

ภาคผนวกที่ 4

สรุปเอกสารสอบเทียบอุปกรณ์เครื่องมือ

Certificate No.: CP20250024EB

Calibration Report

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

Method of Calibration :-
IEC61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

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

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

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

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

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

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

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

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เอกสารการสอบเทียบเครื่องมือตรวจวัดระดับเสียงในบรรยากาศ

ELECTRICAL AND ELECTRONICS INSTITUTE
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.: CP20250024EB
Operation No.: CP2025010014

Certificate of Calibration

This certificate was issued to substitute to Certificate No. CP20250024EA

Equipment: Sound Level Meter
Manufacturer: ACO
Model/Type: 6236 (Meter), 7052NR (Microphone), - (Preamplifier)
Serial No.: 222185 (Meter), 84158 (Microphone), - (Preamplifier)
ID No.: NS-03-015
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran,
Nakorn Phatom 73210
Received Date: 13 January 2025
Calibrated Date: 17 - 20 January 2025
Issued Date: 25 February 2025
Calibrated by: Ms. Juntaporn Kunhakom

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

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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.: CP20250024EB

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value
(dB)
18.8

2.2 Microphone replaced by the electrical input signal device

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

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

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

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

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Certificate No.: CP20250024EB

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Function : 6. Long-Term Stability

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

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

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

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

Certificate No.: CP20250024EB

Calibration Report

Function : 9. Tone burst response

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

Function : 10. Peak C sound level

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

Function : 11. Overload indication

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

Function : 12. High-Level Stability

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

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

Certificate No.: CP20250024EB

Calibration Report

7.2 Level Linearity on the reference level range, Lower

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

Function : 8. Level Linearity including level range control

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

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

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

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

Certificate No.: CP20250024EB

Calibration Report

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 --



ELECTRICAL AND ELECTRONICS INSTITUTE
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Certificate No.: CP20250138EA
Operation No.: CP2025040133

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 Pathom 73210
Received Date: 21 April 2025
Calibrated Date: 28 - 29 April 2025
Issued Date: 30 April 2025
Calibrated by: Ms. Juntaporn Kunhakorn

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

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FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20250138EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
18.7

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	12.2
C-weighting	17.4
Z-weighting	23.5

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	0.2	-0.1	0.2	±1.5
1000	-0.1	-0.1	-0.2	±1.0
8000	-1.6	-1.5	-0.0	±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	-0.1	-0.1	±2.0
125	0.0	-0.1	-0.1	±1.5
250	0.0	0.0	0.0	±1.5
500	0.1	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	-0.4	-0.3	-0.1	±3.0
8000	0.3	0.4	0.2	±5.0

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ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20250138EA

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	4100	2661090	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-F250028 CD20240180EA	23 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)
-	-	-	-

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ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20250138EA

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	93.9	-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
Imp	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	108.9	-0.1	±1.1
114.0	113.9	-0.1	±1.1
119.0	119.0	0.0	±1.1
120.0	120.0	0.0	±1.1
121.0	121.0	0.0	±1.1

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Certificate No.: CP20250138EA

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	68.9	-0.1	±1.1
64.0	63.0	-0.2	±1.1
59.0	58.8	-0.2	±1.1
54.0	53.8	-0.2	±1.1
49.0	48.8	-0.2	±1.1
44.0	43.8	-0.2	±1.1
39.0	38.8	-0.2	±1.1
34.0	33.8	-0.2	±1.1
33.0	32.8	-0.2	±1.1
32.0	31.8	-0.2	±1.1
31.0	31.0	0.0	±1.1
30.0	30.1	0.1	±1.1

Function : 8. Level Linearity including level range control

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

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

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

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-80	25.0	25.3	0.3	±1.1
20-90	25.0	25.4	0.4	±1.1
20-100	25.0	25.5	0.5	±1.1
20-110	25.0	25.5	0.5	±1.1
30-120	35.0	35.0	0.0	±1.1
40-130	45.0	45.1	0.1	±1.1

Certificate No.: CP20250138EA

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 (10 Hz to 4 kHz) 0.70 (>4 kHz to 10 kHz)
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	0.25
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.: CP20250138EA

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
	0.25	109.9	-0.1	±1.0
LAE	200	90.0	0.0	+1.0 ; 2.5
	2	80.9	-0.1	+1.5 ; -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	124.3	-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.: 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 Kunhakorn

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

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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 CD20250094EA	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)
-	-	-	-



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



Certificate No.: CP20250264EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
18.0

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 94 dB.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve				Acceptance limits (dB)
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (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				Acceptance limits (dB)
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (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



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
	200	127.0	0.0	±1.0
SEL	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



Certificate No.: CP2025024EA

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	0.10
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 --



Certificate No.: CP20250254EA

Calibration Report

Equipment:

Sound Level Meter

Manufacturer:

SCARLET TECH

Model/Type:

ST11D (Meter), AWA14425 (Microphone), - (Preamplifier)

Serial No.:

820388 (Meter), 79928 (Microphone), - (Preamplifier)

ID No.:

NS-12-001

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 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)

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)
-	-	-	-



NSC-IRPC TIS 17025
CALIBRATION CENTER

Certificate No.: CP20250254EA

Operation No.: CP2025080247

Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: SCARLET TECH

Model/Type: ST11D (Meter), AWA14425 (Microphone), - (Preamplifier)

Serial No.: 820388 (Meter), 79928 (Microphone), - (Preamplifier)

ID No.: NS-12-001

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

Address: 31/8 Moo 13, T.Rai Khing, A.Sam Phran,
Nakhon Pathom 73210

Received Date: 26 August 2025

Calibrated Date: 2 - 3 September 2025

Issued Date: 4 September 2025

Calibrated by: Ms. Juntaporn Kunhakom

Approved by:

(Mr. Sittichai Swaksuriyawong)

Group Manager

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Certificate No.: CP20250254EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
15.7

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	11.0
C-weighting	12.1
Z-weighting	14.8

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	0.4	0.3	0.4	± 1.0
1000	0.0	0.0	0.0	± 0.7
8000	0.0	0.1	-0.1	+1.5; -2.5

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	-0.1	0.0	± 1.0
125	0.0	-0.2	0.0	± 1.0
250	0.0	-0.1	0.0	± 1.0
500	0.0	-0.1	0.0	± 1.0
1000	0.0	0.0	0.0	± 0.7
2000	0.1	0.0	-0.1	± 1.0
4000	0.1	-0.1	0.0	± 1.0
8000	-0.1	-0.1	0.0	+1.5; -2.5
16000	-5.3	-5.2	0.1	+2.5; -16.0

Certificate No.: CP20250254EA

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	93.9	-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	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	±0.1

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	±0.8
99.0	99.0	0.0	±0.8
104.0	104.0	0.0	±0.8
109.0	109.0	0.0	±0.8
114.0	114.0	0.0	±0.8
119.0	119.0	0.0	±0.8
124.0	124.0	0.0	±0.8
129.0	129.0	0.0	±0.8
134.0	134.0	0.0	±0.8
139.0	139.0	0.0	±0.8
140.0	140.0	0.0	±0.8

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	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8

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Certificate No.: CP20250254EA

Calibration Report

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
143.0	142.8	-0.2	±1.5

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	139.0	139.0	0.0	±0.1

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 1.
4. The coverage factor $k = 2.00$

-- End of Report --

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F-CAL-005 Ed.1

Certificate No.: CP20250254EA

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)
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	33.9	-0.1	±0.8
29.0	28.9	-0.1	±0.8
28.0	27.9	-0.1	±0.8
27.0	26.9	-0.1	±0.8
26.0	26.0	0.0	±0.8
25.0	25.0	0.0	±0.8

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	135.9	-0.1	±0.5
	2	118.7	-0.3	+1.0 ; -1.5
	0.25	109.5	-0.5	+1.0 ; -3.0
Slow	200	129.5	-0.1	±0.5
	2	109.9	-0.1	+1.0 ; -3.0
	0.25	130.0	0.0	±0.5
SEL	200	110.0	0.0	+1.0 ; -1.5
	2	110.8	-0.2	+1.0 ; -3.0
	0.25	100.8	-0.2	+1.0 ; -3.0

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	135.4	135.2	-0.2	±2.0
Positive half cycle	134.4	134.1	-0.3	±1.0
Negative half cycle	134.4	134.1	-0.3	±1.0

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F-CAL-005 Ed.1

Certificate No.: CP20250053EA

Operation No.: CP2025020040

Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: SCARLE TECH

Model/Type: ST11D (Meter), AWA14425 (Microphone), - (Preamplifier)

Serial No.: 820891 (Meter), 60237 (Microphone), - (Preamplifier)

ID No.: NS-12-002

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

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

Received Date: 31 January 2025

Calibrated Date: 17 - 19 February 2025

Issued Date: 24 February 2025

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

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F-CAL-004 Ed.1



Certificate No.: CP20250053EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: SCARLET TECH
Model/Type: ST1110 (Meter), AWA14425 (Microphone), - (Preamplifier)
Serial No.: 820891 (Meter), 60237 (Microphone), - (Preamplifier)
ID No.: NS-12-002
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-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.: CP20250053EA

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	93.9	-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	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	±0.1

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	±0.8
99.0	99.0	0.0	±0.8
104.0	104.0	0.0	±0.8
109.0	109.0	0.0	±0.8
114.0	114.0	0.0	±0.8
119.0	119.0	0.0	±0.8
124.0	124.0	0.0	±0.8
129.0	129.0	0.0	±0.8
134.0	134.0	0.0	±0.8
139.0	139.0	0.0	±0.8
140.0	139.9	-0.1	±0.8

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	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8



Certificate No.: CP20250053EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
15.5

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	5.6
C-weighting	6.5
Z-weighting	12.2

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

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	±1.0
1000	0.0	0.0	0.0	±0.7
8000	-1.7	-1.3	-1.5	+1.5; -2.5

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	±1.0
125	0.0	-0.1	0.0	±1.0
250	0.0	0.1	0.0	±1.0
500	0.1	-0.1	0.0	±1.0
1000	0.0	0.0	0.0	±0.7
2000	0.0	0.0	0.0	±1.0
4000	0.1	0.1	0.0	±1.0
8000	-0.1	-0.1	0.0	+1.5; -2.5
16000	-5.2	-5.2	0.1	+2.5; -16.0



Certificate No.: CP20250053EA

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)
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	33.8	-0.2	±0.8
29.0	28.8	-0.2	±0.8
28.0	27.8	-0.2	±0.8
27.0	26.8	-0.2	±0.8
26.0	25.8	-0.2	±0.8
25.0	24.7	-0.3	±0.8
24.0	23.7	-0.3	±0.8
23.0	22.7	-0.3	±0.8
22.0	21.5	-0.5	±0.8
21.0	20.5	-0.5	±0.8
20.0	19.3	-0.7	±0.8

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	136.0	0.0	±0.5
	2	118.9	-0.1	+1.0; -1.5
	0.25	109.8	-0.2	+1.0; -3.0
Slow	200	129.6	0.0	±0.5
	2	109.9	-0.1	+1.0; -3.0
	200	130.0	0.0	±0.5
SEL	2	110.0	0.0	+1.0; -1.5
	0.25	100.9	-0.1	+1.0; -3.0

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	135.4	135.1	-0.3	±2.0
Positive half cycle	134.4	134.1	-0.3	±1.0
Negative half cycle	134.4	134.1	-0.3	±1.0



Certificate No.: CP20250053EA

Calibration Report

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
142.6	142.6	0.0	±1.5

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	139.0	139.0	0.0	±0.1

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) One 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 IEC 61672-3:2013 Class 1.
 4. The coverage factor $k = 2.00$

-- End of Report --



Certificate No.: CP20250054EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: SCARLET TECH
Model/Type: ST11D (Meter), AWA14425 (Microphone), - (Preamplifier)
Serial No.: 820892 (Meter), 57258 (Microphone), - (Preamplifier)
ID No.: NS-12-003
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-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) 0.5 Digit precision multimeter	8046A	9609027	CD20240120EA	31 July 2025
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-F24002Z 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.: CP20250054EA

Operation No.: CP2025020041

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: SCARLET TECH
Model/Type: ST11D (Meter), AWA14425 (Microphone), - (Preamplifier)
Serial No.: 820892 (Meter), 57258 (Microphone), - (Preamplifier)
ID No.: NS-12-003
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Hai Khung, A.Sam Phran,
Nakorn Phatom 73210
Received Date: 31 January 2025
Calibrated Date: 18 - 20 February 2025
Issued Date: 24 February 2025
Calibrated by: Ms. Juntaporn Kunhakom

Approved by:

(Mr. Sittichai Swaksuriyawong)
Group Manager

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

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



Certificate No.: CP20250054EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
15.8

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	7.8
C-weighting	6.2
Z-weighting	14.6

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	±1.0
1000	0.1	0.1	0.1	±0.7
8000	-0.8	-0.8	-0.7	+1.5; -2.5

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	0.0	±1.0
125	0.1	-0.1	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.0	-0.1	±1.0
1000	0.0	0.0	0.0	±0.7
2000	0.1	0.1	-0.1	±1.0
4000	0.1	0.0	0.0	±1.0
8000	0.0	0.0	-0.1	+1.5; -2.5
16000	-5.2	-5.1	-0.1	+2.5; 16.0

Certificate No.: CP20250054EA

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	93.9	-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	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	±0.1

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	±0.8
99.0	99.0	0.0	±0.8
104.0	104.0	0.0	±0.8
109.0	109.0	0.0	±0.8
114.0	114.0	0.0	±0.8
119.0	119.0	0.0	±0.8
124.0	124.0	0.0	±0.8
129.0	129.0	0.0	±0.8
134.0	134.0	0.0	±0.8
139.0	139.0	0.0	±0.8
140.0	140.0	0.0	±0.8

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	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8

Certificate No.: CP20250054FA

Calibration Report

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle	0.2	±1.5
143.3	143.5		

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	139.0	139.0	0.0	±0.1

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 IEC 61672-3:2013 Class 1.
4. The coverage factor $k = 2.00$

-- End of Report --

Certificate No.: CP20250054EA

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)
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	33.8	-0.2	±0.8
29.0	28.8	-0.2	±0.8
28.0	27.8	-0.2	±0.8
27.0	26.8	-0.2	±0.8
26.0	25.8	-0.2	±0.8
25.0	24.8	0.2	±0.8
24.0	23.7	-0.3	±0.8
23.0	22.6	-0.4	±0.8
22.0	21.5	-0.5	±0.8
21.0	20.5	-0.5	±0.8
20.0	19.4	-0.6	±0.8
19.0	18.3	-0.7	±0.8

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	136.0	0.0	±0.5
	2	118.8	-0.2	+1.0; -1.5
	0.25	109.8	-0.2	+1.0; -3.0
Slow	200	129.5	0.1	±0.5
	2	109.9	-0.1	+1.0; -3.0
	200	130.0	0.0	±0.5
SEL	2	110.0	0.0	+1.0; -1.5
	0.25	100.9	-0.1	+1.0; -3.0

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	135.4	135.1	-0.3	±2.0
Positive half cycle	134.4	134.1	-0.3	±1.0
Negative half cycle	134.4	134.1	-0.3	±1.0

Certificate No.: CP20250054EA

Operation No.: CP2025020042

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: SCARLET TECH
Model/Type: ST11D (Meter), AWA14425 (Microphone), - (Preamplifier)
Serial No.: 821486 (Meter), 61344 (Microphone), - (Preamplifier)
ID No.: NS-12-004
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran, Nakhon Phanom 73210
Received Date: 31 January 2025
Calibrated Date: 18 - 19 February 2025
Issued Date: 24 February 2025
Calibrated by: Ms. Juntaporn Kunhakom

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

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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.

Certificate No.: CP20250055EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: SCARLET TECH
Model/Type: ST110 (Meter), AWA1425 (Microphone), - (Preamplifier)
Serial No.: 821486 (Meter), 61344 (Microphone), - (Preamplifier)
ID No.: NS-12-004
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-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-P2400Z2 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.: CP20250055EA

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	±0.1

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	±0.8
99.0	99.0	0.0	±0.8
104.0	104.0	0.0	±0.8
109.0	109.0	0.0	±0.8
114.0	113.9	-0.1	±0.8
119.0	119.1	0.1	±0.8
124.0	124.0	0.0	±0.8
129.0	129.0	0.0	±0.8
134.0	134.0	0.0	±0.8
139.0	139.0	0.0	±0.8

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
92.0	92.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8

Certificate No.: CP20250055EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
15.6

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	8.0
C-weighting	9.0
Z-weighting	15.0

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

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

Deviation from various Frequency Weighting Response Curve

Frequency (Hz)	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.5	0.3	0.4	±1.0
1000	-0.3	-0.2	-0.3	±0.7
8000	-0.4	-0.3	-0.3	+1.5; -2.5

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Deviation from various Frequency Weighting Response Curve

Frequency (Hz)	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.0	0.0	0.0	±1.0
125	0.0	-0.1	0.0	±1.0
250	0.0	-0.1	0.0	±1.0
500	0.0	-0.1	0.0	±1.0
1000	0.0	0.0	0.0	±0.7
2000	0.1	0.0	0.0	±1.0
4000	-0.1	0.1	0.0	±1.0
8000	-0.1	-0.1	0.0	+1.5; -2.5
16000	-5.2	-5.2	0.1	+2.5; -16.0

Certificate No.: CP20250055EA

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)
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	33.8	-0.2	±0.8
29.0	28.8	-0.2	±0.8
28.0	27.8	-0.2	±0.8
27.0	26.8	-0.2	±0.8
26.0	25.8	-0.2	±0.8
25.0	24.8	-0.2	±0.8
24.0	23.7	-0.3	±0.8
23.0	22.7	-0.3	±0.8
22.0	21.6	-0.4	±0.8
21.0	20.6	-0.4	±0.8
20.0	19.6	-0.4	±0.8
19.0	18.4	-0.6	±0.8

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	136.0	0.0	±0.5
	2	118.9	-0.1	+1.0; -1.5
	0.25	109.8	-0.2	+1.0; -3.0
Slow	200	110.0	0.0	±0.5
	2	110.0	0.0	+1.0; -3.0
	0.25	100.9	-0.1	+1.0; -3.0

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	135.4	135.0	-0.4	±2.0
Positive half cycle	134.4	134.1	-0.3	±1.0
Negative half cycle	134.4	134.1	-0.3	±1.0



Certificate No.: CP20250055EA

Calibration Report

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
143.0	143.3	0.3	±1.5

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	139.0	139.0	0.0	±0.1

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 1.
 4. The coverage factor $k = 2.00$

-- End of Report --



Certificate of Analyzer Performance Testing

Calibrated Date : 29-Jul-25 Certificate No. : 0725-001
Page : 1/1

Analyzer Instruments

Analyzer Type : SO₂ Analyzer Manufacturer : Thermo Environmental
Model : 43C Serial No. : 43C-49901-334

Environmental

Temperature : 35.9 °C
Humidity : 43.3 %RH

Calibration System

Calibrator Units

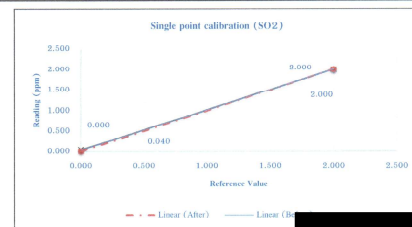
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 148C Model : 701
Serial No. : 514811458 Serial No. : 179

Standard Gas

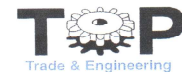
NO Conc. : 2 ppm Cylinder No. : 997199
SO₂ Conc. : 2 ppm Expire Date : 10-Oct-25
CO Conc. : 50 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
SO ₂	0.040	0.000	0.04	2.00	2.000	0.00
After						
SO ₂	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated



Certificate of Analyzer Performance Testing

Calibrated Date : 18-Aug-25 Certificate No. : 0825-002
Page : 1/1

Analyzer Instruments

Analyzer Type : SO₂ Analyzer Manufacturer : Thermo Environmental
Model : 43C Serial No. : 43C-70853-387

Environmental

Temperature : 31.0 °C
Humidity : 42.7 %RH

Calibration System

Calibrator Units

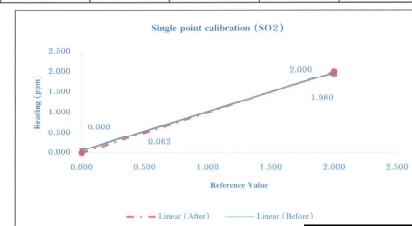
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 148C Model : 701
Serial No. : 514811458 Serial No. : 179

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						
SO ₂	0.082	0.000	0.08	1.98	2.000	-1.00
After						
SO ₂	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในบรรยากาศ

Certificate of Analyzer Performance Testing

Calibrated Date : 18-Aug-25 Certificate No. : 0825-003
Page : 1/1

Analyzer Instruments
Analyzer Type : SO₂ Analyzer Manufacturer : Thermo Environmental
Model : 43C Serial No. : 43C-70859-967

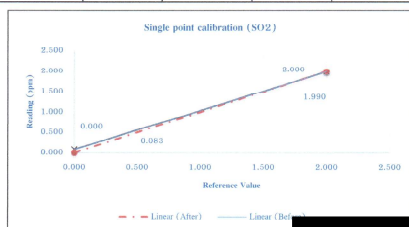
Environmental
Temperature : 26.4 °C
Humidity : 43.2 %RH

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						
SO ₂	0.083	0.000	0.08	1.99	2.000	-0.50
After						
SO ₂	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by

Certificate of Analyzer Performance Testing

Calibrated Date : 1-Mar-25 Certificate No. : 0325-005
Page : 1/1

Analyzer Instruments
Analyzer Type : NO/NO₂/NO_x Analyzer Manufacturer : Thermo Environmental
Model : 42C Serial No. : 58926-320

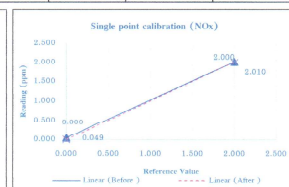
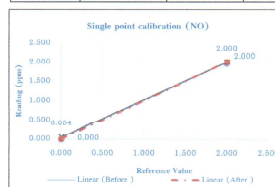
Environmental
Temperature : 25.8 °C
Humidity : 41.9 %RH

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 : 2 ppm Expire Date : 10-Oct-25
CO Conc. : 50 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.054	0.000	0.05	2.00	2.00	0.00
NO _x	0.049	0.000	0.05	2.01	2.00	0.50
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NO _x	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by

Certificate of Analyzer Performance Testing

Calibrated Date : 18-Aug-25 Certificate No. : 0825-004
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Analyzer Instruments
Analyzer Type : SO₂ Analyzer Manufacturer : Thermo Environmental
Model : 43C Serial No. : 43C-77419-385

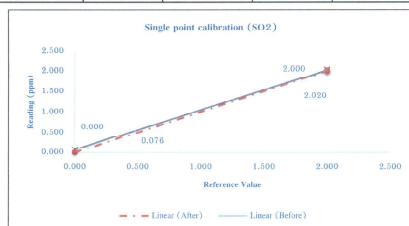
Environmental
Temperature : 24.5 °C
Humidity : 35.9 %RH

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						
SO ₂	0.076	0.000	0.08	2.02	2.000	1.00
After						
SO ₂	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by

Certificate of Analyzer Performance Testing

Calibrated Date : 25-Mar-25 Certificate No. : 0325-003
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Analyzer Instruments
Analyzer Type : NO/NO₂/NO_x Analyzer Manufacturer : Thermo Environmental
Model : 42C Serial No. : 72454-371

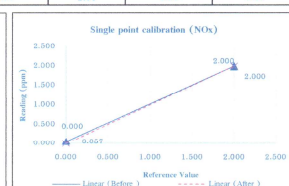
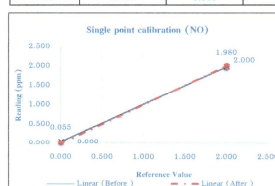
Environmental
Temperature : 25.1 °C
Humidity : 46.2 %RH

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 : 2 ppm Expire Date : 10-Oct-25
CO Conc. : 50 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.055	0.000	0.05	1.98	2.00	-1.00
NO _x	0.057	0.000	0.05	2.00	2.00	0.00
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NO _x	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by

Certificate of Analyzer Performance Testing

Calibrated Date : 1-Aug-25 Certificate No. : 0825-015
Page : 1/1

Analyzer Instruments
Analyzer Type : NO/NO₂/NO_x Analyzer Manufacturer : Thermo Environmental
Model : 42C Serial No. : 50406-323

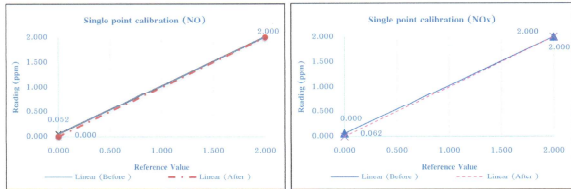
Environmental
Temperature : 24.8 °C
Humidity : 45.9 %RH

Calibration System
Calibrator Units
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 145C 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						
NO	0.052	0.000	0.05	2.01	2.00	0.50
NO _x	0.092	0.000	0.05	2.00	2.00	0.00
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NO _x	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by: [Redacted]

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

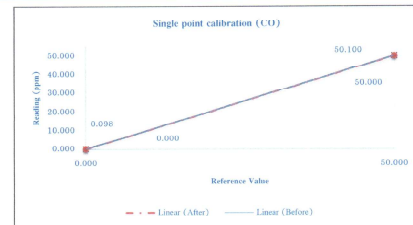
Environmental
Temperature : 25.7 °C
Humidity : 25.1 %RH

Calibration System
Calibrator Units
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 145C 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



Calibrated by: [Redacted]

Certificate of Analyzer Performance Testing

Calibrated Date : 25-Mar-25 Certificate No. : 0325-004
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Analyzer Instruments
Analyzer Type : CO Analyzer Manufacturer : Thermo Environmental
Model : 48C Serial No. : 401304261

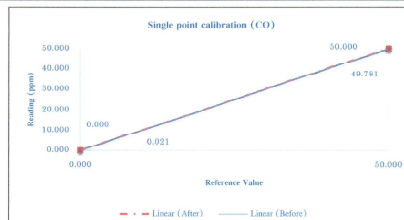
Environmental
Temperature : 29.8 °C
Humidity : 46.9 %RH

Calibration System
Calibrator Units
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 145C Model : 701
Serial No. : 514811458 Serial No. : 179

Standard Gas
NO Conc. : 2 ppm Cylinder No. : 307199
SO₂ Conc. : 2 ppm Expire Date : 10-Oct-25
CO Conc. : 50 ppm

Calibration Check

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



Calibrated by: [Redacted]

Certificate of Analyzer Performance Testing

Calibrated Date : 10-Jan-25 Certificate No. : 0125-012
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Analyzer Instruments
Analyzer Type : CO Analyzer Manufacturer : Thermo Environmental
Model : 48C Serial No. : 71091-367

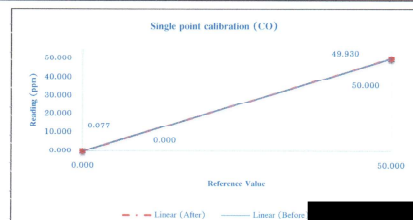
Environmental
Temperature : 25.1 °C
Humidity : 46.2 %RH

Calibration System
Calibrator Units
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 145C Model : 701
Serial No. : 514811458 Serial No. : 179

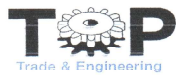
Standard Gas
NO Conc. : 2 ppm Cylinder No. : 307199
SO₂ Conc. : 2 ppm Expire Date : 10-Oct-25
CO Conc. : 50 ppm

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



Calibrated by: [Redacted]



Certificate of Analyzer Performance Testing

Calibrated Date : 13-Jan-25 Certificate No. : 0125-001
Page : 1/1

Analyzer Instruments
Analyzer Type : THC Analyzer Manufacturer : Thermo Environmental
Model : 51 Serial No. : 5110FF-73944-373

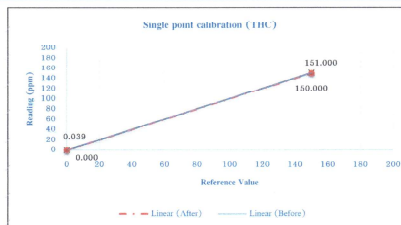
Environmental
Temperature : 26.2 °C
Humidity : 44.1 %RH

Calibration System
Calibrator Units
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514511458 Serial No. : 179

Standard Gas
Propane Conc. : 150 ppm Cylinder No. : 01W001940
Expire Date : 26-Sep-25

Calibration Check

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



Calibrated by :



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

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

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

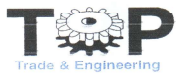
Qstd = standard flow rate
IC = corrected chart response
I = actual chart response
m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg
For subsequent calculation of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

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

Inter 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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Certificate of Analyzer Performance Testing

Calibrated Date : 13-Jan-25 Certificate No. : 0125-002
Page : 1/1

Analyzer Instruments
Analyzer Type : THC Analyzer Manufacturer : Baseline
Model : Series 8800 Serial No. : 584

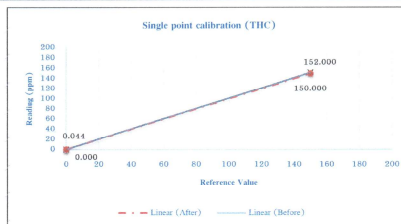
Environmental
Temperature : 26.7 °C
Humidity : 44.0 %RH

Calibration System
Calibrator Units
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514511458 Serial No. : 179

Standard Gas
Propane Conc. : 150 ppm Cylinder No. : 01W001940
Expire Date : 26-Sep-25

Calibration Check

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



Calibrated by :



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

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

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

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

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

Inter 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: 10 Oct 25
Sampler: TE-5000 TSP	Serial No: 3270	Tech: Tong P

Site Conditions

Barometric Pressure (in Hg): 28.50	Corrected Pressure (mm Hg): 723.9
Temperature (deg F): 75.3	Temperature (deg K): 297.2
Average Press. (in Hg): 27.33	Corrected Average (mm Hg): 694.2
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: 22 October 2025

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.20	1.782	60.4	59.03	Slope: 38.8216
2	6.55	1.594	55.6	54.34	Intercept: -9.3751
3	5.60	1.474	47.9	46.81	Corr. Coeff: 0.9935
4	4.55	1.330	43.3	42.32	
5	4.10	1.112	34.5	33.72	# of Observations: 5

Calculations

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

Qstd = standard flow rate
IC = corrected chart response

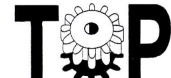
I = actual chart response
m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg
For subsequent calculation of sampler flow:
 $1/m[(1)[\sqrt{(298/Tav)(Pav/760)}]] - b]$

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

Enter Average I (chart):	48.3
Average Flow Calculation m3/min	1.433237179
Average Flow Calculation in cfm	50.60865679
Sample Time (Hrs):	24.0
Total flow in 24 hours m3/min	2063.861538
Total flow in 24 hours cfm	72876.46578

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

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Trade & Engineering
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

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

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:

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

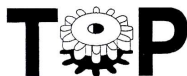
SFR = sampler set point flow rate
SSP = sampler chart set point
m = sampler slope
b = sampler intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
Ts = Average temperature (deg K)
Ps = Average pressure (mm Hg)

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

Average I (chart):	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

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 25
Sampler: TE-5000 TSP	Serial No: 3271	Tech: Tong P

Site Conditions

Barometric Pressure (in Hg): 28.30	Corrected Pressure (mm Hg): 718.8
Temperature (deg F): 75.7	Temperature (deg K): 297.4
Average Press. (in Hg): 27.50	Corrected Average (mm Hg): 698.5
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: 22 October 2025

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.35	1.791	60.5	58.89	Slope: 36.3288
2	6.60	1.594	55.7	54.22	Intercept: -5.0713
3	5.30	1.429	48.5	47.21	Corr. Coeff: 0.9949
4	4.60	1.332	44.3	43.12	
5	4.25	1.112	35.8	34.85	# of Observations: 5

Calculations

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

Qstd = standard flow rate
IC = corrected chart response

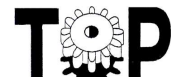
I = actual chart response
m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg
For subsequent calculation of sampler flow:
 $1/m[(1)[\sqrt{(298/Tav)(Pav/760)}]] - b]$

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

Enter Average I (chart):	49.0
Average Flow Calculation m3/min	1.433574848
Average Flow Calculation in cfm	50.62058014
Sample Time (Hrs):	24.0
Total flow in 24 hours m3/min	2064.347782
Total flow in 24 hours cfm	72893.6354

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

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Trade & Engineering
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

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

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:

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

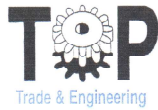
SFR = sampler set point flow rate
SSP = sampler chart set point
m = sampler slope
b = sampler intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
Ts = Average temperature (deg K)
Ps = Average pressure (mm Hg)

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

Average I (chart):	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

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PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 17 September 2025
Sampler: TS-6070 PM10 Serial No: 3245 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 27.06 Corrected Pressure (mm Hg): 697.3
Temperature (deg F): 75.7 Temperature (deg K): 297.3
Average Press. (in Hg): 26.70 Corrected Average (mm Hg): 678.2
Average Temp. (deg F): 75.5 Average Temp. (deg K): 297.2

Calibration Orifice

Make: Tisch Environmental, Inc. Qstd Slope: 1.37894
Model: TS-5028A Qstd Intercept: -0.01520
Serial#: 1179 Calibration Due Date: 28 Oct 25

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	9.50	1.293	61.0	40.12	Slope 39.0144
2	7.80	1.173	57.8	39.01	Intercept 2.0161
3	6.60	1.080	53.5	35.18	Corr. Coeff 0.9603
4	5.80	1.037	51.3	33.74	SFR 1.115
5	5.15	1.006	46.8	30.78	SSP 53.97

of Observations: 5

Calculations

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

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

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)

Average I (chart): 54.3
Average Flow over Sample (m3/min): 1.125540678
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min): 1620.778576
Total flow over sample (CFM): 5729.69153

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

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เอกสารการสอบเทียบเครื่องมือวัดความชื้น



PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 24 October 2025
Sampler: TS-6070 PM10 Serial No: 3524 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 27.20 Corrected Pressure (mm Hg): 690.9
Temperature (deg F): 75.8 Temperature (deg K): 297.3
Average Press. (in Hg): 26.71 Corrected Average (mm Hg): 678.4
Average Temp. (deg F): 76.2 Average Temp. (deg K): 297.6

Calibration Orifice

Make: Tisch Environmental, Inc. Qstd Slope: 1.37894
Model: TS-5028A Qstd Intercept: -0.01520
Serial#: 1179 Calibration Due Date: 28 Oct 25

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	9.45	1.207	61.1	40.00	Slope 37.2075
2	7.50	1.147	56.8	37.26	Intercept 2.2654
3	6.25	1.048	53.5	35.10	Corr. Coeff 0.9634
4	5.50	1.037	51.2	33.59	SFR 1.109
5	4.90	1.006	48.3	31.69	SSP 54.11

of Observations: 5

Calculations

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

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

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)

Average I (chart): 54.3
Average Flow over Sample (m3/min): 1.117476082
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min): 1609.162537
Total flow over sample (CFM): 56919.63583

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

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

Certificate No.: CP20240388EA
Operation No.: CP2024100354

Certificate of Calibration

Equipment: Vibration Meter
Manufacturer: InstanTel
Model/Type: Micromate
Serial No.: UM14163
ID No.: VB-01-001
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran, Nakorn Phatom 73210
Received Date: 16 October 2024
Calibrated Date: 7 - 15 November 2024
Issued Date: 20 November 2024
Calibrated by: Ms. Juntaporn Kunhakom

Approved by:

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Certificate No.: CP20240388EA

Calibration Report

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

Method of Calibration :-

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

Condition of this result of calibration

1. Reference standards instrument :-

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

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	

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	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	0.286	1.50	
10.0	10.000	9.984	10.267	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 --



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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

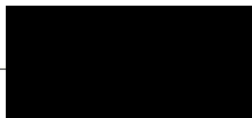
Received Date: 18 March 2025

Calibrated Date: 9 - 10 April 2025

Issued Date: 11 April 2025

Calibrated by: Ms. Juntaporn Kunhakom

Approved by:



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F-CAL-004 Ed.1



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	10.000	10.120	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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F-CAL-005 Ed.1



ELECTRICAL AND ELECTRONICS INSTITUTE
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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	Z525	2685961	AV-0034-24	1-Aug-2025
3) IAN 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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F-CAL-005 Ed.1



ELECTRICAL AND ELECTRONICS INSTITUTE
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	

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F-CAL-005 Ed.1



ELECTRICAL AND ELECTRONICS INSTITUTE
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	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 --

CAL

Calibratech Co.,Ltd.

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



Certificate of Calibration

Certificate No. : 68-400172-1

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 controlled enclosure (Refrigerator)
Manufacturer : Samchai Model : LD2 DC 70
Range : N/A °C Resolution : 1 °C
Serial No. : 85545 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 : Permpon Changu

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)

Approv

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



CAL

Calibratech Co.,Ltd.

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

Certificate of Calibration

Certificate No. : 68-400172-1

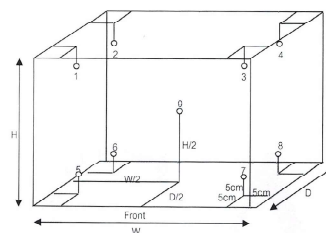
Page : 2 of 2

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)
4	4	4	1.29	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%

- o O o -

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพน้ำ

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

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)

Approve

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

Certificate of Calibration

Certificate No. : 68-430004-1 **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 : Digital Conductivity meter (Pocket)
Manufacturer : XS Instruments Model : PC 5
Serial No. : GB 0706/074 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 : 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 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

Approve

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

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) -

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	UUC Reading	Correction	Uncertainty (±)	Unit
Conductivity Solution				
84*	79.7	4.3	1.1	µS/cm
1413	160.2	-18.9	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	UUC Reading	Correction	Uncertainty (±)	Unit
Conductivity Solution				
84*	84.0	0.0	1.1	µS/cm
1413	141.3	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%

- (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 เพื่อให้บริการตามขอบข่ายของบริการ เฉพาะ ในวันและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากวัน เวลา ราชการ (วันหยุดเสาร์ – อาทิตย์ หรือวันหยุด นักชดถรณ์) บริษัทฯ จะคิดค่าบริการเพิ่มเติมตามอัตราที่กฎหมายแรงงานกำหนดไว้

ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายงานผลการตรวจสอบเครื่องมือ

หมายเหตุ

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

Preventive Maintenance Contract

จำนวนใบการจ้างสัญญาบริการ ...1...ครั้งต่อปี
ครั้งที่ 1, วันที่ 14/05/2025.....

รายละเอียดผู้รับบริการ

หน่วยงาน	บริษัท ซี.อี.เอ็ม เทคโนโลยี (ไทยแลนด์) จำกัด		
ที่อยู่	219/43 หมู่ 2 ถนนเพชรเกษม ตำบลอัมพรมัย อำเภอดำรงวิทยารพณ จัหวัดสมุทรสาคร 74130		
โทรศัพท์	0869054664	แฟกซ์	-

ผู้ติดต่อ

ชื่อ - นามสกุล	คุณศิริพร พินทา				
ตำแหน่ง	เจ้าหน้าที่ห้องปฏิบัติการ				
โทรศัพท์	0869054664	เบอร์โทร	-	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 : คุณจิรายุทธ สดอาด	
เจ้าหน้าที่ให้บริการ	นายจิรายุทธ สดอาด
ตำแหน่ง	Specialist, Technical Service
โทรศัพท์	0938138736
E-mail	Jirayut.js@dksh.com

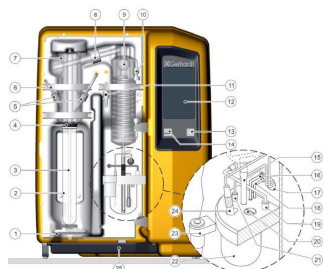
ลงนามผู้รับบริการ		ลงนามผู้ให้บริการ	<i>Jirayut Sadee-Ad</i>
ตำแหน่ง	(.....)	ตำแหน่ง	(นาย จิรายุทธ สดอาด)
ตำแหน่ง		ตำแหน่ง	Specialist, Technical Service
วันที่ / ประทับตราบริษัท		วันที่ / ประทับตราบริษัท	14/05/2025

JOB:VQ-00070598.....MODEL:VAP.200.....S/N: GER5200180181.

Operational Qualification (OQ)

ตรวจสอบสภาพเครื่อง

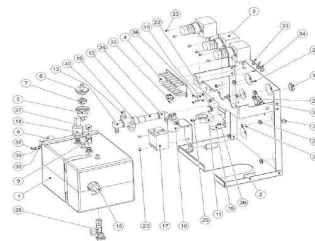
FRONT



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	☒	☐	☐

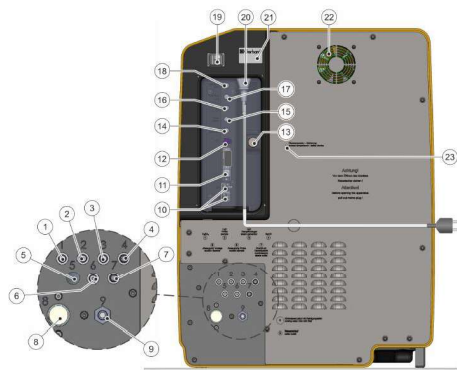
** only VAP 450

Inside Steam generator



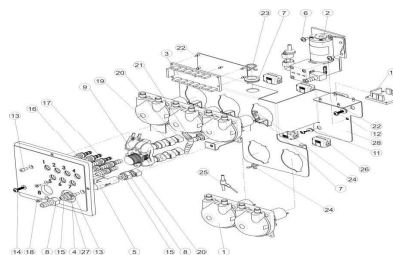
No		PASS	FAIL	N/A
1	Steam generator	☒	☐	☐
2	Steam generator traverse	☒	☐	☐
3	Pinch valve	☒	☐	☐
4	Circuit board distributor	☒	☐	☐
5	Valve tubing connection	☒	☐	☐
6	Housing safety valve	☒	☐	☐
7	Safety valve SKT	☒	☐	☐
8	Excess temperature protection , steam generator	☒	☐	☐
9	Safety valve G 1/8 0.5 bar	☒	☐	☐
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	☒	☐	☐

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	☒	☐	☐

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 pump	☒	☐	☐
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	☒	☐

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รายละเอียดการตรวจสอบ

ขั้นตอนการบริการ

ตรวจสอบระบบไฟฟ้า (Electrical Test)

- ความดันทางไฟฟ้าของเครื่องจักร
- 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
- ระบบการเติมน้ำเข้า Sample Tube
- ระบบการเติม Na OH
- ระบบการเติม H3BO3

รายงานผลการให้บริการ

1. TECHNICAL DATA

	Pass	Fail	N/A	Remark
Main Supply 220 volt + 10% 50 Hz with ground	☒	☐	☐	
Nominal current	☒	☐	☐	

1.1 COOLING WATER BATH

	Pass	Fail	N/A	Remark
Temperature 15-20 °C	☒	☐	☐	
Cooling Water Outlet	☒	☐	☐	
Control Temperature	☒	☐	☐	

1.2 OPTICAL TEST VAP200

	Pass	Fail	N/A	Remark
Screw cap GL14	☒	☐	☐	
Screw cap GL18	☒	☐	☐	
Screw cap GL32	☒	☐	☐	
Distillation Head	☒	☐	☐	
Condensor	☒	☐	☐	
Viton Cone	☐	☒	☐	ไม่พบ Viton cone
Ventilation Valve BV	☒	☐	☐	
Micro Switch Sample	☒	☐	☐	
Agitator motor for propeller	☐	☐	☒	

2. SYSTEM COOLING WATER INLET

	Pass	Fail	N/A	Remark
Cooling Water Inlet	☒	☐	☐	
Cooling Water Outlet	☒	☐	☐	
Flow control valve	☒	☐	☐	

3.SYSTEM CONTROL

	Pass	Fail	N/A	Remark
Display	☒	☐	☐	
Program	☒	☐	☐	
Adding NaOH	☒	☐	☐	
Adding H2O	☐	☐	☒	
Adding H3BO3	☐	☐	☒	
Suction Sample	☐	☐	☒	
Suction Receiver	☐	☐	☒	

4.SYSTEM DISTILLATION

	Pass	Fail	N/A	Remark
Boiler	☒	☐	☐	
Level Sensor	☒	☐	☐	
Novopren	☐	☒	☐	ไม่พบ Novopren
Solenoid Valve Shut-Off	☒	☐	☐	
Solenoid Valve Steam	☒	☐	☐	
Solenoid Valve soft steam	☒	☐	☐	
Ventilation Valve Premount	☒	☐	☐	
Excess Pressure Detector	☒	☐	☐	
Heating Element	☒	☐	☐	

5. PUMP

	Pass	Fail	N/A	Remark
Pump H ₂ O Steam	☒	☐	☐	
- Non-Return Valve	-	-	-	
Pump H ₂ O Sample	☐	☐	☒	
- Non-Return Valve	-	-	-	
Pump NaOH	☒	☐	☐	
- Non-Rutum Valve	☒	☐	☐	
Pump H3BO3	☐	☐	☒	
- Non-Rutum Valve	☐	☐	☒	
Pump suction	☐	☐	☒	
Pump suction receiver	☐	☐	☒	

6. The Following Program Run :

	Pass	Fail	N/A	Remark
Addition H2O 0-999 ml.	☐	☐	☒	
Addition NaOH 0-999 ml.	☒	☐	☐	
Addition H3BO3 0-999 ml.	☐	☐	☒	
Reaction Time 0-108 min	☒	☐	☐	
Distillation Time 0-108 min	☒	☐	☐	
Steam Capacity 10%-100%	☒	☐	☐	
Suction Sampe	☐	☐	☒	
Suction Receiver	☐	☐	☒	

7. Measured pumps

	Pass	Fail	N/A	Remark
Pump NaOH				
Volume : ..13.33.....ml				

Remark : ไม่พบ condensor ไม่พบสกรู viton cone ไม่พบ novopren ไม่พบ

ข้อมูลสนับสนุนด้านเทคนิค (General Technical Support)

การบำรุงรักษาทั่วไป (Basic maintenance)

Cleaning program

Glass parts and tubes must be rinsed 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
Sudden sample	30 s

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

General error message

Fault description	Cause	Remedy
'Cooling water flow volume too low'	Cooling water pressure under 1 bar	■ Open water tap. ■ Check coolant 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.
'Distillation 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	■ Fill storage tank. ■ Check correct seating of the universal sensors. The running program can be continued after rectification of the error.
	The sample waste tank is full	■ Empty sample waste tank. ■ Check correct seating of the universal sensors. The running program can be continued after rectification of the error.

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

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.
	Violent reaction in the digestion tube, sodium hydroxide drops get into the receiver.	■ Increase of the water addition amount.
	Glass bridge of the condenser is broken or torn 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.
Analyte result too low or no result	Enrichment of ammonia from the previous sample.	■ Increase distillation time. ■ Check whether the sample was previously sufficiently alkalinised.
	Incomplete distillation; distillation time too short.	■ No quantitative evaporation of the ammonia content. ■ The distillation amount should be 100 ml.
	Ammonia escapes at leaking places.	■ Soiled or defective Viton plugs; clean or replace. ■ Check seals (GL screw connections) on the distribution head; replace if necessary. ■ Check valve at the condenser is gummed up; clean or replace. ■ Digestion tube is damaged at the neck extension. ■ Distribution head glass leaks; replace.
	Addition amount of the sodium hydroxide too little; no ammonia development.	■ 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 which are not destroyed with sodium hydroxide.	■ This problem only occurs with catalysts containing mercury. Sodium sulphate solution destroys these compounds.

เงื่อนไขการให้บริการ Preventive Maintenance

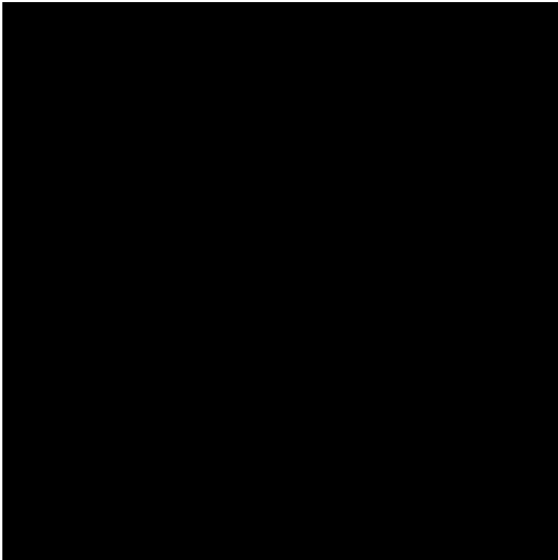
บริษัทฯ จะส่งวิศวกรผู้ชำนาญ เพื่อให้บริการตรวจเช็คของบริการ เฉพาะ ในวันและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากรับ เวลา ราชการ (วันหยุดเสาร์ – อาทิตย์ หรือวันหยุด นักชดุดาน) บริษัทฯ จะคิดค่าบริการเพิ่มเติมตามอัตรา ที่กำหนดไว้

ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายการผลการตรวจสอบเครื่องมือ

หมายเหตุ

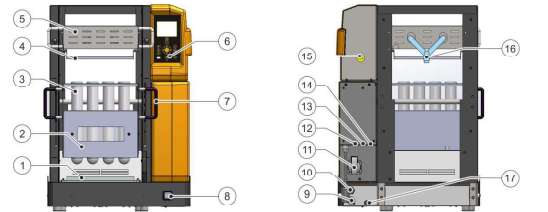
- ราคาเป็นรวมค่าบริการซ่อม หรือ เปลี่ยนอะไหล่ที่ชำรุดเสียหาย หรือหมดสภาพการใช้งาน
- ในกรณีที่ผู้รับบริการอยู่นอกเขตพื้นที่ให้บริการ บริษัทฯ จำเป็นต้องคิดค่าใช้จ่ายเพิ่มเติม ได้แก่ ค่าเดินทาง เป็นต้น
- บริษัทฯ ขอสงวนสิทธิ์ในการเปลี่ยนแปลงราคา โดยไม่แจ้งให้ทราบล่วงหน้า



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

Part 3: ตรวจเช็คสภาพเครื่อง

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	☒	☐	☐	

Preventive Maintenance Contract

จำนวนใบการทำสัญญาบริการครั้งต่อปี
ครั้งที่ 1, วันที่ 14/05/2025.....

รายละเอียดผู้รับบริการ

หน่วยงาน	บริษัท ซี.เอ็ม. เทคโนโลยี (ไทยแลนด์) จำกัด				
ที่อยู่	219/43 หมู่12 ถนนเพชรเกษม ตำบลจอมน้อย อำเภอกระทุ่มแบน จังหวัดสมุทรสาคร 74130				
โทรศัพท์	0869054664	แฟกซ์	-		

ผู้ติดต่อ

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

รายละเอียดผู้ให้บริการ

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

ลงนามผู้รับบริการ		ลงนามผู้ให้บริการ	<i>Jirayut Saibud</i>
ตัวบรรจง	(.....)	ตัวบรรจง	(นาย.จิรายุ. ปลอด)
ตำแหน่ง		ตำแหน่ง	Specialist, Technical Service.
วันที่ / ประทับตราบริษัท		วันที่ / ประทับตราบริษัท	14/05/2025

Part 4: รายละเอียดรายงานผลการให้บริการ Preventive Maintenance

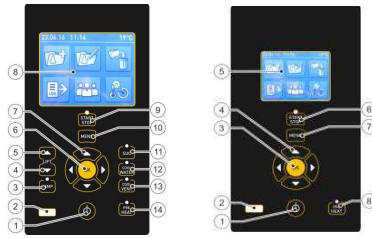
4.1 ตรวจเช็คระบบไฟฟ้า

	Pass	Fai	N/A	Remark
ใช้ไฟ 220 V50 Hz	☒	☐	☐	
กระแสไฟฟ้าตามพิกัดเครื่อง	☒	☐	☐	

4.2 ตรวจสอบสภาพอุปกรณ์ภายนอก

	Pass	Fail	N/A	Remark
สายไฟของเครื่อง	☒	☐	☐	
ท่อความร้อน Isolard	☒	☐	☐	
สายเบรคกับท่อความร้อน Isolard	☒	☐	☐	
สภาพของ Aluminum block	☒	☐	☐	เสื่อมสภาพ
การเชื่อมของ Lift	☐	☐	☒	
Light	☐	☐	☒	
Current Switch	☒	☐	☐	
Thermostat	☒	☐	☐	

4.3 ตรวจสอบการทำงาน



☐ 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 VENT button (optional)	☐	☐	☒	
PRE HEAT button	☒	☐	☐	
การขึ้นของอุณหภูมิมากกว่า10องศาต่อวินาทีที่250องศา	☒	☐	☐	
การทำงานของลิฟท์ขึ้นอุณหภูมิสูงเกิน	☒	☐	☐	
การทำงานของระบบควบคุมอุณหภูมิ	☒	☐	☐	

การบำรุงรักษาทั่วไป (Basic maintenance)

- การย่อยตัวอย่างเกิดการเดือดที่รุนแรงขึ้นเนื่องจากตัวอย่างนั้นสามารถป้องกันได้โดยแนะนำให้ย่อยด้วยการตั้งการเพิ่มอุณหภูมิเป็นระดับขั้น ย่อยที่ระดับอุณหภูมิ 250 C ครบเวลา 15 นาทีจึงเปลี่ยนเป็นอุณหภูมิ 380 C เพื่อป้องกันการเดือดออกมา
- เมื่อใช้เสร็จไม่ควรปล่อยให้ Tube เย็นกับตัวเครื่อง
- ต้องนำเอาหลอดไอกรดใส่ทุกครั้งหลังจากใช้งานเสร็จ เพื่อป้องกันการหยดของไอกรดที่จะไหลลงมาที่ตัวเครื่อง
- ทำความสะอาดตัวหลุมย่อยด้วยน้ำหรือผ้าชุบน้ำในกรณีที่มีคราบกรดไหลลงมาติดอยู่ในหลุม เพื่อป้องกันไม่ให้คราบดังกล่าวไปกับการเพิ่มอุณหภูมิ



Certificate of Calibration

Equipment:	Cooled Incubator	Certificate No.:	C31250348
Model:	KB 240	Issued Date:	10 February 2025
Serial No.(or ID):	20180000012164 (WW-16-001)	Job No.:	WO-00060640
Manufacturer:	Binder	Page:	1 of 3
Condition:	In Condition	Ventilation Valve:	Closed
Shelves(pc):	3		

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

Environment Condition:	Temperature:	22 °C	±	1.0 °C
	Humidity:	61 %RH	±	5.3 %RH
	Voltage:	230 VAC	±	1.5 VAC

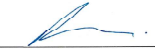
Calibration Place: C.E.M Technology (Thailand) Co., Ltd. (Laboratory Room)
219/43 Moo 12 Petchkasem Road,
Omnoi Krathum Baen, Samut Sakhon 74130 Thailand

Calibration By: Mr. Tweewong Thailiang

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 (NIM), Thailand through UKSH Technology Limited.
Certificate No. C10240018


(Mr. Tweewong Thailiang)

Person in charge


(Mr. Udon Srichana)

Authorized signatory

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.

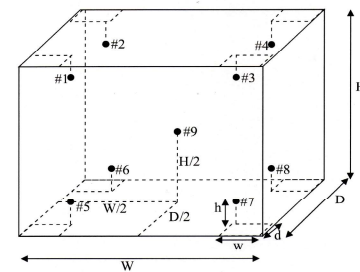
บริษัท เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Phone: +66 2039 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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

บริษัท เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Phone: +66 2039 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:

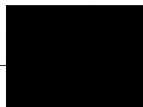
This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

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

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
Phone: +66 2839 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

ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-0006040

ชนิดเครื่องมือ: Cooled Incubator

รุ่น: KB 240

หมายเลขเครื่อง: 2018000012164 (WW-16-001)

ตรวจสอบ (รับ)		รายการตรวจสอบ	ตรวจสอบ (ส่ง)		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 พัดลม	☒	☐	
☐	☐	6. สลัก Lever of Ventilation valve	☐	☐	ไม่มี
☒	☐	7. สลัก Lever door open / close	☒	☐	
☒	☐	8. สลัก Door seal	☒	☐	
☒	☐	9. การทำงานของระบบ Safety	☒	☐	
☒	☐	10. การทำงานของระบบทำความเย็น	☒	☐	
☐	☐	11. การทำงานของระบบทำความร้อน	☐	☐	ไม่มี
☒	☐	12. สลักตัวเครื่อง	☒	☐	
☒	☐	13. สลักแฉกคอม. ณ สถานที่ตั้งเครื่อง	☒	☐	

ข้อเสนอแนะ :

Mr. Tweepong Thaihiang

Service Engineer

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
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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)*
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

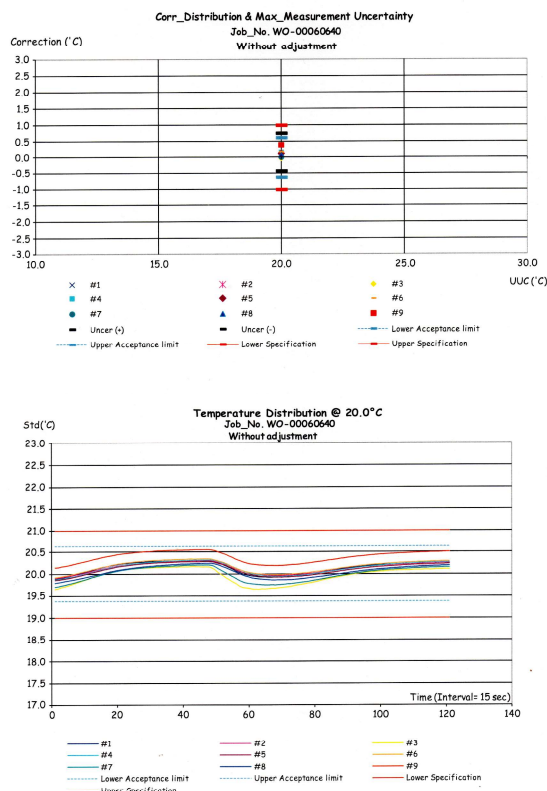
Note: * Maximum uncertainty of the each position

The End of Certificate

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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.): Z

Certificate No.: C31250347
Issued Date: 10 February 2025
Job No.: WO-00060640
Page: 1 of 4
Ventilation Valve: Closed

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: 01 %RH ± 5.0 %RH
Voltage: 230 VAC ± 1.5 VAC

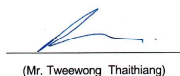
Calibration Place: C.E.M Technology (Thailand) Co., Ltd. (Laboratory Room)
219/43 Moo 12 Petchkasem Road,
Omnoi Krathum Baen, Samut Sakhon 74130 Thailand

Calibration By: Mr. Tweekong 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


(Mr. Tweekong Thaitiang)
Person in charge

This certificate is issued the units of measurement according to the International System of Units (SI) and is traceable 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 a 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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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)*
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

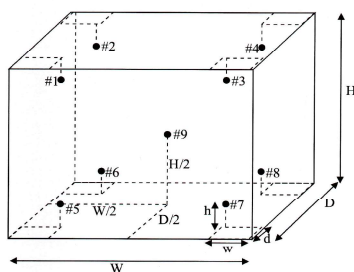
Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	0.76	0.18	1.04

Note: * Maximum uncertainty of the each position

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Delivering Growth - in Asia and Beyond.

CAL-FM-C31-10: 12 Sep 2022



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.

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Delivering Growth - in Asia and Beyond.

CAL-FM-C31-10: 12 Sep 2022

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)*
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

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DKSH Technology Limited
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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

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

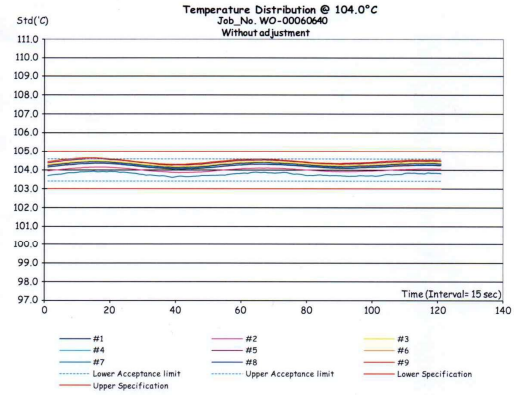
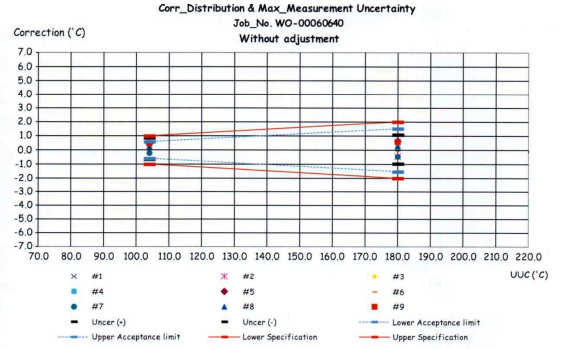
Desired Temperature : 104.0 °C Tolerances : 1.0 °C

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

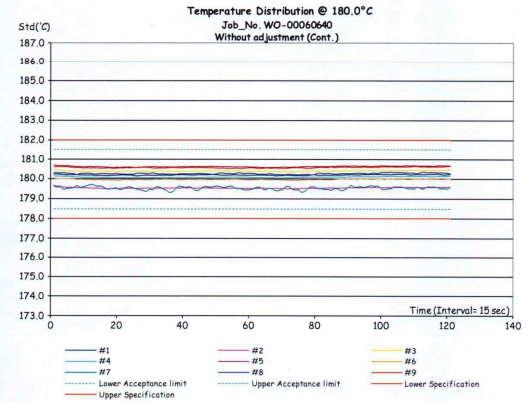
Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

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



ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

ชนิดเครื่องมือ: Hot Air Oven รุ่น: UF 55
หมายเลขเครื่อง: B219.0142 (WW-05-002)

เลขที่ใบงาน: WO-00060640

ตรวจสอบ (วัน)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		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. สภาพ Lever of Ventilation valve	☒	☐	
☒	☐	7. สภาพ Lever door open / close	☒	☐	
☒	☐	8. สภาพ Door seal	☒	☐	
☒	☐	9. การทำงานของระบบ Safety	☒	☐	
☐	☐	10. การทำงานของระบบทำความเย็น	☐	☐	ไม่มี
☐	☐	11. การทำงานของระบบทำความร้อน	☐	☐	ไม่มี
☒	☐	12. สภาพตัวเครื่อง	☒	☐	
☒	☐	13. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	☒	☐	

ข้อแนะนำ:

Mr. Tweewong Thaihiang
Service Engineer

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

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%

- e00 -



CAL-F0031-03

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

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 Sheath Material : Stainless
Diameter : 4.8 mm. Length : 100 mm.
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) %
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 : Permpon 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

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

Approved



The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

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

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 : Permpon 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 17025
6.987	61297593	1027614	15 Sep 2025	CPA Chem Ltd. Accredited to ISO 17025
10.010	61306165	1027613	15 Sep 2025	CPA Chem Ltd. Accredited to ISO 17025

Approved by



The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

Certificate of Calibration

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		Correction (mV)	Uncertainty (± mV)
			(pH)	(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 (± 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%

- 000 -

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 Conductivity Solution	UUC Reading	Correction	Uncertainty (±)	Unit
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 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%

- 000 -

CAL-F0031-03

Certificate of Calibration

Certificate No. : 68-430004-2

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 : 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 : Permpon 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

Approved by

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

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 : Permpon 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)

Approved by

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

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%

- o(0) -

CAL-F0031-03

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, Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

Equipment : pH Meter with electrode

pH meter

Manufacturer : Thermo Scientific Model : VERSA STAR PRO

Range : N/A pH 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 : Permpoon 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

Approved by

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

Certificate of Calibration

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		Correction (mV)	Uncertainty (± mV)
			(pH)	(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 (± 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%

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CAL-F0031-03

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 : Permpoon 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

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

Certificate of Calibration

Certificate No. : 68-40089-1

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%

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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 (±)	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

CALIBRATION CERTIFICATE

Certificate No.S2503003S

page 1 of 2

Customer : C.E.M TECHNOLOGY (THAILAND) CO., LTD.
219/43 Moo 12 Petchkasem Road, Omnoi,
Krathumban, Samutsakorn 74130

Equipment : Non-automatic weighing instrument (Electronic instrument)
Manufacturer : Sartorius **Order No. :** 68S0877-1
Model : BSA224S-CW **Ambient temperature :** (20.2 ± 5.0) °C
Accuracy class : - **Relative humidity :** (54.5 ± 10.0) %
Capacity : 220 g **Received date :** 01-Mar-2025
Resolution : 0.0001 g **Date of calibration :** 01-Mar-2025
Serial No. : 3139614148 **Date of issue :** 01-Mar-2025
ID No. : CI-01-003 **Condition of the balance :** Good working conditions
Place of calibration : กรุงเทพมหานคร

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	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.

Calibrated By : Sathaporn Rueangpluppla
Technician

Approved Signatory :

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

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 **Order No. :** 68S1799-1
Model : QUINTIX224-1S **Ambient temperature :** (23.9 ± 1.0) °C
Accuracy class : - **Relative humidity :** (38.9 ± 5.0) %
Capacity : 220000 mg **Received date :** 30-Apr-2025
Resolution : 0.1 mg **Date of calibration :** 30-Apr-2025
Serial No. : 0035009070 **Date of issue :** 03-May-2025
ID No. : CI-01-002 **Condition of the balance :** Good working conditions
Place of calibration : กรุงเทพมหานคร

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	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.

Calibrated By : Aekhasak Silarat
Technician

Approved Signatory :

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

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	0.13	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--