative humidity :

(54.5 ± 10.0) %

Received date :

01-Mar-2025

Date of calibration :

01-Mar-2025

Date of issue :

01-Mar-2025

Condition of the balance : Good working conditions

Calibration method

This instrument was calibrated according to the EURAMET Calibration Guide No. 18.

Condition of reference standard weight

Instrument	Nominal value	Serial No.	Certificate No.	Due-date	Density (kg/m ³)
1 Standard weight set	1 mg to 2 kg	15845+15849	M2410001S	5-Oct-2025	7930

Traceability of the reference standard weight

This certificate is traceable to SI unit through Mass Calibration Laboratory Thai Calibration Services Co., Ltd., NSC-ONSC accredited no. Calibration 0189.

This calibration certificate may not be reproduced other than in full,
except with the prior written approval of the head of TCS calibration laboratory.

TCS-F-138 Issue 01/Rev.01/12 Jun 2023

NO. 42531



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www.thaicl.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com



CALIBRATION CERTIFICATE

Certificate No.S2503003S

page 2 of 2

The repeatability of indication

Nominal Value (g)	Standard Deviation of reading (g)	Maximum difference between successive reading (g)	n
200	0.00000	0.0000	5

The effect of eccentric application of a load on the indication (test load : 100 g)

Position	Balance Reading (g)
Point 1	100.0000
Point 2	100.0000
Point 3	99.9999
Point 4	99.9998
Point 5	100.0000
Eccentric Value	0.0002



The error of indication

Nominal Value (g)	Value of Reference Standard Weight (g)	Balance Reading (g)	Correction (g)	Uncertainty (±) (g)	k
Unload	0.0000	0.0000	0.0000	0.000082	2.00
1	1.0000	1.0000	0.0000	0.000085	2.00
2	2.0000	2.0000	0.0000	0.000087	2.00
5	5.0000	5.0001	-0.0001	0.000090	2.00
10	10.0000	10.0000	0.0000	0.000094	2.00
20	20.0000	20.0000	0.0000	0.00011	2.00
50	50.0000	50.0000	0.0000	0.00013	2.00
100	100.0000	100.0000	0.0000	0.00019	2.00
120	120.0000	120.0001	-0.0001	0.00024	2.00
150	150.0000	150.0000	0.0000	0.00027	2.00
200	200.0002	200.0000	+0.0002	0.00033	2.00

Remark : Adjustment, Internal weight

Uncertainty of measurement

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor (k), which for a normal distribution corresponds to a coverage probability of approximately 95% (confidence level).

This report will certify of the calibrated equipment only.

--End--

TCS-F-138 Issue 01/Rev.01/12 Jun 2023

NO. 42532



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www.thaicl.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com



CALIBRATION CERTIFICATE

Certificate No.S2505043S

page 1 of 2

Customer :

C.E.M. TECHNOLOGY (THAILAND) CO., LTD.

219/43 Moo 12, Petchkasem Rd., Omnoi,

Krathumban, Samutsakorn 74130

Equipment :

Non-automatic weighing instrument (Electronic instrument)

Manufacturer :

Sartorius

Model :

QUINTIX224-IS

Accuracy class :

220000 mg

Capacity :

0.1 mg

Resolution :

0.035009070

Serial No. :

C1-01-002

ID No. :

CI-01-002

Place of calibration :

วัดตะไคร้

Order No. :

68S1799-1

Ambient temperature :

(23.9 ± 1.0) °C

Relative humidity :

(38.9 ± 5.0) %

Received date :

30-Apr-2025

Date of calibration :

30-Apr-2025

Date of issue :

03-May-2025

Condition of the balance :

Good working conditions

Calibration method

This instrument was calibrated according to the EURAMET Calibration Guide No. 18.

Condition of reference standard weight

Instrument	Nominal value	Serial No.	Certificate No.	Due-date	Density (kg/m³)
1 Standard weight set	1 mg to 2 kg	15885+15849	M2410001S	5-Oct-2025	7950

Traceability of the reference standard weight

This certificate is traceable to SI unit through Mass Calibration Laboratory Thai Calibration Services Co., Ltd., NSC-ONSC accredited no. Calibration 0189.

This calibration certificate may not be reproduced other than in full, except with the prior written approval of the head of TCS calibration laboratory.

TCS-F-138 Issue 01/Rev.01/12 Jun 2023

NO. 3113



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NSC-TISI-TIS 17025
CALIBRATION 0189

CALIBRATION CERTIFICATE

Certificate No.S2505043S

page 2 of 2

The repeatability of indication

Nominal Value (mg)	Standard Deviation of reading (mg)	Maximum difference between successive reading (mg)	n
200000	0.04	0.1	5

The effect of eccentric application of a load on the indication (test load : 100000 mg)

Position	Balance Reading (mg)
Point 1	99999.8
Point 2	99999.8
Point 3	99999.8
Point 4	99999.6
Point 5	99999.6
Eccentric Value	0.2



The error of indication

Nominal Value (mg)	Value of Reference Standard Weight (mg)	Balance Reading (mg)	Correction (mg)	Uncertainty ($\pm$) (mg)	k
Unload	0.0	0.0	0.0	0.14	2.21
100	100.0	100.0	0.0	0.14	2.21
200	200.0	200.1	-0.1	0.14	2.21
500	500.0	500.0	0.0	0.14	2.20
1000	1000.0	1000.0	0.0	0.14	2.20
2000	2000.0	2000.0	0.0	0.14	2.20
5000	5000.0	5000.1	-0.1	0.14	2.18
10000	10000.0	10000.0	0.0	0.14	2.16
20000	20000.0	20000.0	0.0	0.15	2.13
50000	50000.0	50000.0	0.0	0.16	2.08
100000	100000.0	99999.8	+0.2	0.21	2.00
200000	200000.2	199999.7	+0.5	0.34	2.00

Remark : Without adjustment

Uncertainty of measurement

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor (k), which for a normal distribution corresponds to a coverage probability of approximately 95% (confidence level).

This report will certify of the calibrated equipment only.

--End--