

ภาคผนวกที่ 4

สรุปเอกสารสอบเทียบอุปกรณ์เครื่องมือ

เอกสารการสอบเทียบเครื่องมือตรวจวัดระดับเสียงในบรรยากาศ



**ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT**
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Certificate No.: CP20240384EA
Operation No.: CP2024100365

Certificate of Calibration

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

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.

Page 1 of 7

F-CAL-004 Ed.1



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

Certificate No.: CP20240384EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: ACO
Model/Type: 6236 (Meter), 7052 (Microphone), - (Preamplifier)
Serial No.: 222129 (Meter), 72838 (Microphone), - (Preamplifier)
ID No.: NS-03-014
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-
IEC61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2661000	AA-1007-24	6 June 2025
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2913	EF-0021-24	3 June 2025
4) 6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P240022 CD20240180EA	20 March 2025 7 August 2025
6) Performance Audio Analyzer	U8903B	MY56510003	CB20240035EB CK20240069EA	13 February 2025 19 September 2025

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

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

- Reference standards instrument for Acoustic function
- National Institute of Metrology (Thailand)
- Electrical and Electronics Institute; NSC Accredited Calibration No.0119
- Reference standards instrument for Electrical function
- National Institute of Metrology (Thailand)
- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

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



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

Certificate No.: CP20240384EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value
(dB)
20.7

2.2 Microphone replaced by the electrical input signal device

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

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

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	-0.4	-0.6	-0.5	±1.5
1000	-0.7	-0.7	-0.7	±1.0
8000	1.5	1.8	1.8	±5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Certificate No.: CP20240384EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Function : 6. Long-Term Stability

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

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

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

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

Page 4 of 7

F-CAL-005 Ed.1

Certificate No.: CP20240384EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	58.9	-0.1	±1.1
54.0	53.9	-0.1	±1.1
49.0	48.9	-0.1	±1.1
44.0	43.9	-0.1	±1.1
39.0	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
33.0	33.0	0.0	±1.1
32.0	32.1	0.1	±1.1
31.0	31.2	0.2	±1.1
30.0	30.4	0.4	±1.1
29.0	29.7	0.7	±1.1

Function : 8. Level Linearity including level range control

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

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

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

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

Page 5 of 7

F-CAL-005 Ed.1

Certificate No.: CP20240384EA

Calibration Report

Function : 9. Tone burst response

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

Function : 10. Peak C sound level

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

Function : 11. Overload indication

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

Function : 12. High-Level Stability

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

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

Page 6 of 7

F-CAL-005 Ed.1

Certificate No.: CP20240384EA

Calibration Report

Uncertainty of measurement

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

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

-- End of Report --

Page 7 of 7

F-CAL-005 Ed.1



Certificate No.: CP20240126EA
Operation No.: CP2024030095

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: ACO
Model/Type: 6236 (Meter), 7052NR (Microphone), - (Preamplifier)
Serial No.: 222186 (Meter), 84150 (Microphone), - (Preamplifier)
ID No.: NS-03-016
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran,
Nakorn Phatom 73210
Received Date: 7 March 2024
Calibrated Date: 13 - 18 March 2024
Issued Date: 19 March 2024
Calibrated by: Ms. Juntaporn Kunhakom

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

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.

Page 1 of 7

F-CAL-004 Ed.1



Certificate No.: CP20240126EA

Calibration Report

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

Condition of this result of calibration

1. Reference standards instrument :-

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

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

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

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

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

Page 2 of 7

F-CAL-005 Ed.1



Certificate No.: CP20240126EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
21.9

2.2 Microphone replaced by the electrical input signal device

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

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

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

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

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Page 3 of 7

F-CAL-005 Ed.1



Certificate No.: CP20240126EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Function : 6. Long-Term Stability

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

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

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

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

Page 4 of 7

F-CAL-005 Ed.1

Certificate No.: CP20240126EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

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

Function : 8. Level Linearity including level range control

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

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

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

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

Certificate No.: CP20240126EA

Calibration Report

Function : 9. Tone burst response

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

Function : 10. Peak C sound level

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

Function : 11. Overload indication

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

Function : 12. High-Level Stability

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

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

Certificate No.: CP20240126EA

Calibration Report

Uncertainty of measurement

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

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

-- End of Report --

Certificate No.: CP20250051EA
Operation No.: CP2025020038

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: ACO
Model/Type: 6236 (Meter), 7052NR (Microphone), - (Preamplifier)
Serial No.: 222186 (Meter), 84150 (Microphone), - (Preamplifier)
ID No.: NS 03 016
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran, Nakorn Phatom 73210
Received Date: 31 January 2025
Calibrated Date: 17 - 19 February 2025
Issued Date: 24 February 2025
Calibrated by: Ms. Iuntaporn Kunhakom

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

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Certificate No.: CP20250051EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: ACO
Model/Type: 6736 (Meter), 7052UR (Microphone), - (Preamplifier)
Serial No.: 222186 (Meter), 84150 (Microphone), - (Preamplifier)
ID No.: NS-03-016
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-
IEC61672-3:2013

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2661000	AA-1007-24	6 June 2025
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2913	EF-0021-24	3 June 2025
4) 6.5 Digit precision multimeter	8846A	9609027	CB20240128EA	31 July 2025
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1 P240022 CD20240180EA	20 March 2025 7 August 2025
6) Performance Audio Analyzer	U89U3B	MY56510003	CR20250030FA CK20240069EA	13 February 2026 19 September 2025

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

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

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

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

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

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



Certificate No.: CP20250051EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
21.3

2.2 Microphone replaced by the electrical input signal device

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

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

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

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

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	-0.1	-0.2	0.1	±2.0
125	0.0	-0.2	0.3	±1.5
250	0.0	0.1	0.4	±1.5
500	0.1	-0.1	0.4	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.5	±2.0
4000	-0.3	-0.3	0.4	±3.0
8000	-0.5	-0.4	0.2	±5.0



Certificate No.: CP20250051EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.1	0.1	±0.2

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	93.9	-0.1	±0.1

Function : 6. Long-Term Stability

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

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

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

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



Certificate No.: CP20250051EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.1	0.1	±1.1
64.0	64.0	0.0	±1.1
59.0	58.9	-0.1	±1.1
54.0	53.9	-0.1	±1.1
49.0	48.9	-0.1	±1.1
44.0	44.0	0.0	±1.1
39.0	39.2	0.2	±1.1
34.0	34.7	0.7	±1.1
33.0	34.0	1.0	±1.1
32.0	33.3	1.3	±1.1
31.0	32.7	1.7	±1.1
30.0	32.1	2.1	±1.1

Function : 8. Level Linearity including level range control

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

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-100	94.0	93.9	-0.1	±1.1
20-110	94.0	94.0	0.0	±1.1
30-120	94.0	94.0	0.0	±1.1
40-130	94.0	94.0	0.0	±1.1

8.2. Level Linearity including the Level range (±dB Above Under-range)

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-80	25.0	25.6	0.6	±1.1
20-90	25.0	25.6	0.6	±1.1
20-100	25.0	25.8	0.8	±1.1
20-110	25.0	25.8	0.8	±1.1
30-120	35.0	35.0	0.0	±1.1
40-130	45.0	44.9	-0.1	±1.1



Certificate No.: CP20250051EA

Calibration Report

Function : 9. Tone burst response

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

Function : 10. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	125.4	125.6	0.2	±3.0
Positive half cycle	124.4	124.2	-0.2	±2.0
Negative half cycle	124.4	124.2	-0.2	±2.0

Function : 11. Overload indication

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

Function : 12. High-Level Stability

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

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

Page 6 of 7

F-CAL-005 Ed.1



Certificate No.: CP20250051EA

Calibration Report

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings		
- Free-field sound pressure response level	0.30	0.60 (10kHz to 4kHz)
4) Electrical signal tests of frequency weightings	0.20	0.70 (>4kHz to 10kHz)
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 IEC 61672-3:2013 Class 2.
5. The coverage factor $k = 2.00$.

-- End of Report --

Page 7 of 7

F-CAL-005 Ed.1



Certificate No.: CP20250052EA
Operation No.: CP2025020039

Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: ACO

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

Serial No.: 222187 (Meter), 84151 (Microphone), - (Preamplifier)

ID No.: NS-03-017

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

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 ($k=1$) 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.

Page 1 of 7

F-CAL-004 Ed.1



Certificate No.: CP20250052EA

Calibration Report

Equipment: Sound Level Meter

Manufacturer: ACO

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

Serial No.: 222187 (Meter), 84151 (Microphone), - (Preamplifier)

ID No.: NS-03-017

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)
-	-	-	-

Page 2 of 7

F-CAL-005 Ed.1

Certificate No.: CP20250052EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
19.8

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	16.9
C-weighting	24.8
Z-weighting	32.3

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

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

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

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

Certificate No.: CP20250052EA

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	94.1	0.1	±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

Certificate No.: CP20250052EA

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	63.9	-0.1	±1.1
59.0	58.9	-0.1	±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	32.9	-0.1	±1.1
32.0	32.0	0.0	±1.1
31.0	31.1	0.1	±1.1
30.0	30.2	0.2	±1.1

Function : 8. Level Linearity including level range control

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

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-100	94.0	93.9	-0.1	±1.1
20-110	94.0	93.9	-0.1	±1.1
30-120	94.0	94.0	0.0	±1.1
40-130	94.0	93.9	-0.1	±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	25.4	0.4	±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	25.4	0.4	±1.1
30-120	35.0	35.0	0.0	±1.1
40-130	45.0	45.1	0.1	±1.1

Certificate No.: CP20250052EA

Calibration Report

Function : 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	116.0	0.0	±1.0
	2	98.9	-0.1	+1.0 ; -2.5
	0.25	89.8	-0.2	+1.5 ; -5.0
Slow	200	109.5	-0.1	±1.0
	2	89.8	-0.2	+1.0 ; -5.0
	0.25	80.9	-0.1	±1.0
LAeq	200	109.0	0.0	+1.0 ; 2.5
	2	90.0	0.0	+1.0 ; 2.5
	0.25	80.9	-0.1	+1.0 ; -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	125.4	0.0	±3.0
Positive half cycle	124.4	124.2	-0.2	±2.0
Negative half cycle	124.4	124.2	-0.2	±2.0

Function : 11. Overload indication

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

Function : 12. High-level Stability

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

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



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20250052EA

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
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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



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 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.



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: $(23 \pm 2) ^\circ\text{C}$
Relative Humidity: $(50 \pm 15) \%$
Pressure: $(101.3 \pm 1.5) \text{ kPa}$

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	23 March 2025
6) Performance Audio Analyzer	U8903B	MY56510003	CD20240180EA	7 August 2025
			CB20250030EA	13 February 2026
			CK20240069EA	19 September 2025

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

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

Reference standards instrument for Acoustic function

National Institute of Metrology (Thailand)

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

Reference standards instrument for Electrical function

National Institute of Metrology (Thailand)

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

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

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



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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 (Hz)	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 64 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	-0.8	± 5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.0	-0.1	-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

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
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	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

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

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	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	125.6	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.: 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 (101 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	0.20	0.30
9) Tone burst response	0.20	0.35
10) Peak C sound level	0.24	0.25
11) Overload indication	0.10	0.10
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.: CP20240353EA
Operation No.: CP2024090328

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: BSWA TECH
Model/Type: BSWA 309 (Meter), MP309 (Microphone), MAZ311 (Preamplifier)
Serial No.: 590101 (Meter), 395615 (Microphone), 590614 (Preamplifier)
ID No.: NS-04-002
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Rai Khiriung, A.Samit Phraia,
Nakorn Phatom 73210
Received Date: 18 September 2024
Calibrated Date: 1 - 2 October 2024
Issued Date: 4 October 2024
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
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Page 1 of 6

F-CAL-004 Ed.1



Certificate No.: CP20240353EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: BSWA TECH
Model/Type: BSWA 309 (Meter), MP309 (Microphone), MAZ311 (Preamplifier)
Serial No.: 590101 (Meter), 395615 (Microphone), 590614 (Preamplifier)
ID No.: NS-04-002
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	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2913	EF-0021-24	3 June 2025
4) 6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P240022 CD20240180EA	20 March 2025 7 August 2025
6) Performance Audio Analyzer	U8903B	MY56510003	CR20240035FR CK20240069EA	13 February 2025 19 September 2025

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

3. This certification is traceable to the international system of unit maintained at :-
- National Institute of Metrology (Thailand)
- Electrical and Electronics Institute; NSC Accredited Calibration No.0119
Reference standards instrument for Electrical function
- National Institute of Metrology (Thailand)
- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

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

Page 2 of 6

F-CAL-005 Ed.1



Certificate No.: CP20240353EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
18.2

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	10.6
C-weighting	13.9
Z-weighting	20.0

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

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.2	0.1	0.2	±1.5
1000	-0.2	-0.2	-0.2	±1.0
8000	-1.0	-1.1	-0.6	±5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Page 3 of 6

F-CAL-005 Ed.1



Certificate No.: CP20240353EA

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

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	33.9	-0.1	±1.1

Page 4 of 6

F-CAL-005 Ed.1



Certificate No.: CP20240353EA

Calibration Report

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

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
29.0	29.0	0.0	+1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.1	0.1	±1.1
25.0	25.1	0.1	±1.1
24.0	24.2	0.2	±1.1
23.0	23.3	0.3	±1.1
22.0	22.4	0.4	±1.1
21.0	21.4	0.4	±1.1
20.0	20.6	0.6	±1.1
19.0	19.7	0.7	±1.1
18.0	18.9	0.9	±1.1

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	131.0	0.0	±1.0
	2	113.9	-0.1	+1.0 ; -2.5
	0.25	104.8	-0.2	+1.5 ; -5.0
Slow	200	124.5	-0.1	±1.0
	2	104.9	-0.1	+1.0 ; -5.0
	0.25	95.8	0.2	+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	130.4	130.0	-0.4	±3.0
Positive half cycle	129.4	129.2	-0.2	±2.0
Negative half cycle	129.4	129.2	-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		
136.4	136.2	-0.2	±1.5



Certificate No.: CP20240353EA

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	134.0	134.0	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	
2) Self generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.24	0.25
11) High-Level Stability	0.10	0.10

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

-- End of Report --



Certificate No.: CP20250053EA
Operation No.: CP2025020040

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: SCARLEI 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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The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k) providing a level of confidence or 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.: CP20250053EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: SCARLEI TECH
Model/Type: ST11D (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 : 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	0.1	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

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

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
24.0	23.8	-0.2	±0.8
21.0	20.8	-0.2	±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
	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) 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 CALIBRATION

NO. 20240313386

Name of Product: Sound Level Meter
Model: ST-11D
Serial Number: 821486
Specification: Class 1
Conclusion: Pass
Date of calibration: 2024-03-22
Due Date: 2025-03-21

Calibrated by: *Jim Lin*



- I. This report certifies that all calibration equipment used in the test is traceable with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass them, and applies only to the unit identified above.
II. This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
III. This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlet Tech Co Ltd Taiwan.

1. Preliminary inspection: OK

2. Type & serial No. of Microphone: AWA14425-61344

4. Measuring up limits: 140 dBA

3. Adjustments to indicated sound levels:

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

Type of Calibrator: B&K 4231

Sound Pressure Level: 94.0 dB

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

Nominal frequency / Hz	Frequency weighting / dB			Nominal frequency / Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
10	-71.5	-14.9	-1.0	1000	0.0	0.0	-0.1
20	-50.4	-6.4	-0.4	2000	1.3	-0.2	-0.1
25	-30.6	-3.1	-0.4	4000	1.1	-0.7	0.0
63	-26.3	-0.9	-0.2	8000	-1.0	-3.0	0.0
125	-16.2	-0.2	-0.1	12500	-6.0	-7.9	-0.1
250	-8.7	-0.1	-0.1	16000	-11.7	-13.7	0.0
500	-3.2	0.0	-0.1	20000	-23.8	-25.8	-0.3

6. Self-generated noise

Microphone replaced by electrical input signal device

9.4 dB(A)	10.2 dB(C)	16.5 dB(Z)
-----------	------------	------------

7. F&S Weighting

Rate of the F weighting decrease (dB/s)	35.2
Rate of the S weighting decrease (dB/s)	4.3
Deviation of F&S	-0.1

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

Reference sound level 90.0 dB

Max error at 10dB steps upper reference sound level 0.1 dB

Max error at 1dB steps within 5dB of the upper limit linear operating range 0.0 dB

Max error at 10dB steps below reference sound level 0.1 dB

Max error at 1dB steps within 5dB upper the lower limit linear operating range 0.1 dB

9. Tone burst response (A Weighting) :

Single Toneburst duration / ms	Toneburst response / dB			
	L _{center} -L _a	L _{center} -L _a	L _a -L _a	L _{center} -L _a
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-7.4	-6.9	-7.0
2	-17.9	-26.9	-26.9	-7.0
0.25	-27.2	/	-36.0	-7.0

10. Peak C sound level (500Hz) :

Cycle	One cycle	nominal value	Positive half	nominal value	Negative half	nominal value
LCpeak-LC(dB)	3.4	3.5	2.4	2.4	2.4	2.4

11. Overload indication: Pass

12. Statistical analysis function

Sweep signal maximum indicated sound level: 112.8 dB

Sweep amplitude: 40 dB

Scan cycle time: 60 S; Measurement period: 180 S.

G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 17 E 30064

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226
SERIAL No. : 090057
ID No. : CEM-SI-02
SUBMITTED BY : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.
219/43 MOO 12, PETCHKASEM RD., OMNOI,
KRATHUMBAN SAMUTSAKORN 74130

CALIBRATED BY : *Suravit K.*
CALIBRATION DATE : 10-April-25

APPROVED BY : *Dongwan P.*
AUDIT P.

ISSUED DATE : 10-April-25

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
L _{Aeq,T}	103.2	103.2	0.0
L ₅	110.8	110.8	0.0
L ₁₀	108.8	108.8	0.0
L ₅₀	92.9	92.8	0.1
L ₉₀	76.9	76.8	0.1
L ₉₅	75.0	74.9	0.1

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

Environment conditions:

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

Reference equipment used in the calibration:

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

Test specifications:

- All Scarlet's Sound level Meter has been calibrated in accordance with the requirements as specified in ISO 17025 and the lab calibration procedure SMTP004-CA-152.
- The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.
- The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responses of the Sound Level Meter.

References:

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

G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 17 E 30064

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226 SERIAL NUMBER : 090057
ID No. : CEM-SI-02
RECEIVED DATE : 7-April-25 CALIBRATION DATE : 10-April-25
AMBIENT TEMPERATURE : 22 °C ± 3°C RELATIVE HUMIDITY : 60%RH ± 20%RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

INSTRUMENT MODEL SERIAL No. CERTIFICATE No. DUE DATE
1) MULTIFUNCTION 1986 01827 EEL.BP.68/09/4 10-Jan-26
SOUND CALIBRATOR.
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO :-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

3. SOUND LEVEL LINEARITY TEST AT 1000 Hz STANDARD APPLIED (dB)

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

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

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

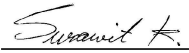
CERTIFICATE No :


GR 1 E 30061

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226
SERIAL No. : 122024
ID No. : CEM-SI-04
SUBMITTED BY : C,E,M TECHNOLOGY (THAILAND) CO.,LTD.
219/43 MOO 12, PETCHKASEM RD., OMNOI,
KRATHUMBAN SAMUTSAKORN 74130

CALIBRATED BY : 
CALIBRATION DATE : 10-April-25

APPROVED BY : 
PRUDITH P.

ISSUED DATE : 10-April-25

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
G.RUAMKIT PANICH CO.,LTD.

G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 1 E 30061

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226 SERIAL NUMBER : 122024
ID No. : CEM-SI-04
RECEIVED DATE : 7-April-25 CALIBRATION DATE : 10-April-25
AMBIENT TEMPERATURE : 22 °C ± 3°C RELATIVE HUMIDITY : 60%RH ± 20%RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

INSTRUMENT MODEL SERIAL No. CERTIFICATE No. DUE DATE
1) MULTIFUNCTION 1986 01827 EEL.BP.68/09/4 10-Jan-26
SOUND CALIBRATOR.
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO :-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

3. SOUND LEVEL LINEARITY TEST AT 1000 Hz STANDARD APPLIED (dB)

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

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

G.Ruamkit Panich Co.,Ltd.

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


CERTIFICATE No :


GR 17 E 30066

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226
SERIAL No. : 150006
ID No. : CEM-SI-06
SUBMITTED BY : C,E,M TECHNOLOGY (THAILAND) CO.,LTD.
219/43 MOO 12, PETCHKASEM RD., OMNOI,
KRATHUMBAN SAMUTSAKORN 74130

CALIBRATED BY : 
CALIBRATION DATE : 10-April-25

APPROVED BY : 
PRUDITH P.

ISSUED DATE : 10-April-25

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
G.RUAMKIT PANICH CO.,LTD.

Calibration Report

EQUIPMENT : SOUND LEVEL METER
 MANUFACTURER : ACO
 MODEL : TYPE 6226 SERIAL NUMBER : 150006
 ID No. : CEM-SI-06
 RECEIVED DATE : 7-April-25 CALIBRATION DATE : 10-April-25
 AMBIENT TEMPERATURE : 22 °C ± 3°C RELATIVE HUMIDITY : 50%RH ± 20%RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

INSTRUMENT	MODEL	SERIAL No.	CERTIFICATE No.	DUE DATE
1) MULTIFUNCTION SOUND CALIBRATOR	1986	01827	EEL.BP.68/06/4	10-Jan-26

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO :-

- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
125.00	-16.10	-15.20	-0.90	0.50
250.00	-8.20	-8.10	-0.10	0.50
500.00	-3.20	-3.0	-0.20	0.50
1000.00	0.00	0.00	0.0	0.50
2000.00	1.20	0.90	0.3	0.50

2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

3. SOUND LEVEL LINEARITY TEST AT 1000 Hz

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

UUC* : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในบรรยากาศ



Certificate of Analyzer Performance Testing

Calibrated Date : 20-Aug-24 Certificate No. : 0824-005
 Page : 1/1

Analyzer Instruments
 Analyzer Type : SO2 Analyzer Manufacturer : Thermo Environmental
 Model : 43C Serial No. : 43C-70852-387

Environmental
 Temperature : 26.2 °C
 Humidity : 44.1 %RH

Calibration System

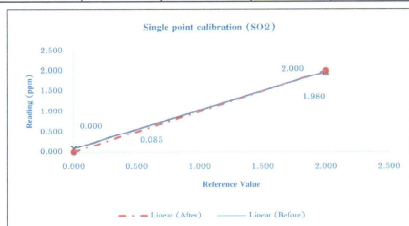
Calibrator Units

Gas Calibration : Thermo Environmental Zero Air Generator : API
 Model : 149C 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. : 30 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
SO2	0.085	0.000	0.09	1.98	2.000	-1.00
After						
SO2	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by : (Mr. Tong Pima)



Certificate of Analyzer Performance Testing

Calibrated Date : 20-Aug-24 Certificate No. : 0824-009
 Page : 1/1

Analyzer Instruments
 Analyzer Type : SO2 Analyzer Manufacturer : Thermo Environmental
 Model : 43C Serial No. : 43C-77419-385

Environmental
 Temperature : 25.0 °C
 Humidity : 48.6 %RH

Calibration System

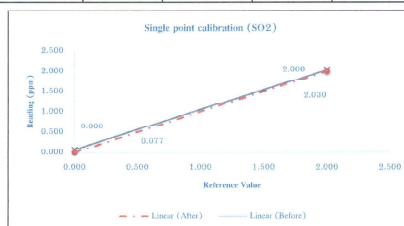
Calibrator Units

Gas Calibration : Thermo Environmental Zero Air Generator : API
 Model : 149C 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. : 30 ppm

Calibration Check

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



Calibrated by : (Mr. Tong Pima)

Certificate of Analyzer Performance Testing

Calibrated Date : 28-Mar-25 Certificate No. : 0325-005
Page : 1/1

Analyzer Instruments
Analyzer Type : SO2 Analyzer Manufacturer : Thermo Environmental
Model : 43C Serial No. : 69808-304

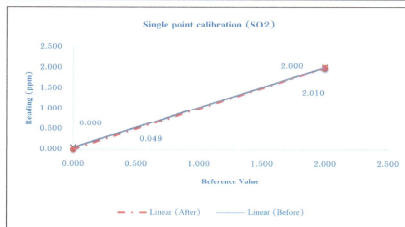
Environmental
Temperature : 25.0 °C
Humidity : 37.6 %RH

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

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

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
SO2	0.049	0.000	0.05	2.01	2.000	0.50
After						
SO2	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by :

Tong Pima
(Mr. Tong Pima)

Certificate of Analyzer Performance Testing

Calibrated Date : 23-Aug-24 Certificate No. : 0824-007
Page : 1/1

Analyzer Instruments
Analyzer Type : NO/NO_x Analyzer Manufacturer : Thermo Environmental
Model : 42C Serial No. : 66193-351

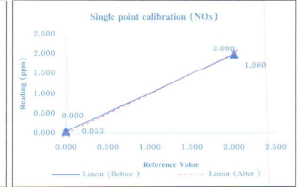
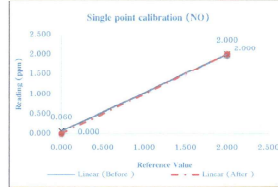
Environmental
Temperature : 26.2 °C
Humidity : 44.1 %RH

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

Standard Gas
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	0.000	0.000	0.06	2.00	2.00	0.00
NO _x	0.053	0.000	0.05	1.98	2.00	-1.00
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NO _x	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by :

Tong Pima
(Mr. Tong Pima)

Certificate of Analyzer Performance Testing

Calibrated Date : 25-Mar-25 Certificate No. : 0325-003
Page : 1/1

Analyzer Instruments
Analyzer Type : NO/NO_x Analyzer Manufacturer : Thermo Environmental
Model : 43C Serial No. : 72454-371

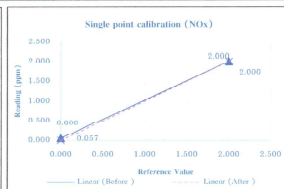
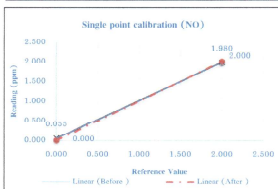
Environmental
Temperature : 25.1 °C
Humidity : 46.9 %RH

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

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

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.055	0.000	0.06	1.98	2.00	-1.00
NO _x	0.057	0.000	0.06	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 :

Tong Pima
(Mr. Tong Pima)

Certificate of Analyzer Performance Testing

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

Analyzer Instruments
Analyzer Type : NO/NO_x Analyzer Manufacturer : Thermo Environmental
Model : 42C Serial No. : 63470-339

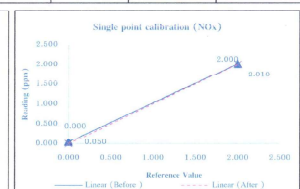
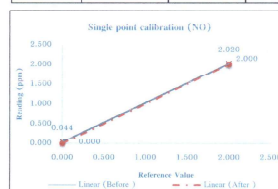
Environmental
Temperature : 26.3 °C
Humidity : 42.5 %RH

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

Standard Gas
NO Conc. : 2 ppm Cylinder No. : 307199
SO2 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	0.044	0.000	0.04	2.02	2.00	1.00
NO _x	0.050	0.000	0.05	2.01	2.00	0.50
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NO _x	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by :

Tong Pima
(Mr. Tong Pima)

Certificate of Analyzer Performance Testing

Calibrated Date : 23-Aug-24 Certificate No. : 0824-008
Page : 1/1

Analyzer Instruments
Analyzer Type : CO Analyzer Manufacturer : Thermo Environmental
Model : 48C Serial No. : 508011069

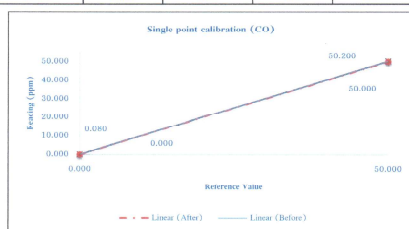
Environmental
Temperature : 26.2 °C
Humidity : 51.8 %RH

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

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

Calibration Check

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



Calibrated by :

Topik
(Mr. Tong Pima)

Certificate of Analyzer Performance Testing

Calibrated Date : 23-Aug-24 Certificate No. : 0824-008
Page : 1/1

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

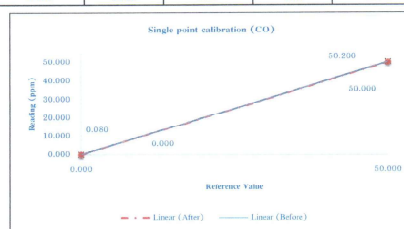
Environmental
Temperature : 26.2 °C
Humidity : 51.8 %RH

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

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

Calibration Check

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



Calibrated by :

Topik
(Mr. Tong Pima)

Certificate of Analyzer Performance Testing

Calibrated Date : 0-Jun-24 Certificate No. : 0624-001
Page : 1/1

Analyzer Instruments
Analyzer Type : CO Analyzer Manufacturer : Thermo Environmental
Model : 48C Serial No. : 508011068

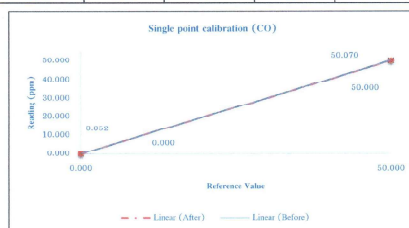
Environmental
Temperature : 25.0 °C
Humidity : 51.5 %RH

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

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

Calibration Check

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



Calibrated by :

Topik
(Mr. Tong Pima)

Certificate of Analyzer Performance Testing

Calibrated Date : 13-Jun-23 Certificate No. : 0123-001
Page : 1/1

Analyzer Instruments
Analyzer Type : THC Analyzer Manufacturer : Thermo Environmental
Model : 51 Serial No. : 51HT-73244-373

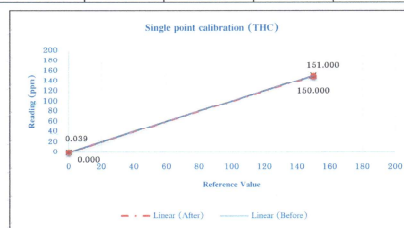
Environmental
Temperature : 26.2 °C
Humidity : 44.1 %RH

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

Standard Gas
Propane Conc. : 150 ppm Cylinder No. : 21W281048
Expire Date : 26-Sep-25

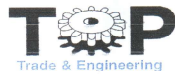
Calibration Check

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	0.887
After						
THC	0.000	0.000	0.000	150	150	0.000



Calibrated by :

Topik
(Mr. Tong Pima)



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

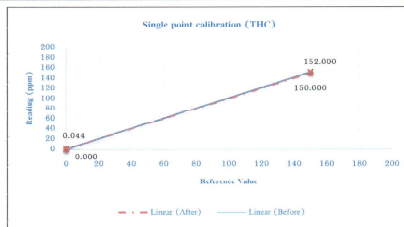
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 140C Model : 701
Serial No. : 514811458 Serial No. : 179

Standard Gas

Propane Conc. : 150 ppm Cylinder No. : 21W981040
Expire Date : 28-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	1.353
After						
THC	0.000	0.000	0.000	150	150	0.000



Calibrated by :

(Mg Tong Pima)



Trade & Engineering

TSP High Volume Sampler

TE-5000 TSP Sampler Verification

Site Information

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

Site Conditions

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

Calibration Orifice

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

Calibration Information

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

Calculations

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

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

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

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

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

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Trade & Engineering

TSP High Volume Sampler

TE-5000 TSP Sampler Verification

Site Information

Location : - Site ID : - Date: 14 Oct 24
Sampler: TE-5000 TSP Serial No: 3271 Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 28.20 Corrected Pressure (mm Hg): 716.3
Temperature (deg F): 75.6 Temperature (deg K): 297.4
Average Press. (in Hg): 27.30 Corrected Average (mm Hg): 693.4
Average Temp (Deg F): 75.2 Average Temp (Deg K): 297.2

Calibration Orifice

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

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.30	1.783	60.3	58.60	Slope: 37.3775
2	6.65	1.597	55.8	54.23	Intercept: -6.7828
3	5.35	1.433	48.6	47.23	Corr. Coeff: 0.9943
4	4.65	1.337	44.7	43.44	
5	4.20	1.112	35.0	34.01	# 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

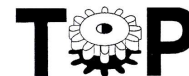
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg
For subsequent calculation of sampler flow:
 $1/m[(I[\sqrt{(298/Tav)(Pav/760)]}] - b]$

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

Enter Average I (chart): 48.9
Average Flow Calculation m3/min
1.432395965
Average Flow Calculation in cfm
50.5789529
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min
2062.650189
Total flow in 24 hours cfm
72833.69218

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: 14 Oct 24
Sampler: TE-5000 TSP Serial No: 3272 Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 28.10 Corrected Pressure (mm Hg): 713.7
Temperature (deg F): 75.5 Temperature (deg K): 297.3
Average Press. (in Hg): 27.28 Corrected Average (mm Hg): 692.9
Average Temp (Deg F): 75.3 Average Temp (Deg K): 297.2

Calibration Orifice

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

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.25	1.775	61.2	59.38	Slope: 37.6196
2	6.60	1.588	56.1	54.43	Intercept: -6.5584
3	5.40	1.438	48.9	47.44	Corr. Coeff: 0.9968
4	4.65	1.335	44.9	43.56	
5	4.15	1.112	36.1	35.02	# 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

Enter Average I (chart): 49.4
Average Flow Calculation m3/min
1.430874947
Average Flow Calculation in cfm
50.5252464
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min
2060.459923
Total flow in 24 hours cfm
72756.35227

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: 15 Oct 24
Sampler: TE-5000 TSP	Serial No: 3273	Tech: Tong, P

Site Conditions

Barometric Pressure (in Hg): 28.20	Corrected Pressure (mm Hg): 716.3
Temperature (deg F): 75.6	Temperature (deg K): 297.4
Average Press. (in Hg): 27.31	Corrected Average (mm Hg): 693.7
Average Temp (deg F): 75.3	Average Temp (deg K): 297.2

Calibration Orifice

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

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.35	1.788	61.3	59.57	Slope: 36.1873
2	6.55	1.585	57.2	55.59	Intercept: -3.8369
3	5.30	1.427	49.3	47.91	Corr. Coeff: 0.9907
4	4.60	1.330	44.9	43.64	
5	4.10	1.112	37.2	36.15	# of Observations: 5

Calculations

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

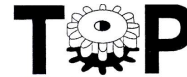
Qstd = standard flow rate
IC = corrected chart response
I = actual chart response
m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg
For subsequent calculation of 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):	50.0
Average Flow Calculation m3/min	1.427299081
Average Flow Calculation in cfm	50.39897817
Sample Time (Hrs):	24.0
Total flow in 24 hours m3/min	2055.310676
Total flow in 24 hours cfm	72574.52857

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: 15 Oct 24
Sampler: TE-5000 TSP	Serial No: 3274	Tech: Tong, P

Site Conditions

Barometric Pressure (in Hg): 28.25	Corrected Pressure (mm Hg): 717.6
Temperature (deg F): 75.6	Temperature (deg K): 297.4
Average Press. (in Hg): 27.30	Corrected Average (mm Hg): 693.4
Average Temp (deg F): 75.2	Average Temp (deg K): 297.2

Calibration Orifice

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

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.40	1.795	61.5	59.82	Slope: 35.3518
2	6.50	1.580	57.4	55.83	Intercept: -2.5399
3	5.35	1.435	49.1	47.76	Corr. Coeff: 0.9860
4	4.65	1.338	44.7	43.48	
5	4.15	1.112	38.1	37.06	# of Observations: 5

Calculations

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

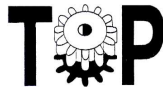
Qstd = standard flow rate
IC = corrected chart response
I = actual chart response
m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg
For subsequent calculation of 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):	50.2
Average Flow Calculation m3/min	1.429087439
Average Flow Calculation in cfm	50.46212644
Sample Time (Hrs):	24.0
Total flow in 24 hours m3/min	2057.885913
Total flow in 24 hours cfm	72665.46207

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

Site Conditions

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

Calibration Orifice

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

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	9.40	1.287	60.0	39.47	Slope 30.7100
2	7.80	1.173	57.3	37.69	Intercept 0.7813
3	6.50	1.072	52.9	34.80	Corr. Coeff 0.9489
4	5.80	1.037	50.3	33.09	SFR 1.116
5	5.05	1.006	45.7	30.06	SSP 53.31
# of Observations:					5

Calculations

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

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:
 $Qa = 1/m[\sqrt{(H2O)(Ta/Pa))}-b]$
 $IC = I[\sqrt{(Ta/Pa))}]$
SFR = 1.13(Ps/Pa)(Ta/Ts)
SSP = (m*SFR+b)/[sqrt(Pa/Ta)]
SFR = sampler set point flow rate
SSP = sampler chart set point
m = sampler slope
b = sampler intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
Ts = Average temperature (deg K)
Ps = Average pressure (mm Hg)

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

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

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

Site Conditions

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

Calibration Orifice

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

Calibration Data

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

Calculations

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

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:
 $Qa = 1/m[\sqrt{(H2O)(Ta/Pa))}-b]$
 $IC = I[\sqrt{(Ta/Pa))}]$
SFR = 1.13(Ps/Pa)(Ta/Ts)
SSP = (m*SFR+b)/[sqrt(Pa/Ta)]
SFR = sampler set point flow rate
SSP = sampler chart set point
m = calibrator slope
b = sampler intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
Ts = Average temperature (deg K)
Ps = Average pressure (mm Hg)

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

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

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

Site Conditions

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

Calibration Orifice

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

Calibration Data

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

of Observations: 5

Calculations

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

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

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

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

Tisch Environmental 145 South Miami Ave, Cleves OH 45002 • 877.263.7610 • sales@tisch-env.com • www.tisch-env.com



PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 27 September 2024
Sampler: TE-6070 PM10 Serial No: 3286 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 27.30 Corrected Pressure (mm Hg): 693.4
Temperature (deg F): 76.2 Temperature (deg K): 297.6
Average Press. (in Hg): 26.70 Corrected Average (mm Hg): 678.2
Average Temp. (deg F): 76.3 Average Temp. (deg K): 297.6

Calibration Orifice

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

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	9.50	1.288	62.1	40.68	Slope 34.2249
2	7.55	1.150	56.1	36.75	Intercept -3.0352
3	6.45	1.063	51.9	34.00	Corr. Coeff 0.9864
4	5.30	1.037	49.9	32.69	SFR 1.105
5	5.05	1.006	46.5	30.46	SSP 53.10

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): 53.3
Average Flow over Sample (m3/min)
1.120345001
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min)
1613.296801
Total flow over sample (CFM)
56965.51004

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: 27 September 2024
Sampler: TE-6070 PM10 Serial No: 3482 Tech: Tong P.

Site Conditions

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

Calibration Orifice

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

Calibration Data

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

of Observations: 5

Calculations

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

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

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

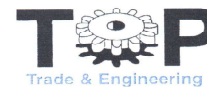
Qa = actual flow rate
IC = corrected chart response
m = calibrator slope
b = calibrator intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
For subsequent calculation
of sampler flow:

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

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

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Certificate of Calibration

Calibrated Date: 30-Aug-24 Certificate No: 0824-001
Page: 1/1

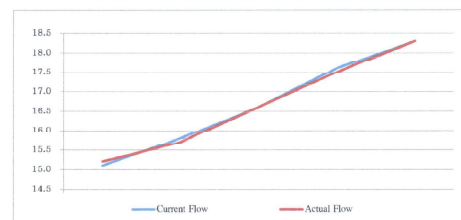
Instruments
Instruments: PM2.5-PM10 Air Sampler Manufacturer: Thermo Scientific
Model: 2000-D Serial No: 200DA300310704

Environmental
Temperature: 26.3 °C
Humidity: 42.5 %RH

Calibration System
Instruments: Deyol Manufacturer: Bios
Model: DCL-H Serial No: 102591
Calibration due date: 1-Nov-24

Flow Testing

Filter	Set Flow Instrument (L/min)	Current Flow Instrument reading (L/min)	Actual Flow Reference Standard (L/min)
47 mm.	16.0	16.0	16.0
	17.6	17.6	17.5
	15.8	15.8	15.7
	16.2	16.3	16.3
	15.0	15.1	15.2



Calibrated by: Tong P.
(Mr. Tong Pima)

Certificate of Calibration

Calibrated Date : 3-Sep-24 Certificate No. : 0924-003
Page : 1/1

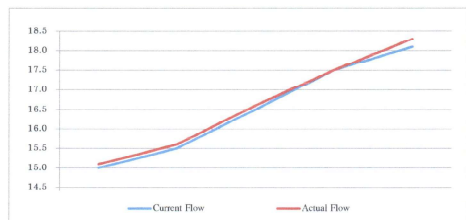
Instruments
Instruments : PM2.5-PM10 Air Sampler Manufacturer : TEOM Control Unit (RP)
Model : 1400a Serial No. : 140AB254490412

Environmental
Temperature : 26.7 °C
Humidity : 47.7 %RH

Calibration System
Instruments : Drycal Manufacturer : Bios
Model : DCL-H Serial No. : 102591
Calibration due date : 1-Nov-24

Flow Testing

Filter	Set Flow Instrument (L/min)	Current Flow Instrument reading (L/min)	Actual Flow Reference Standard (L/min)
47 mm.	16.6	16.5	16.6
	17.4	17.5	17.5
	15.5	15.5	15.6
	18.2	18.1	18.3
	15.0	15.0	15.1



Calibrated by : *Tong*
(Mr. Tong Pima)

Certificate of Calibration

Calibrated Date : 3-Sep-24 Certificate No. : 0924-002
Page : 1/1

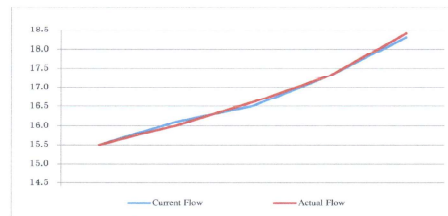
Instruments
Instruments : PM2.5-PM10 Air Sampler Manufacturer : TEOM Control Unit (RP)
Model : 1400a Serial No. : 140AB254490411

Environmental
Temperature : 25.9 °C
Humidity : 47.0 %RH

Calibration System
Instruments : Drycal Manufacturer : Bios
Model : DCL-H Serial No. : 102591
Calibration due date : 1-Nov-24

Flow Testing

Filter	Set Flow Instrument (L/min)	Current Flow Instrument reading (L/min)	Actual Flow Reference Standard (L/min)
47 mm.	16.5	16.5	16.6
	17.3	17.3	17.3
	15.9	16.1	16.0
	18.4	18.3	18.4
	15.5	15.5	15.5



Calibrated by : *Tong*
(Mr. Tong Pima)

Certificate of Calibration

Calibrated Date : 3-Sep-24 Certificate No. : 0924-001
Page : 1/1

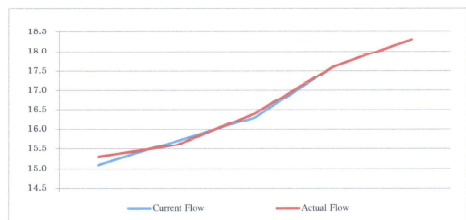
Instruments
Instruments : PM2.5-PM10 Air Sampler Manufacturer : BGI
Model : PQ-200 Serial No. : 140AB25409410

Environmental
Temperature : 25.1 °C
Humidity : 46.2 %RH

Calibration System
Instruments : Drycal Manufacturer : Bios
Model : DCL-H Serial No. : 102591
Calibration due date : 1-Nov-24

Flow Testing

Filter	Set Flow Instrument (L/min)	Current Flow Instrument reading (L/min)	Actual Flow Reference Standard (L/min)
47 mm.	16.3	16.3	16.4
	17.5	17.6	17.6
	15.6	15.7	15.6
	18.4	18.3	18.3
	15.2	15.1	15.3



Calibrated by : *Tong*
(Mr. Tong Pima)


เอกสารการสอบเทียบเครื่องมือตรวจวัดความชื้น



Certificate No.: CP20240388EA
Operation No.: CP2024100354

Certificate of Calibration

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

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

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.

Page 1 of 5

F-CAL-004 Ed.1



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

Page 2 of 5

F-CAL-005 Ed.1



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	

Page 3 of 5

F-CAL-005 Ed.1



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	

Page 4 of 5

F-CAL-005 Ed.1



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	0.280	1.50	
10.0	10.000	9.984	10.207	0.223	1.50	
12.5	10.000	9.987	10.160	0.173	1.50	
16.0	10.000	10.003	10.191	0.188	1.50	
	20.000	20.011	20.402	0.390	1.60	
	30.000	29.995	30.589	0.594	1.50	
	50.000	49.992	51.011	1.019	1.50	
20.0	10.000	10.011	10.215	0.204	1.50	
25.0	10.000	9.983	10.120	0.137	1.50	
31.5	10.000	9.983	10.047	0.064	1.60	
40.0	10.000	9.990	10.081	0.091	1.50	
52.0	10.000	9.998	10.294	0.296	1.50	
63.0	10.000	10.010	10.404	0.394	1.50	
80.0	10.000	10.004	10.696	0.692	1.50	

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

-- End of Report --

Page 5 of 5

F-CAL-005 Ed.1



THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonon 5 Rd., Sampran, Nakornpatom 73210
Tel. 0-3439-7682-5 Fax: 0-3439-7687

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



CALIBRATION CERTIFICATE

Certificate No.S2505043S

page 1 of 2

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

Equipment : Non-automatic weighing instrument (Electronic instrument)

Manufacturer : Sartorius
Model : QUINTIX224-1S
Accuracy class :
Capacity : 220000 mg
Resolution : 0.1 mg
Serial No. : 0035009070
ID No. : CI-01-002
Place of calibration : ห้องเครื่อง

Order No. : 68S1799-1
Ambient temperature : $(23.9 \pm 1.0) ^\circ\text{C}$
Relative humidity : $(38.9 \pm 5.0) \%$
Received date : 30-Apr-2025
Date of calibration : 30-Apr-2025
Date of issue : 03-May-2025
Condition of the balance : Good working conditions

Calibration method

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

Condition of reference standard weight

Instrument	Nominal value	Serial No.	Certificate No.	Due-date	Density (kg/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., NSG-ONSC accredited no. Calibration 0189.

Calibrated By : Aekhasak Silarut
Technician

Approved Signatory :
Somwang Wongduang

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



THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonon 5 Rd., Sampran, Nakornpatom 73210
Tel. 0-3439-7682-5 Fax: 0-3439-7687

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



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 (±) (mg)	k
Unload	0.0	0.0	0.0	0.14	2.21
100	100.0	100.0	0.0	0.14	2.21
200	200.0	200.1	-0.1	0.14	2.21
500	500.0	500.0	0.0	0.14	2.20
1000	1000.0	1000.0	0.0	0.14	2.20
2000	2000.0	2000.0	0.0	0.14	2.20
5000	5000.0	5000.1	-0.1	0.14	2.18
10000	10000.0	10000.0	0.0	0.14	2.16
20000	20000.0	20000.0	0.0	0.15	2.13
50000	50000.0	50000.0	0.0	0.16	2.08
100000	100000.0	99999.8	+0.2	0.21	2.00
200000	200000.2	199999.7	+0.5	0.34	2.00

Remark : Without adjustment

Uncertainty of measurement

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

This report will certify of the calibrated equipment only.

--End--

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 : 9156RNWP Serial No. : VV1-15843
ID No. : WW-03-001Environment : 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 17025Approved by : 
(Permpoon Chanpu)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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



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

Remarks

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. : 68-400089-1

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-03-001Environment : 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 (NIMT)Approved by : 
(Permpoon Chanpu)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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



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

Remarks

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. : 68-400089-1 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	24F633	21 Feb 2026	National Institute of Metrology Thailand (NIMT)

Approved by : 

(Permpon Chanpu)

Supervisor

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%

- 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.N.
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 : 

(Permpon Chanpu)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

Certificate of Calibration

Certificate No. : 68-430004-2 Page : 2 of 2

Result of Calibration : Without Adjustment

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.

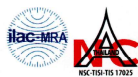
This result of calibration was found accurate as shown on date and place of calibration only.

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

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. Tiewewong 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. Tiewewong Thaitiang)
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.

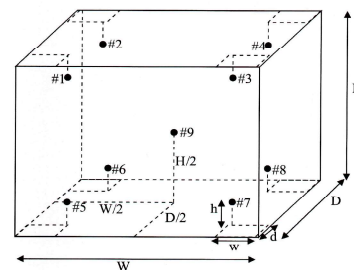
บริษัท ดีเคเอส เทคโนโลยี จำกัด
DKSH Technology Limited
2533 สุขุมวิท กรุงเทพมหานคร 10260
Phone: +66 2839 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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Certificate No.: C31250347

Page: 2 of 4



Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

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

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

Standard Locations (#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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Phone: +66 2839 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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Certificate No.: C31250347

Page: 3 of 4

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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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

Certificate No.: C31250347

Page: 4 of 4

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
2533 สุขุมวิท 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

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

(Signature)

(Mr. Udon Srichana)
Authorized signatory

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

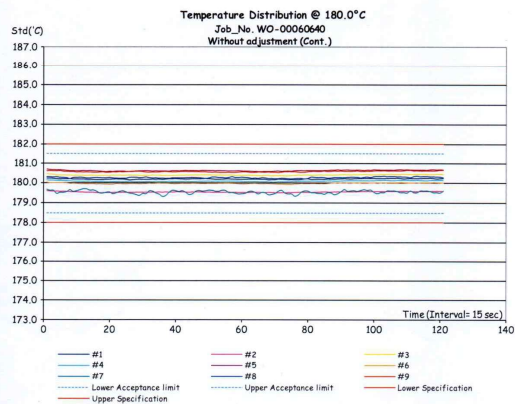
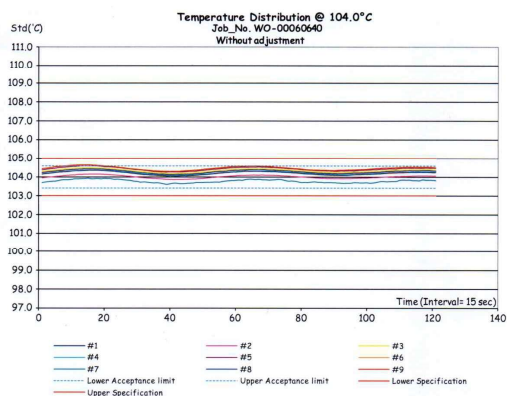
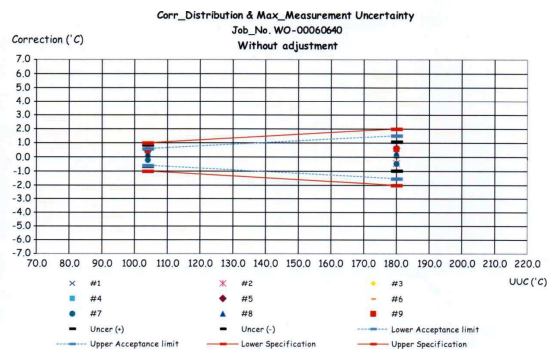
Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

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 (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
10 Feb 2025			10 Feb 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน ฟัดลม	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. สภาพ Lever of Ventilation valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพ Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพ Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. การทำงานของระบบทำความเย็น	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input type="checkbox"/>	<input type="checkbox"/>	11. การทำงานของระบบทำความร้อน	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อเสนอแนะ:

Mr. Tweewong Thaitiang
Service Engineer

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phrahanong, Bangkok 10260
Phone: +66 2839 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand
Delivering Growth - in Asia and Beyond.



Certificate of Calibration

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

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 Thaitiang
Calibration Date: 10 February 2025

The Method used: In house method, Ckal-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 Thaitiang)
Person in charge

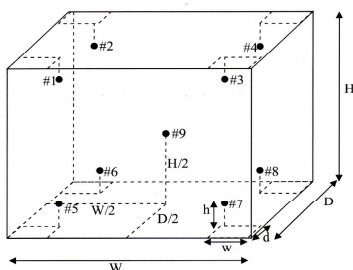
(Mr. Udon Srichana)
Authorized signatory

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

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DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phrahanong, Bangkok 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

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 ดีเคเอส อีเซีย จำกัด
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2533 Sukhumvit Road, Bangkok, Phrahanong, Bangkok 10260
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Delivering Growth - in Asia and Beyond.

CAL-FM-C31-10: 12 Sep 2022

Refer to Certificate No.: C31250348 Page: 1 of 1

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

(Mr. Udon Srichana)
Authorized signatory

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

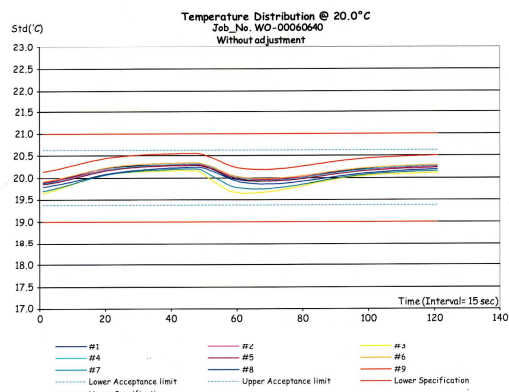
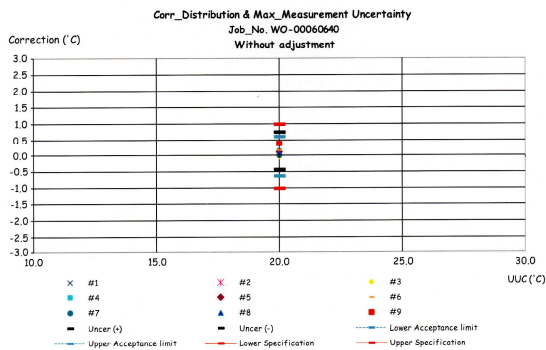
Correction* = Measured Temperature - Desired Temperature

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

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CAL-FM-C31-10: 12 Sep 2022



ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

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

เลขที่ใบงาน: WO-00060640

ตรวจสอบ (รับ)		รายการตรวจสอบ	ตรวจสอบ (ส่ง)		หมายเหตุ
10 Feb 2025			10 Feb 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน พัดลม	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	6. สภาวะ Lever of Ventilation valve	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาวะ Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาวะ Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. การทำงานของระบบทำความเย็น	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. การทำงานของระบบทำความร้อน	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. สภาวะตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ : _____

Mr. Tiewong Thaihiang
Service Engineer

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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	20.36	0.36	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

การดูแลบำรุงรักษาเชิงป้องกัน Preventive Maintenance



บริษัท ดีเคเอสเอ เทคโนโลยี จำกัด

ฝ่ายบริการหลังการขาย

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

ฝ่ายขายและการตลาด

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

เงื่อนไขการให้บริการ Preventive Maintenance

บริษัทฯ จะส่งวิศวกรผู้ชำนาญ เพื่อให้บริการตามขอบข่ายของบริการ เฉพาะ ในวันและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากวัน เวลา ราชการ (วันหยุดเสาร์ – อาทิตย์ หรือวันหยุด นักชดถุณ) บริษัทฯ จะคิดค่าบริการเพิ่มเติมตามอัตรา ที่กฎหมายแรงงานกำหนดไว้

ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายการผลการตรวจสอบเครื่องมือ

หมายเหตุ

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

Preventive Maintenance Contract

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

รายละเอียดผู้รับบริการ

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

ผู้ติดต่อ

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

รายละเอียดผู้ให้บริการ

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด (ฝ่ายบริการหลังการขาย) (สำนักงานใหญ่) เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260 โทรศัพท์ 0 2 693 7000 Email: jirayut.js@dksh.com เจ้าหน้าที่ประสานงาน : คุณจิรายุทธ สกลอด	
เจ้าหน้าที่ให้บริการ	นายจิรายุทธ สกลอด
ตำแหน่ง	Specialist, Technical Service
โทรศัพท์	0938138736
E-mail	jirayut.js@dksh.com

ลงนามผู้รับบริการ		ลงนามผู้ให้บริการ	<i>Jirayut Saksod</i>
ตัวจริง	(.....)	ตัวจริง	(น.พ.จิรายุทธ สกลอด)
ตำแหน่ง		ตำแหน่ง	Specialist, Technical Service
วันที่ / ประทับตราบริษัท		วันที่ / ประทับตราบริษัท	14/05/2025

ช่องทางการติดต่อ



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



Call center 0 2 639 7000



DKSH Scientific



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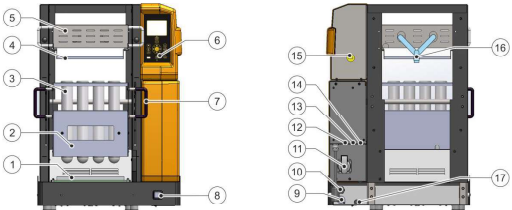


@dkshscientific

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

Part 3: ตรวจสอบสภาพเครื่อง

Front and rear view of KT-L version



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

Part 4: ฉะเชียดและรายงานผลการใช้บ้กรร Preventive Maintenance

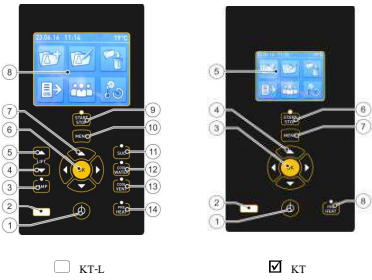
4.1 ตารางเช้กระบบไฟฟ้า

	Pass	Fai	N/A	Remark
ไฟไฟ 220 V/50 Hz	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
กระเชไฟฟ้าตามพิคัยกรร	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4.2 ตารางกอนสภาพทูลบารณ์ภายนอก

	Pass	Fail	N/A	Remark
สายไฟของกรร	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ทอแ้รวรว ไอกรร	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
สายบงล่อกับทอแ้รวรว ไอกรร	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
สภาพของ Aluminum block	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
การเช้บของ Lift	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Light	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Current Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Thermostat	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4.3ตารางเช้กระบบการทำงาน



	Pass	Fail	N/A	Remark
Switch controller on or off.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
USB port	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LAMP button	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
LIFT down button	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
LIFT up button	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
OK button	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Navigation buttons	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
START/STOP button	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MENU button	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SUC button	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
COOL WATER button (optional)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
COOL VENT button (optional)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRE HEAT button	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
การเช้บของอุณหภูมิมากกว่า10องศาต่อบเรที่250องศา	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
การทำงานของลว้บอ้งกับอุณหภูมิสูงกั	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
การทำงานของระบบควบคุมอุณหภูมิ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

การบารุงรักษาทั่วไป (Basic maintenance)

- การย้อยตัวอย่างเกดการเดอดที่รุนแรงอันเนื่องจากตัวอย่างนั้นสามารถบ้องกันได้โดยเนะนำให้ย้อยด้วยการตั้งการเพิ่มอุณหภูมิเป็นระดับช้น ย้อยที่ระดับอุณหภูมิ 250 C ครนเวลา 15 นาทีจึงเปลี่ยนเป็นอุณหภูมิ 380 C เพื่อบ้องกันการฉ้นออกมา
 - เมื่อใช้เสร็จไม่ควรปล่อยให้ Tube เย็นกับตัวกรร
 - ต้องนำเอาคองไอกรรใส่ทุกรร้งหลังจากใช้งานเสร็จ เพื่อบ้องกันการหยดของไอกรรที่จะหยดลงมาที่ตัวกรร
 - ทำควมสะอาดตัวหลุมย้อยด้วยน้ำหรือผ้าชุบน้ำนกรณที่มีคราบกรดหยดลงมาติดอยู่ในหลุม
- เพื่อบ้องกันไม่ให้คราบดังกล่าวไปกัการแผ่อุณหภูมิ

การดูแลบารุงรักษาเชิงบ้องกัน
Preventive Maintenance



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

เงื่อนไขการให้บริการ Preventive Maintenance

บริษัทฯ จะส่งวิศวกรผู้ชำนาญ เพื่อให้บริการตามขอบข่ายของการบริการ เฉพาะ ในวันและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากวัน เวลา ราชการ (วันพฤหัสบดี – อาทิตย์ หรือวันหยุด วันพัชฉัตร) บริษัทฯ จะคิดค่าบริการเพิ่มเติมตามอัตราที่กฎหมายแรงงานกำหนดไว้

ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายงานผลการตรวจสอบเครื่องมือ

หมายเหตุ

- ราคานี้ไม่รวมค่าการซ่อม หรือ เปลี่ยนอะไหล่ที่ชำรุดเสียหาย หรือหมดสภาพการใช้งาน
- ในกรณีที่รับบริการนอกขอบเขตพื้นที่ให้บริการ บริษัทฯ จำเป็นต้องคิดค่าใช้จ่ายเพิ่มเติม ได้แก่ ค่าเดินทาง เป็นต้น
- บริษัทฯ ขอสงวนสิทธิ์ในการเปลี่ยนแปลงราคา โดยไม่แจ้งให้ทราบล่วงหน้า

ช่องทางการติดต่อ



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



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DKSH Scientific



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@dkshscientific

Preventive Maintenance Contract

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

รายละเอียดผู้รับบริการ

หน่วยงาน	บริษัท ซี.อี.เอ็ม เทคโนโลยี (ไทยแลนด์) จำกัด		
ที่อยู่	219/43 หมู่ 12 ถนนเพชรเกษม ตำบลเขื่อนขันธ์ อำเภอกะระกุ่มแบน จังหวัดสุราษฎร์ธานี 74130		
โทรศัพท์	0869054664	แฟกซ์	-

ผู้ติดต่อ

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

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 สกลอด	
เจ้าหน้าที่ผู้ให้บริการ	นายจิรายุทธ สกลอด
ตำแหน่ง	Specialist, Technical Service.
โทรศัพท์	0938138736
E-mail	Jirayut.js@dksh.com

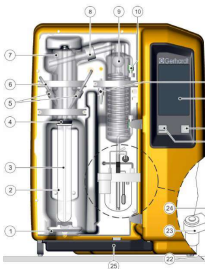
ลงนามผู้รับบริการ		ลงนามผู้ให้บริการ	Jirayut Saksod
ตัวบรรจง	(.....)	ตัวบรรจง	(นาย จิรายุทธ สกลอด)
ตำแหน่ง		ตำแหน่ง	Specialist, Technical Service.
วันที่ / ประทับตราบริษัท		วันที่ / ประทับตราบริษัท	14/05/2025

JOB:WQ-00070298.....MODEL:VAP.200.....S/N: GER5200180181

Operational Qualification (OQ)

ตรวจสอบสภาพเครื่อง

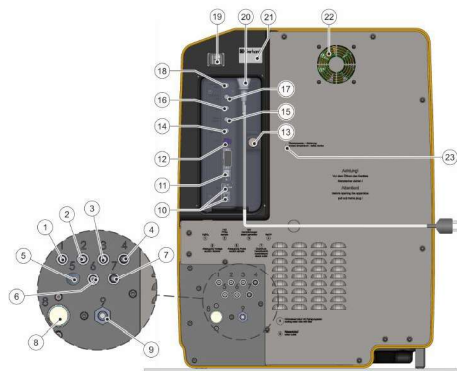
FRONT



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

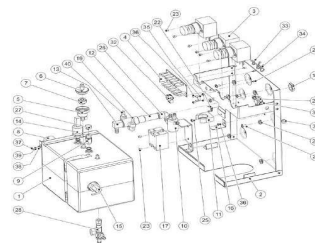
** only VAP 450

REAR



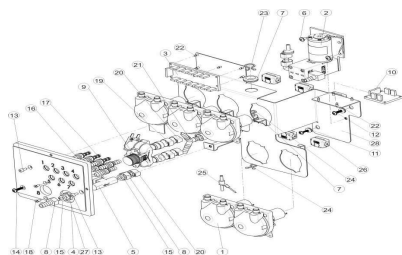
No		PASS	FAIL	N/A
1	Tube connection for sample H3BO3 supply	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2	Tube connection for sample H2O supply	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3	Tube connection for steam generator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

Inside Steam generator



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

Module Pump holder VAP200 - 450 V3



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

Control panel



No		PASS	FAIL
1	Title bar	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Status bar	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Navigation button	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Smart switch with multiple functions	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	USB interface	<input checked="" type="checkbox"/>	<input type="checkbox"/>

รายละเอียดการตรวจสอบ

ขั้นตอนการบริการ

ตรวจสอบระบบไฟฟ้า (Electrical Test)

- ความต้านทานทางไฟฟ้าของเครื่องจักรวัด
- 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

Main Supply 220 volt + 10% 50 Hz with ground
Nominal current

Pass
Fail
N/A

Remark
.....
.....Sa.....

1.1 COOLING WATER BATH

Temperature 15-20 °C
Cooling Water Outlet
Control Temperature

Pass
Fail
N/A

Remark
.....
.....
.....

1.2 OPTICAL TEST VAP200

Screw cap GL14
Screw cap GL18
Screw cap GL32
Distillation Head
Condensor
Viton Cone
Ventilation Valve BV
Micro Switch Sample
Agitator motor for propeller

Pass
Fail
N/A

Remark
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.....

ปลั๊กของวาล์ว
เปิดอยู่

2. SYSTEM COOLING WATER INLET

Cooling Water Inlet
Cooling Water Outlet
Flow control valve

Pass
Fail
N/A

Remark
.....
.....
.....

3.SYSTEM CONTROL

Display
Program
Adding NaOH
Adding H2O
Adding H3BO3
Suction Sample
Suction Receiver

Pass
Fail
N/A

Remark
.....
.....
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.....
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.....
.....

4.SYSTEM DISTILLATION

Boiler
Level Sensor
Novopren
Solenoid Valve Shut-Off
Solenoid Valve Steam
Solenoid Valve soft steam
Ventilation Valve Premount
Excess Pressure Detector
Heating Element

Pass
Fail
N/A

Remark
.....
.....
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.....
.....
.....
.....

5. PUMP

Pump H₂O Steam
- Non-Return Valve
Pump H₂O Sample
- Non-Return Valve
Pump NaOH
- Non-Return Valve
Pump H3BO3
- Non-Return Valve
Pump suction
Pump suction receiver

Pass
Fail
N/A

Remark
.....
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.....
.....

6. The Following Program Run :

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 Sample
Suction Receiver

Pass
Fail
N/A

Remark
.....
.....
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.....
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.....
.....

7. Measured pumps

Pump NaOH Volume : ..13.33.....ml

Remark
.....

Remark :ปลั๊ก condensor เสียบสภาพ,viton cone เสียบ,novopren เสียบ

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
Suction sample	30 s

→ Insert a digestion tube (without sample) and start the program.

→ All liquid carrying parts are cleaned. In the case of strong clogging, approx. 10 ml of sodium 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.

Analytical errors

Fault description	Cause	Remedy
Analyte results too high	The chemicals used are contaminated with nitrogen compounds.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> Increase of the water addition amount.
	Glass bridge of the condenser is broken or worn out, sodium hydroxide drops get into the receiver.	<ul style="list-style-type: none"> Replacement of the glass condenser.
	Grease cleaning agents in the digestion tube.	<ul style="list-style-type: none"> Clean digestion tube in advance with distilled water.
Analyte result too low or no result	Entrapment of ammonia from the previous sample.	<ul style="list-style-type: none"> Increase distillation time. Check whether the sample was previously sufficiently distilled.
	Incomplete distillation; distillation time too short.	<ul style="list-style-type: none"> No quantitative expulsion of the ammonia content. The distillation amount should be 100 ml.
	Ammonia escapes at leaking places.	<ul style="list-style-type: none"> Solder 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.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> Increase of the boric acid amount.
	Tube not completely immersed in the acid receiver.	<ul style="list-style-type: none"> Increase of the acid amount.
	Formation of stable ammonia compounds which are not destroyed with sodium hydroxide.	<ul style="list-style-type: none"> This problem only occurs with catalysts containing mercury. Sodium sulphate solution destroys these compounds.

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. : GR 0706/074 ID No. : W/W-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 : Permporn 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 : 
(Permporn Chanpu)
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 : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Conductivity measurement

Before Adjustment

Standard Conductivity Solution	UUC Reading	Correction	Uncertainty (±)	Unit
84*	79.7	4.3	1.1	µS/cm
1413	160.2	-189	9.0	µS/cm
12.88	12.81	0.07	0.082	mS/cm

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

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

Remark

UUC : Unit Under Calibration

* This parameter 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%

- (0.0) -

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 : Permporn Chanpu

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)

Approved by : 
(Permporn Chanpu)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



Certificate of Calibration

Certificate No. : 68-400172-1

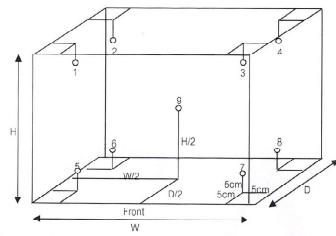
Page : 2 of 2

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%

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