

ภาคผนวกที่ 4

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สรุปเอกสารสอบเทียบอุปกรณ์เครื่องมือ

เอกสารการสอบเทียบเครื่องมือตรวจวัดระดับเสียงในบรรยากาศ

## CERTIFICATE OF CALIBRATION

Certificate No. : 66S1031-25 Job No. : 66S1031 Page : 1 of 2

Customer : C.E.M. Technology (Thailand) Co., Ltd.  
 Address : 31/8 Moo 13, Raikhing, Samphran,  
 Nakhornpathom 73210  
 Location : Laboratory

Equipment : Sound Level Meter :  $(20 \pm 2) ^\circ\text{C}$   
 Manufacturer : ACO : Relative humidity :  $(50 \pm 15) \%$   
 Model : 6236 : Atmospheric pressure : -  
 Serial No. : 222128 : Date of received : 26-Oct-2023  
 Identity No. : NS-03-013 : Date of calibration : 30-Oct-2023  
 Range : See to Data : Date of issued : 01-Nov-2023

Calibration Method : This instrument was calibrated by comparison measurement with sound level calibrator, according to in house calibration method.

### Reference Standard Instruments :

Equipment	Model	Serial No.	Certification No.	Due Date
Sound Level Calibrator	8930B	2000210	EEL.BP.40/0666	21-Jun-2025

Traceability : This certification is traceable to the International System of Unit maintained at :  
 - National Institute of Metrology Thailand, (NIMT).

Calibrated By : Mr. Boonyarit Auejirakarn  
 Reviewed By : [ ] Mr. Sompong Srisert  
 [ ] Ms. Natthaprakarn Thammaphan  
 Approved By : [ ] Ms. Bhacharin Phanangkaew (MD)  
 [ ] Mr. Boonyarit Auejirakarn

The reported expanded uncertainty is based on uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence approximately 95%.  
 This result relates only to the item calibrated. The certificate shall not be reproduced except in full, without the written approval of the calibration director.

## Continuation of Calibration Report

Certificate No. : 66S1031-25 Job No. : 66S1031 Page : 2 of 2

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.0	0.0	0.20
	104	104.0	0.0	0.20
	114	114.0	0.0	0.20
C	94	94.0	0.0	0.20
	104	104.0	0.0	0.20
	114	114.0	0.0	0.20
Z	94	93.9	-0.1	0.20
	104	103.9	-0.1	0.20
	114	113.9	-0.1	0.20

UUC\* = Unit Under Calibration

- The End -

## CERTIFICATE OF CALIBRATION

Certificate No. : 66S1031-24 Job No. : 66S1031 Page : 1 of 2

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

Address : 31/8 Moo 13, Raikhing, Samphran,

Nakhornpathom 73210

Location : Laboratory

Equipment : Sound Level Meter

Ambient temperature :  $(20 \pm 2) ^\circ\text{C}$

Manufacturer : ACO

Relative humidity :  $(50 \pm 15) \%$

Model : 6236

Atmospheric pressure : -

Serial No. : 222129

Date of received : 26-Oct-2023

Identity No. : NS-03-014

Date of calibration : 30-Oct-2023

Range : See to Data

Date of issued : 01-Nov-2023

Calibration Method : This instrument was calibrated by comparison measurement with sound level calibrator, according to in house calibration method.

### Reference Standard Instruments :

Equipment	Model	Serial No.	Certification No.	Due Date
Sound Level Calibrator	8930B	2000210	EEL.BP.40/06666	21-Jun-2025

Traceability : This certification is traceable to the International System of Unit maintained at :

- National Institute of Metrology Thailand, (NIMT).

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

Ms. Bhacharin Phanangkaew (MD)

Reviewed By : Mr. Sompong Srisert

Mr. Boonyarit Auejirakarn

Ms. Natthaparakarn Thammaphan

The reported expanded uncertainty is based on uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence approximately 95%. This result relates only to the item calibrated. The certificate shall not be reproduced except in full, without the written approval of the calibration director.

06Jun-2019

FM-FCS-040

## Continuation of Calibration Report

Certificate No. : 66S1031-24 Job No. : 66S1031

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Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.1	0.1	0.20
	104	104.2	0.2	0.20
	114	114.2	0.2	0.20
C	94	94.1	0.1	0.20
	104	104.1	0.1	0.20
	114	114.1	0.1	0.20
Z	94	94.1	0.1	0.20
	104	104.1	0.1	0.20
	114	114.1	0.1	0.20

UUC\* = Unit Under Calibration

- The End -

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.

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	20 March 2024
6) Pressure humidity and Temperature Transmitter	PTU301	F0640003	CD20230196EA	23 July 2024
7) Performance Audio Analyzer	U89038	MY56510003	CL1-P230032	4 April 2024
			CB20240035EA	23 July 2024
			CK20230072EA	13 February 2025
				13 September 2024

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

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

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

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



Certificate No.: CP20240126EA

### Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Frequency Weighting	Measured value (dB)
A-weighting	21.9
C-weighting	
Z-weighting	

2.2 Microphone replaced by the electrical input signal device

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

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

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

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

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Certificate No.: CP20240126EA

### Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Function : 6. Long-Term Stability

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

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

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

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



Certificate No.: CP2020/126EA

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.: CP2020/126EA

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
	0.25	90.0	0.0	+1.0 ; -2.5
LAE	200	109.9	-0.1	±1.0
	2	90.0	0.0	+1.0 ; -2.5
	0.25	80.9	-0.1	+1.5 ; -5.0

Function : 10. Peak C sound level

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

Function : 11. Overload indication

Positive one-half cycle	Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
	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.: 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		0.60 (10Hz to 4kHz)
- Free-field sound pressure response level	0.30	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 OF CALIBRATION

Certificate No.: 66S1229-11

Job No.: 66S1229

Page: 1 of 2

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

Address : 31/8 Moo 13, Raikhing, Samphran,

Nakhornpathom 73210

Location : Laboratory

Equipment : Sound Level Meter Ambient temperature :  $(20 \pm 2) ^\circ\text{C}$

Manufacturer : ACO Relative humidity :  $(50 \pm 15) \%$

Model : 6236 Atmospheric pressure : -

Serial No. : 222185 Date of received : 12-Dec-2023

Identity No. : NS-03-015 Date of calibration : 15-Dec-2023

Range : See to Data Date of issued : 18-Dec-2023

Calibration Method : This instrument was calibrated by comparison measurement with sound level calibrator, according to in house calibration method.

Reference Standard Instruments :

Equipment	Model	Serial No.	Certification No.	Due Date
Sound Level Calibrator	8930B	2000210	EEL.BP.40/0666	21-Jun-2025

Traceability : This certification is traceable to the International System of Unit maintained at :  
- National Institute of Metrology Thailand, (NIMT).

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

Reviewed By : Mr. Sompong Srisert

Mr. Natthaparakarn Thammaphan

Ms. Bhacharin Phanangkaew (MD)

Mr. Boonyarit Auejirakarn

The reported expanded uncertainty is based uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence approximately 95%.  
This result relates only to the item calibrated. The certificate shall not be reproduced except in full, without the written approval of the calibration director.



Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting ( dB )	UUC Reading ( dB )	Error Value ( dB )	Uncertainty ( +/- dB )
A	94	94.5	0.5	0.20
	104	104.5	0.5	0.20
	114	114.5	0.5	0.20
C	94	94.5	0.5	0.20
	104	104.4	0.4	0.20
	114	114.4	0.4	0.20
Z	94	94.5	0.5	0.20
	104	104.4	0.4	0.20
	114	114.4	0.4	0.20

UUC\* = Unit Under Calibration

- The End -

## CERTIFICATE OF CALIBRATION

Certificate No. : 66S0420-21

Job No. : 66S0420

Page : 1 of 2

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

Address : 31/8 Moo 13, Raikhing, Samphan,

Nakhornpathom 73210

Location : Laboratory

Equipment : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 222191

Identity No. : NS-03-021

Range : See to Data

Ambient temperature : ( 20 ± 2 ) °C

Relative humidity : ( 50 ± 15 ) %

Atmospheric pressure : -

Date of received : 30-Mar-2023

Date of calibration : 03-Apr-2023

Date of issued : 05-Apr-2023

Calibration Method : This instrument was calibrated by comparison measurement with sound level calibrator, according to in house calibration method.

### Reference Standard Instruments :

Equipment	Model	Serial No.	Certification No.	Due Date
Sound Level Calibrator	8930B	2000210	EEL.BP.31/0664	15-Jun-2023

Traceability : This certification is traceable to the International System of Unit maintained at :  
- National Institute of Metrology Thailand, (NIMT).

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

[ ] Ms. Bhacharin Phanangkaew (MD)

[ ] Mr. Boonyarit Auejirakarn

Reviewed By : [ ] Mr. Sompong Srisert

[ ] Ms. Natthaprakarn Thammaphan

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.2	0.2	0.20
	104	104.2	0.2	0.20
	114	114.2	0.2	0.20
B	94	94.2	0.2	0.20
	104	104.2	0.2	0.20
	114	114.2	0.2	0.20
Z	94	94.2	0.2	0.20
	104	104.2	0.2	0.20
	114	114.2	0.2	0.20

UUC\* = Unit Under Calibration

- The End -

## CERTIFICATE OF CALIBRATION

Certificate No. : 66S0420-23 Job No. : 66S0420 Page : 1 of 2

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

Address : 31/8 Moo 13, Raikhing, Samphran,

Nakhornpathom 73210

Location : Laboratory

Equipment : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 222192

Identity No. : NS-03-022

Range : See to Data

Ambient temperature : ( 20 ± 2 ) °C

Relative humidity : ( 50 ± 15 ) %

Atmospheric pressure : -

Date of received : 30-Mar-2023

Date of calibration : 03-Apr-2023

Date of issued : 05-Apr-2023

Calibration Method : This instrument was calibrated by comparison measurement with sound level calibrator, according to in house calibration method.

### Reference Standard Instruments :

Equipment	Model	Serial No.	Certification No.	Due Date
Sound Level Calibrator	8930B	2000210	EEL.BP.31/0664	15-Jun-2023

Traceability : This certification is traceable to the International System of Unit maintained at :  
- National Institute of Metrology Thailand, (NIMT).

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

[ ] Ms. Bhacharin Phanangkaew (MD)

[ ] Mr. Boonyarit Auejirakarn

Reviewed By : [ ] Mr. Sompong Srisert

[ ] Ms. Natthaprakarn Thammaphan

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	93.9	-0.1	0.20
	104	103.9	-0.1	0.20
	114	114.0	0.0	0.20
B	94	93.9	-0.1	0.20
	104	103.9	-0.1	0.20
	114	113.9	-0.1	0.20
Z	94	93.9	-0.1	0.20
	104	103.9	-0.1	0.20
	114	114.0	0.0	0.20

UUC\* = Unit Under Calibration

- The End -

## CERTIFICATE OF CALIBRATION

Certificate No. : 66S0420-24

Job No. : 66S0420

Page : 1 of 2

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

Address : 31/8 Moo 13, Raikhang, Samphran,

Nakhornpathom 73210

Location : Laboratory

Equipment : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 222193

Identity No. : NS-03-023

Range : See to Data

Ambient temperature : (20 ± 2) °C

Relative humidity : (50 ± 15) %

Atmospheric pressure : -

Date of received : 30-Mar-2023

Date of calibration : 03-Apr-2023

Date of issued : 05-Apr-2023

Calibration Method : This instrument was calibrated by comparison measurement with sound level calibrator, according to in house calibration method.

### Reference Standard Instruments :

Equipment	Model	Serial No.	Certification No.	Due Date
Sound Level Calibrator	8930B	2000210	EEL.BP.31/0664	15-Jun-2023

Traceability : This certification is traceable to the International System of Unit maintained at : -  
National Institute of Metrology Thailand, (NIMT).

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

[ ] Ms. Bhacharin Phanangkaew (MD)

Reviewed By : [ ] Mr. Sompong Srisert

[ ] Mr. Boonyarit Auejirakarn

✓ [ ] Ms. Natthaprakarn Thammaphan



Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	93.8	-0.2	0.20
	104	103.8	-0.2	0.20
	114	113.8	-0.2	0.20
B	94	93.8	-0.2	0.20
	104	103.8	-0.2	0.20
	114	113.8	-0.2	0.20
Z	94	93.8	-0.2	0.20
	104	103.8	-0.2	0.20
	114	113.8	-0.2	0.20

UUC\* = Unit Under Calibration

- The End -

## CERTIFICATE OF CALIBRATION

Certificate No. : 66S0330-3

Job No. : 66S0330

Page : 1 of 2

Customer : C.E.M Technology (Thailand) Co.,Ltd.  
Address : 31/9 Moo 13, Raikhing, Samphran,  
Nakhornpathom 73210  
Location : Laboratory

Equipment : Sound Level Meter Ambient temperature : ( 20 ± 2 ) °C  
Manufacturer : ACO Relative humidity : ( 50 ± 15 ) %  
Model : 6236 Atmospheric pressure : -  
Serial No. : 222195 Date of received : 08-Mar-2023  
Identity No. : NS-03-025 Date of calibration : 10-Mar-2023  
Range : See to Data Date of issued : 13-Mar-2023

Calibration Method : This instrument was calibrated by comparison measurement with sound level calibrator, according to in house calibration method.

### Reference Standard Instruments :

Equipment	Model	Serial No.	Certification No.	Due Date
Sound Level Calibrator	8930B	2000210	EELBP.31/0664	15-Jun-2023

Traceability : This certification is traceable to the International System of Unit maintained at :

- National Institute of Metrology Thailand, (NIMT).

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

Reviewed By : [ ] Mr. Sompong Srisert

[ ] Ms. Bhacharin Phanangkaew (MD)

[x] Mr. Boonyarit Auejirakarn

[x] Ms. Natthaprakarn Thammaphan

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.3	0.3	0.20
	104	104.0	0.0	0.20
	114	113.7	-0.3	0.20
C	94	94.1	0.1	0.20
	104	104.0	0.0	0.20
	114	114.0	0.0	0.20
Z	94	94.3	0.3	0.20
	104	104.3	0.3	0.20
	114	114.3	0.3	0.20

UUC\* = Unit Under Calibration

- The End -

CERTIFICATE No : GR 17 E 30062

PAGE : 1 OF 2

## Certificate of Calibration

**EQUIPMENT** : SOUND LEVEL METER

**MANUFACTURER** : ACO

**MODEL** : TYPE 6226

**SERIAL No.** : 060209

**ID No.** : CEM-SI-01

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

**CALIBRATED BY** : Suvant K.

**CALIBRATION DATE** : 9-May-23

**APPROVED BY** : Dongorn (Do)  
PHUDIT P.

**ISSUED DATE** : 9-May-23

## Calibration Report

**EQUIPMENT** : SOUND LEVEL METER  
**MANUFACTURER** : ACO  
**MODEL** : TYPE 6226  
**SERIAL NUMBER** : 060209  
**ID No.** : CEM-SI-01  
**RECEIVED DATE** : 4-May-23  
**CALIBRATION DATE** : 9-May-23  
**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** : 1986  
**MODEL** : 01827  
**SERIAL No.** : EEL BP 55/0974  
**CERTIFICATL No.** :  
**DUE DATE** : 12-Jan-24

1) MULTIFUNCTION  
 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	-16.80	-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

## 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** :

**CALIBRATION DATE** :

25-April-24

**APPROVED BY** :

**ISSUED DATE** :

25-April-24



Calibration Report

EQUIPMENT : SOUND LEVEL METER  
MANUFACTURER : ACO  
MODEL : TYPE 6226 SERIAL NUMBER : 090057  
ID No. : CEM-SI-02  
RECEIVED DATE : 23-April-24 CALIBRATION DATE : 25-April-24  
AMBIENT TEMPERATURE : 22 °C ± 3°C RELATIVE HUMIDITY : 50%RH ± 20%RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT MODEL SERIAL No. CERTIFICATE No. DUE DATE  
1) MULTIFUNCTION 1986 01827 EEL BR 67/0974 10-Jan-25  
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

Certificate of Calibration

EQUIPMENT : SOUND LEVEL METER  
MANUFACTURER : ACO  
MODEL : TYPE 6226  
SERIAL No. : 150010  
ID No. : CEM-SI-10  
SUBMITTED BY : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.  
219/43 MOO 12, PETCHKASEM RD., OMNOI,  
KRATHUMBAN SAMUTSAKORN 74130

CALIBRATED BY

SURAWIT K.

9-May-23

CALIBRATION DATE

APPROVED BY

PHUDIT P.

ISSUED DATE

9-May-23

Calibration Report

EQUIPMENT : SOUND LEVEL METER  
MANUFACTURER : ACO  
MODEL : TYPE 6226 SERIAL NUMBER : 150010  
ID No. : CEM-SI-10  
RECEIVED DATE : 4-May-23 CALIBRATION DATE : 9-May-23  
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 1986 01827 EEL.BP.55/0974 12-Jan-24  
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	-16.80	-0.30	0.50
250.00	-8.60	-8.10	-0.50	0.50
500.00	-3.20	-3.0	-0.20	0.50
1000.00	0.00	0.00	0.0	0.50
2000.00	1.20	0.90	0.3	0.50

2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

3. SOUND LEVEL LINEARITY TEST AT 1000 Hz

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

UUC\* : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในบรรยากาศ



Trade & Engineering

## TSP High Volume Sampler TE-5000 TSP Sampler Verification

### Site Information

Location: -	Site ID: -	Date: 16 Oct. 23
Sampler: TE-5000 TSP	Serial No: 3271	Tech: Tong, P

### Site Conditions

Barometric Pressure (in Hg): 27.20	Corrected Pressure (mm Hg): 690.9
Temperature (deg F): 75.8	Temperature (deg K): 255.4
Average Press. (in Hg): 27.50	Corrected Average (mm Hg): 698.5
Average Temp (Deg F): 75.0	Average Temp: (Deg K): 297.0

### Calibration Orifice

Make: Tisch	Qstd Slope: 1.56304
Model: TE-5028A	Qstd Intercept: -0.01520
Serial#: 1179	Calibration Due Date 12 December 2023

### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression Slope
1	7.80	1.827	61.5	63.34	31.5959
2	6.70	1.694	57.7	59.43	5.8641
3	5.90	1.590	54.3	55.93	0.9885
4	4.40	1.374	49.5	50.98	
5	3.80	1.278	43.6	44.91	
					# of Observations: 5

### Calculations

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

Qstd = standard flow rate  
IC = corrected chart response  
I = actual chart response  
m = calibrator Qstd slope  
b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)  
Pa = actual pressure during calibration (mm Hg)  
Tstd = 298 deg K  
Pstd = 760 mm Hg

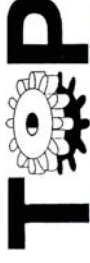
For subsequent calculation of sampler flow:

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

Enter Average 1 (chart):	53.3
Average Flow Calculation m3/min	1.434856906
Average Flow Calculation in cfm	50.66585053
Sample Time (Hrs):	24.0
Total flow in 24 hours m3/min	2066.193944
Total flow in 24 hours cfm	72958.82476

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



Trade & Engineering

## TSP High Volume Sampler TE-5000 TSP Sampler Verification

### Site Information

Location: -	Site ID: -	Date: 18 Oct. 23
Sampler: TE-5000 TSP	Serial No: 3280	Tech: Tong, P

### Site Conditions

Barometric Pressure (in Hg): 28.40	Corrected Pressure (mm Hg): 721.4
Temperature (deg F): 77.0	Temperature (deg K): 298.2
Average Press. (in Hg): 26.50	Corrected Average (mm Hg): 673.1
Average Temp (Deg F): 75.8	Average Temp: (Deg K): 297.5

### Calibration Orifice

Make: Tisch	Qstd Slope: 1.56304
Model: TE-5028A	Qstd Intercept: -0.01520
Serial#: 1179	Calibration Due Date 12 December 2023

### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression Slope
1	7.50	1.695	60.9	59.32	39.2312
2	6.00	1.517	56.0	54.54	-5.8658
3	4.80	1.358	50.7	49.38	0.9824
4	4.30	1.285	45.8	44.61	
5	3.60	1.177	39.7	38.67	
					# of Observations: 5

### Calculations

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

Qstd = standard flow rate  
IC = corrected chart response  
I = actual chart response  
m = calibrator Qstd slope  
b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)  
Pa = actual pressure during calibration (mm Hg)  
Tstd = 298 deg K  
Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

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

Enter Average 1 (chart):	50.6
Average Flow Calculation m3/min	1.364865144
Average Flow Calculation in cfm	48.19439004
Sample Time (Hrs):	24.0
Total flow in 24 hours m3/min	1965.405807
Total flow in 24 hours cfm	69399.92166

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: 2 October 2023  
Sampler: TE-6070 PM10 Serial No: 3211 Tech: Tong P.

### Site Conditions

Barometric Pressure (in Hg): 27.10 Corrected Pressure (mm Hg): 688.3  
Temperature (deg F): 75.3 Temperature (deg K): 297.0  
Average Press. (in Hg): 26.55 Corrected Average (mm Hg): 674.4  
Average Temp. (deg F): 76.2 Average Temp. (deg K): 297.6

### Calibration Orifice

Make: Tisch Environmental, Inc. Qstd Slope: 1.58304  
Model: TE-5028A Qstd Intercept: -0.01520  
Serial#: 1179 Calibration Due Date: 12 Dec 23

### Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression Slope	Intercept	Corr. Coeff	SFR	SSP	# of Observations:
1	9.60	1.295	60.7	39.87	34.8028	-4.2838	0.9827	1.105	52.02	5
2	7.50	1.146	55.5	36.46						
3	6.45	1.063	50.8	33.37						
4	5.35	0.969	45.9	30.15						
5	4.60	0.900	39.2	25.75						

# of Observations: 5

### Calculations

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

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

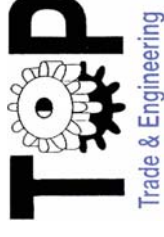
b = calibrator intercept

Ta = actual temperature (deg K)  
Pa = actual pressure (mm Hg)

For subsequent calculation of sampler flow:  
Ts = Average temperature (deg K)  
Ps = Average pressure (mm Hg)

Average I (chart): 50.4  
Average Flow over Sample (m3/min): 1.085070646  
Enter Total Time (Hrs): 24.0  
Total flow over sample (m3/min): 1562.501731  
Total flow over sample (CFM): 55171.9361

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



## PM10 High Volume Sampler Verification

### Site Information

Location: - Site ID: - Date: 2 October 2023  
Sampler: TE-6070 PM10 Serial No: 3310 Tech: Tong P.

### Site Conditions

Barometric Pressure (in Hg): 26.70 Corrected Pressure (mm Hg): 678.2  
Temperature (deg F): 75.1 Temperature (deg K): 296.9  
Average Press. (in Hg): 26.50 Corrected Average (mm Hg): 673.1  
Average Temp. (deg F): 76.2 Average Temp. (deg K): 297.6

### Calibration Orifice

Make: Tisch Environmental, Inc. Qstd Slope: 1.58304  
Model: TE-5028A Qstd Intercept: -0.01520  
Serial#: 1179 Calibration Due Date: 12 Dec 23

### Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression Slope	Intercept	Corr. Coeff	SFR	SSP	# of Observations:
1	9.80	1.318	60.7	40.17	34.0987	-3.7000	0.9779	1.119	52.08	5
2	7.40	1.147	55.6	36.79						
3	6.60	1.083	50.8	33.61						
4	5.35	0.976	45.7	30.24						
5	4.60	0.906	39.1	25.87						

# of Observations: 5

### Calculations

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

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:  
Ts = Average temperature (deg K)  
Ps = Average pressure (mm Hg)

Average I (chart): 50.4  
Average Flow over Sample (m3/min): 1.091243428  
Enter Total Time (Hrs): 24.0  
Total flow over sample (m3/min): 1571.390536  
Total flow over sample (CFM): 55485.79984

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

## Certificate of Analyzer Performance Testing

Calibrated Date : 22-Jul-23 Certificate No. : 0723-001 Page : 1/1

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

**Environmental**  
Temperature : 24.2 °C  
Humidity : 52.0 %RH

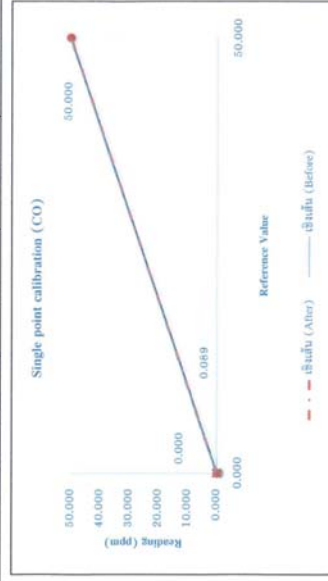
### Calibration System

**Calibrator Units**  
Gas Calibration : Thermo Environmental  
Model : 146C  
Serial No. : 514811438  
Zero Air Generator : API  
Model : 701  
Serial No. : 179

**Standard Gas**  
NO Conc. : 2 ppm  
SO2 Conc. : 2 ppm  
CO Conc. : 50 ppm  
Cylinder No. : CC750227  
Expire Date : 21-Nov-23

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)
CO	0.089	0.000	0.09	Before		
				After		
CO	0.000	0.000	0.00	Before		
				After		



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

## Certificate of Analyzer Performance Testing

Calibrated Date : 1-Apr-23 Certificate No. : 0423-001 Page : 1/1

**Analyzer Instruments**  
Analyzer Type : CO Analyzer  
Model : 48C  
Manufacturer : Thermo Environmental  
Serial No. : 401304261

**Environmental**  
Temperature : 25.2 °C  
Humidity : 52.3 %RH

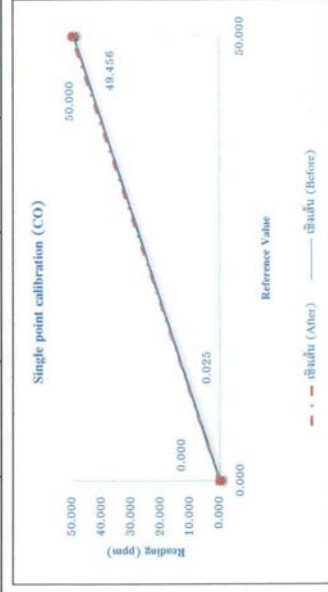
### Calibration System

**Calibrator Units**  
Gas Calibration : Thermo Environmental  
Model : 146C  
Serial No. : 514811438  
Zero Air Generator : API  
Model : 701  
Serial No. : 179

**Standard Gas**  
NO Conc. : 2 ppm  
SO2 Conc. : 2 ppm  
CO Conc. : 50 ppm  
Cylinder No. : CC750227  
Expire Date : 21-Nov-23

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)
CO	0.025	0.000	0.03	Before		
				After		
CO	0.000	0.000	0.00	Before		
				After		



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



## Certificate of Analyzer Performance Testing

Calibrated Date : 26-Aug-23 Certificate No. : 0823-003 Page : 1/1

**Analyzer Instruments**  
 Analyzer Type : CO Analyzer  
 Model : 48C  
 Environmental  
 Temperature : 25.5 °C  
 Humidity : 53.7 %RH

Manufacturer : Thermo Environmental  
 Serial No. : 508011069

**Calibrator System**  
 Calibrator Units

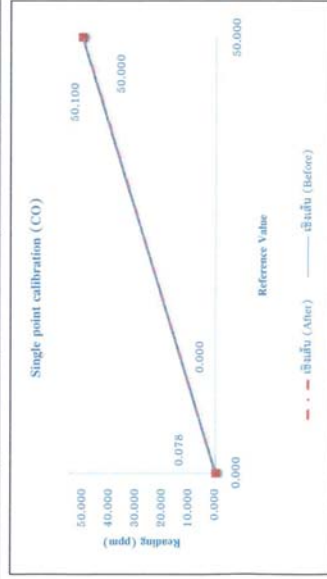
Gas Calibration : Thermo Environmental  
 Model : 146C  
 Serial No. : 514811438  
 Zero Air Generator : API  
 Model : 701  
 Serial No. : 179

**Standard Gas**  
 NO Conc. : 2 ppm  
 SO2 Conc. : 2 ppm  
 CO Conc. : 50 ppm

Cylinder No. : CC750227  
 Expire Date : 21-Nov-23

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
CO	Before			After		
	0.076	0.000	0.08	50.1	50.000	0.20
CO	0.000	0.000	0.00	50.0	50.000	0.00



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

## Certificate of Analyzer Performance Testing

Calibrated Date : 10-Jun-23 Certificate No. : 0023-001 Page : 1/1

**Analyzer Instruments**  
 Analyzer Type : CO Analyzer  
 Model : 48C  
 Environmental  
 Temperature : 25.2 °C  
 Humidity : 51.3 %RH

Manufacturer : Thermo Environmental  
 Serial No. : 508011068

**Calibrator System**  
 Calibrator Units

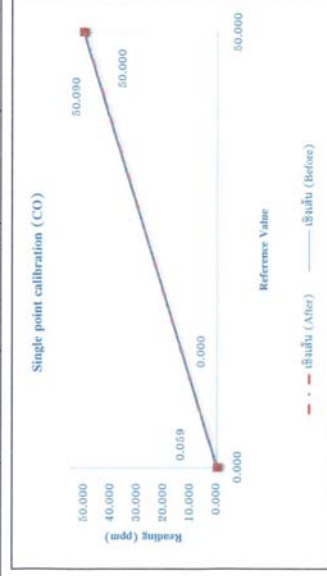
Gas Calibration : Thermo Environmental  
 Model : 146C  
 Serial No. : 514811438  
 Zero Air Generator : API  
 Model : 701  
 Serial No. : 179

**Standard Gas**  
 NO Conc. : 2 ppm  
 SO2 Conc. : 2 ppm  
 CO Conc. : 50 ppm

Cylinder No. : CC750227  
 Expire Date : 21-Nov-23

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
CO	Before			After		
	0.059	0.000	0.06	50.1	50.000	0.18
CO	0.000	0.000	0.00	50.0	50.000	0.00



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

## Certificate of Analyzer Performance Testing

Calibrated Date : 20-Sep-23 Certificate No. : 0923-006 Page : 1/1

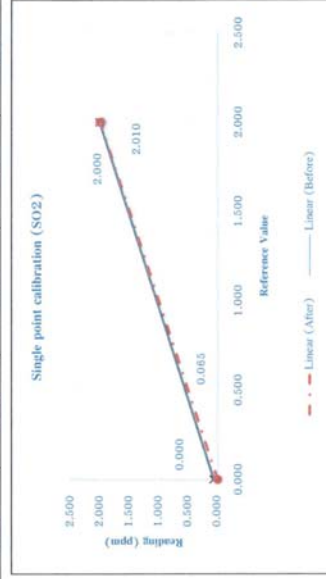
**Analyzer Instruments**  
 Analyzer Type : SO2 Analyzer  
 Model : 43C  
 Environmental :  
 Temperature : 26.7 °C  
 Humidity : 44.0 %RH

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

**Standard Gas**  
 NO Conc. : 2 ppm  
 SO2 Conc. : 2 ppm  
 CO Conc. : 50 ppm  
 Cylinder No. : CC750227  
 Expire Date : 21-Nov-23

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
SO2	Before					
	0.065	0.060	0.07	2.01	2.000	0.50
SO2	After					
	0.060	0.060	0.00	2.00	2.000	0.00



Calibrated by :

*Tong*

(Mr. Tong Pima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 26-Aug-23 Certificate No. : 0823-004 Page : 1/1

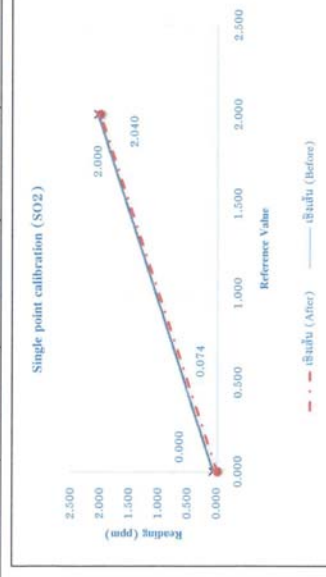
**Analyzer Instruments**  
 Analyzer Type : SO2 Analyzer  
 Model : 43C  
 Environmental :  
 Temperature : 25.1 °C  
 Humidity : 46.2 %RH

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

**Standard Gas**  
 NO Conc. : 2 ppm  
 SO2 Conc. : 2 ppm  
 CO Conc. : 50 ppm  
 Cylinder No. : CC750227  
 Expire Date : 21-Nov-23

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
SO2	Before					
	0.074	0.000	0.07	2.04	2.000	2.00
SO2	After					
	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by :

*Tong*

(Mr. Tong Pima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 1-Apr-23 Certificate No. : 0423-003 Page : 1/1

**Analyzer Instruments**  
 Analyzer Type : SO2 Analyzer  
 Model : 43C  
 Manufacturer : Thermo Environmental  
 Serial No. : 60858-364

**Environmental**  
 Temperature : 25.2 °C  
 Humidity : 52.3 %RH

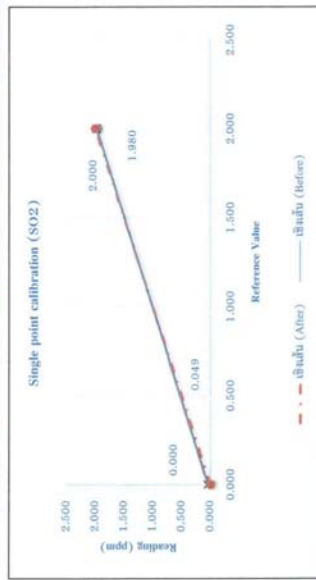
### Calibration System

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

**Standard Gas**  
 NO Conc. : 2 ppm  
 SO2 Conc. : 2 ppm  
 CO Conc. : 50 ppm  
 Cylinder No. : CC750227  
 Expire Date : 21-Nov-23

### 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	0.03	1.98	2.000	-1.00
After						
SO2	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by :

*Tanji*  
(Mr. Yong Pima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 26-Aug-23 Certificate No. : 0823-001 Page : 1/1

### Analyzer Instruments

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

**Environmental**  
 Temperature : 25.3 °C  
 Humidity : 40.2 %RH

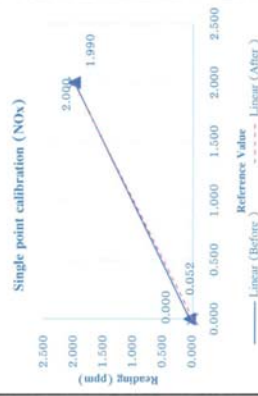
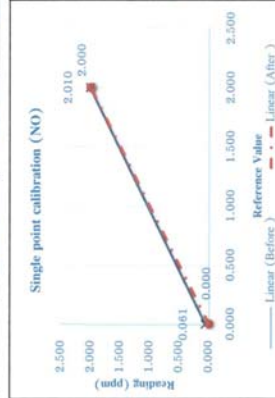
### Calibration System

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

**Standard Gas**  
 NO Conc. : 2 ppm  
 SO2 : 2 ppm  
 CO Conc. : 50 ppm  
 Cylinder No. : CC750227  
 Expire Date : 21-Nov-23

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.061	0.000	0.06	2.01	2.00	0.50
NOx	0.052	0.000	0.05	1.99	2.00	-0.50
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NOx	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by :

*Tanji*  
(Mr. Yong Pima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 1-Apr-23 Certificate No. : 0423-004 Page : 1/1

**Analyzer Instruments**  
 Analyzer Type : NO/NO<sub>x</sub> Analyzer  
 Model : 42C  
 Manufacturer : Thermo Environmental  
 Serial No. : 72454-371

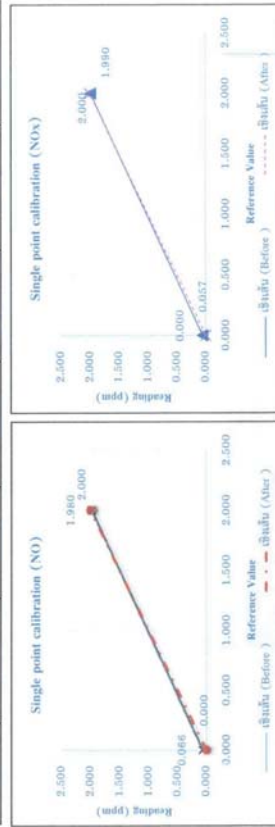
**Environmental**  
 Temperature : 25.2 °C  
 Humidity : 52.3 %RH

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

**Standard Gas**  
 NO Conc. : 2 ppm  
 SO<sub>2</sub> : 2 ppm  
 CO Conc. : 50 ppm  
 Cylinder No. : CC750227  
 Expire Date : 21-Nov-23

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.046	0.000	0.07	1.98	2.00	-1.00
NO <sub>x</sub>	0.037	0.000	0.06	1.99	2.00	-0.50
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NO <sub>x</sub>	0.000	0.000	0.00	2.00	2.00	0.00



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

## Certificate of Analyzer Performance Testing

Calibrated Date : 4-Jul-23 Certificate No. : 0723-001 Page : 1/1

**Analyzer Instruments**  
 Analyzer Type : NO/NO<sub>x</sub> Analyzer  
 Model : 42C  
 Manufacturer : Thermo Environmental  
 Serial No. : 63470-339

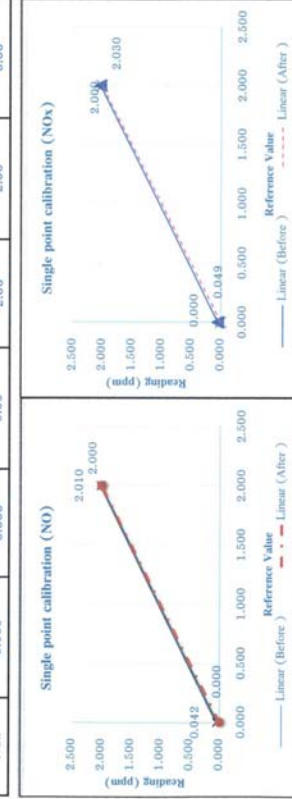
**Environmental**  
 Temperature : 25.1 °C  
 Humidity : 40.4 %RH

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

**Standard Gas**  
 NO Conc. : 2 ppm  
 SO<sub>2</sub> : 2 ppm  
 CO Conc. : 50 ppm  
 Cylinder No. : CC750227  
 Expire Date : 21-Nov-23

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.042	0.000	0.04	2.01	2.00	0.50
NO <sub>x</sub>	0.049	0.000	0.05	2.03	2.00	1.50
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NO <sub>x</sub>	0.000	0.000	0.00	2.00	2.00	0.00



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



## Certificate of Analyzer Performance Testing

Calibrated Date : 15-Jan-24 Certificate No. : 0124-001 Page : 1/1

**Analyzer Instruments**  
 Analyzer Type : THC Analyzer  
 Model : 51  
 Manufacturer : Thermo Environmental  
 Serial No. : 51HT-72244-373

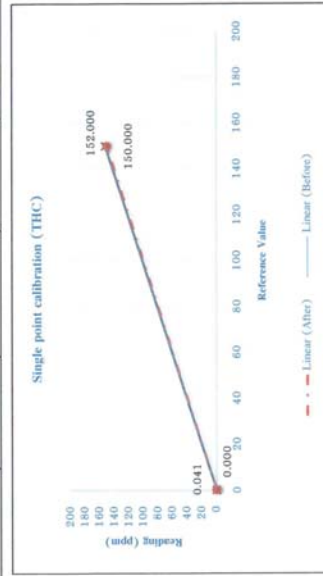
**Environmental**  
 Temperature : 25.1 °C  
 Humidity : 40.4 %RH

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

**Standard Gas**  
 Propane Conc. : 150 ppm  
 Cylinder No. : 21W281046  
 Expire Date : 26-Sep-25

### Calibration Check

Gas	Zero				Span			
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)		Reading Value (ppm)	Expected Value (ppm)	Drift (%)	
Before								
THC	0.041	0.050	0.041		132	150	1.333	
After								
THC	0.050	0.050	0.000		150	150	0.000	



Calibrated by : *Topin*  
 (Mr. Tong Pina)

## Certificate of Analyzer Performance Testing

Calibrated Date : 15-Jan-24 Certificate No. : 0124-002 Page : 1/1

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

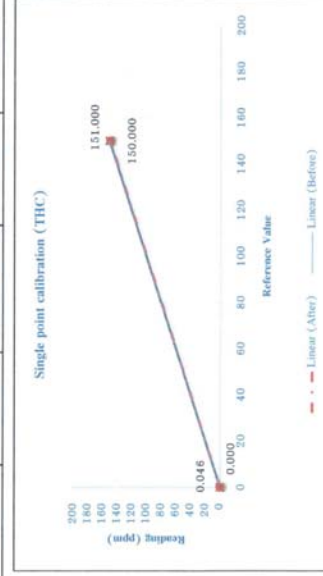
**Environmental**  
 Temperature : 24.6 °C  
 Humidity : 45.1 %RH

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

**Standard Gas**  
 Propane Conc. : 150 ppm  
 Cylinder No. : 21W281046  
 Expire Date : 26-Sep-25

### Calibration Check

Gas	Zero				Span			
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)		Reading Value (ppm)	Expected Value (ppm)	Drift (%)	
Before								
THC	0.046	0.000	0.046		151	150	0.667	
After								
THC	0.000	0.000	0.000		150	150	0.000	



Calibrated by : *Topin*  
 (Mr. Tong Pina)

เอกสารการสอบเทียบเครื่องมือตรวจวัดความชื้นสะท้อน





Certificate No.: CP20230379EA

### 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

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard Accelerometer	8305	2708237	AV-0001-23	20-Jul-2024
2) Measuring Amplifier	2525	2685967	AV-0044-23	20-Jul-2024
3) PULSE Multi-analyzer system	3560-C	2705645	CQ20230003EA	25-Dec-2023
4) Humidity and Temperature Transmitter	HMT331	K3810009	CD20230166EA	14-Jun-2024

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

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

- National Institute of Metrology (Thailand)

Certificate No.: CP20230379EA  
Operation No.: CP2023100002

### 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: 6 October 2023

Calibrated Date: 18 - 20 October 2023

Issued Date: 31 October 2023

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.

ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20230379EA

## Calibration Report

## Result of Calibration:-

Function : Frequency response and Linearity test at 16 Hz

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty $\pm$ (%)	Direction
4.0	10.000	10.006	10.412	0.406	1.50	Longitudinal (L)
5.0	10.000	9.984	10.254	0.270	1.50	
6.3	10.000	9.991	10.483	0.492	1.50	
8.0	10.000	10.013	10.215	0.202	1.50	
10.0	10.000	10.008	10.199	0.191	1.50	
12.5	10.000	10.000	10.104	0.104	1.50	
16.0	10.000	9.993	10.073	0.080	1.50	
	20.000	19.983	20.146	0.163	1.50	
	30.000	29.995	30.219	0.224	1.50	
	50.000	49.992	50.396	0.404	1.50	
20.0	10.000	10.006	10.112	0.106	1.50	
25.0	10.000	10.003	10.097	0.094	1.50	
31.5	10.000	10.000	10.160	0.160	1.50	
40.0	10.000	10.008	10.302	0.294	1.50	
50.0	10.000	10.006	10.357	0.351	1.50	
52.0	10.000	9.994	10.412	0.418	1.50	
63.0	10.000	10.008	10.711	0.703	1.50	
80.0	10.000	9.984	11.097	1.113	1.50	

ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20230379EA

## Calibration Report

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

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty $\pm$ (%)	Direction
4.0	10.000	9.997	10.372	0.375	1.50	Transverse (T)
5.0	10.000	9.991	10.325	0.334	1.50	
6.3	10.000	10.000	10.501	0.501	1.50	
8.0	10.000	10.008	10.357	0.349	1.50	
10.0	10.000	10.015	10.294	0.279	1.50	
12.5	10.000	9.997	10.231	0.234	1.50	
16.0	10.000	10.004	10.191	0.187	1.50	
	20.000	20.011	20.248	0.237	1.50	
	30.000	29.995	30.298	0.303	1.50	
	50.000	49.978	50.562	0.584	1.50	
20.0	10.000	10.001	10.144	0.143	1.50	
25.0	10.000	9.997	10.120	0.123	1.50	
31.5	10.000	9.998	10.144	0.146	1.50	
40.0	10.000	10.013	10.246	0.233	1.50	
50.0	10.000	9.991	10.388	0.397	1.50	
52.0	10.000	10.006	10.404	0.398	1.50	
63.0	10.000	10.013	10.696	0.683	1.50	
80.0	10.000	9.991	11.098	1.107	1.50	



Certificate No.: CP20230379EA

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	10.008	10.002	-0.006	1.50	Vertical (V)
5.0	10.000	9.991	10.136	0.145	1.50	
6.3	10.000	9.997	10.365	0.368	1.50	
8.0	10.000	10.008	10.270	0.262	1.50	
10.0	10.000	9.990	10.278	0.288	1.50	
12.5	10.000	9.997	10.238	0.241	1.50	
16.0	10.000	9.994	10.175	0.181	1.50	
	20.000	19.997	20.445	0.448	1.50	
	30.000	29.995	30.597	0.602	1.50	
	50.000	49.992	51.043	1.051	1.50	
20.0	10.000	10.003	10.231	0.228	1.50	
25.0	10.000	9.997	9.726	-0.271	1.50	
31.5	10.000	10.000	10.057	0.057	1.50	
40.0	10.000	9.996	10.168	0.172	1.50	
50.0	10.000	9.996	10.199	0.203	1.50	
52.0	10.000	9.994	10.309	0.315	1.50	
63.0	10.000	9.984	10.396	0.412	1.50	
80.0	10.000	9.998	10.672	0.674	1.50	

Remark

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

-- End of Report --

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพน้ำ

CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



## Certificate of Calibration

Certificate No. : 67-420018-1

Page : 1 of 2

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

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

Equipment : pH Meter with electrode

pH meter

Manufacturer : Thermo Scientific Model : VERSA STAR PRO

Range : N/A pH Resolution : 0.01 pH

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

Electrode

Model : 9156BNWP Serial No. : VV1-15843

ID No. : WW-03-001

Environment : On site calibration was carried out at the Laboratory, C.E.M Technology (Thailand) Co., Ltd.

Ambient Temperature : (23.0 to 24.0)°C

Relative Humidity : (50 to 55) %

Date of Received : 10 February 2024

Date of Calibration : 10 February 2024

Date of Issue : 15 February 2024

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	944535	27 Nov 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.986	61281486	944537	17 Nov 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
9.997	61281073	944536	17 Nov 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :   
( Surachai Promthong )  
Laboratory Manager

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. : 67-420018-1

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
	6.986	7.00	-0.01	0.011
	9.997	10.01	-0.01	0.014

### Remark

UUC : Unit Under Calibration

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

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

- 000 -

*Signature*



## Certificate of Calibration

Certificate No. : 67-400074-1

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 Thermometer 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 : (23.0 to 24.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (224.5 to 226.0) VAC

Date of Received : 10 February 2024

Date of Calibration : 10 February 2024

Date of Issue : 15 February 2024

Calibrated by : Permpon Chanpu

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

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400002	TT-0074-22	20 Jun 2024	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400033	22E569	22 Feb 2024	National Institute of Metrology Thailand (NIMT)

Approved by :

( Surachai Promthong )  
Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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# CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

## Certificate of Calibration

Certificate No. : 67-400074-1

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 )
120	25.002	25.0	0.0	0.19

Remark

UUC : Unit Under Calibration

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

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

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ABJ



CAL-F0031-03

# CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



## Certificate of Calibration

Certificate No. : 67-420018-3

Page : 1 of 2

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

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

Equipment : pH Meter with electrode

pH meter

Manufacturer : Apera

Model : PC 910

Range : N/A pH

Resolution : 0.01 pH

Serial No. : PC910X1220811001

ID No. : WW-03-002

Electrode

Model : LabSen 211

Serial No. : 2110009/213

ID No. : WW-03-002

Environment : On site calibration was carried out at the Laboratory, C.E.M Technology (Thailand) Co., Ltd.

Ambient Temperature : (23.0 to 24.0) °C

Relative Humidity : (50 to 55) %

Date of Received : 10 February 2024

Date of Calibration : 10 February 2024

Date of Issue : 15 February 2024

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	944535	27 Nov 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.986	61281486	944537	17 Nov 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
9.997	61281073	944536	17 Nov 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :

( Surachai Promthong )

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



## Certificate of Calibration

Certificate No. : 67-420018-3

Page : 2 of 2

### Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

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

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

Function : pH meter with electrode

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

Adjustment Curve at nominal pH	Standard Buffer ( pH )	UUC Reading ( pH )	Correction ( pH )	Uncertainty ( ± pH )
4, 7, 10	4.008	4.00	0.00	0.010
	6.986	7.00	-0.01	0.011
	9.997	10.01	-0.01	0.014

### Remark

UUC : Unit Under Calibration

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

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

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1.12



## Certificate of Calibration

Certificate No. : 67-400074-2

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 Thermometer with Thermistor probe

Temperature Indicator

Manufacturer : Apera

Model : PC 910

Range : N/A °C

Resolution : 0.1 °C

Serial No. : PC910X1220811001

ID No. : WW-03-002

Thermistor probe

Model : N/A

Sheath Material : Stainless

Diameter : 4.8 mm.

Length : 100 mm.

Serial No. : N/A

ID No. : WW-03-002

Environment :

On site calibration was carried out at the Laboratory, C.E.M Technology (Thailand) Co., Ltd.

Ambient Temperature : (23.0 to 24.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (224.5 to 226.0) VAC

Date of Received : 10 February 2024

Date of Calibration : 10 February 2024

Date of Issue : 15 February 2024

Calibrated by : Permpon Chanpu

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

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

ID No. Cert. No. Due Date Traceability

400002 TT-0074-22 20 Jun 2024 National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No. Cert. No. Due Date Traceability

400033 22E569 22 Feb 2024 National Institute of Metrology Thailand (NIMT)

Approved by :

1.12

( Surachai Promthong )

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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# CAL

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7/106-7 Moo 2, Sukhprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

## Certificate of Calibration

Certificate No. : 67-400074-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth ( mm. )	Standard Reading ( °C )	UUC Reading ( °C )	Correction ( °C )	Uncertainty ( ± °C )
100	25.005	25.1	-0.1	0.19

Remark

UUC : Unit Under Calibration

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

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

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ABJ



CAL-F0031-03



## 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.: C31240373  
Issued Date: 16 February 2024  
Job No.: WO-00017098  
Page: 1 of 3  
Ventilation Valve: None

Customer: C.E.M Technology (Thailand) Co., Ltd.  
31/8 Moo 13, Tambon Raikhing,  
Amphur Sampran, Nakhonpathom 73210 Thailand.

Environment Condition: Temperature: 24 °C ± 1.1 °C  
Humidity: 63 %RH ± 5.9 %RH  
Voltage: 229 VAC ± 1.2 VAC

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

Calibration By: Mr. Ampol Srisumphan

Calibration Date: 14 February 2024

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. C10240001

(Mr. Ampol Srisumphan)

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.

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

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CAL-FM-C31-10: 12 Sep 2022



Refer to Certificate No.: C31240373 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	20.17	0.17	0.49	1.0	Pass
#2	20.13	0.13	0.49	1.0	Pass
#3	19.99	-0.01	0.56	1.0	Pass
#4	19.98	-0.02	0.60	1.0	Pass
#5	20.21	0.21	0.51	1.0	Pass
#6	20.17	0.17	0.46	1.0	Pass
#7	19.97	-0.03	0.57	1.0	Pass
#8	20.07	0.07	0.47	1.0	Pass
#9	20.13	0.13	0.43	1.0	Pass

Correction\* = Measured Temperature - Desired Temperature

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

### The End of Statements of Conformity

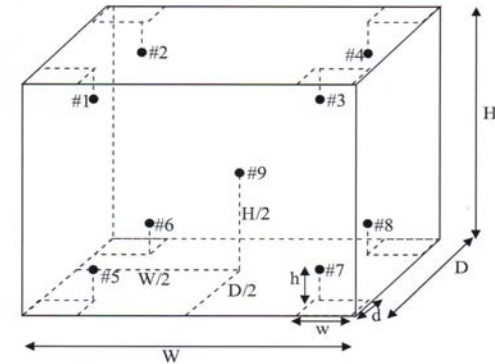
บริษัท ดีเคเอส อีเซีย จำกัด  
DKSH Technology Limited  
2533 สุขุมวิท/ถนนสุขุมวิท/ซอยสุขุมวิท 102/60  
2533 Sukhumvit Road, Bangkok, Phrahanong, Bangkok 10260  
Phone: +66 2839 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-10: 12 Sep 2022



Certificate No.: C31240373 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	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.

บริษัท ดีเคเอส อีเซีย จำกัด  
DKSH Technology Limited  
2533 สุขุมวิท/ถนนสุขุมวิท/ซอยสุขุมวิท 102/60  
2533 Sukhumvit Road, Bangkok, Phrahanong, Bangkok 10260  
Phone: +66 2839 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-10: 12 Sep 2022





Certificate No.: C31240373 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	20.17	0.17	0.49
#2	20.13	0.13	0.49
#3	19.99	-0.01	0.56
#4	19.98	-0.02	0.60
#5	20.21	0.21	0.51
#6	20.17	0.17	0.46
#7	19.97	-0.03	0.57
#8	20.07	0.07	0.47
#9	20.13	0.13	0.43

**Temperature Distribution**

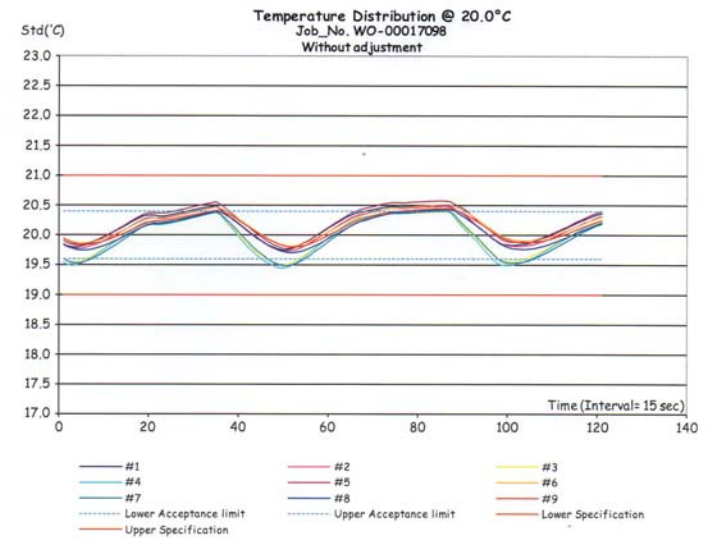
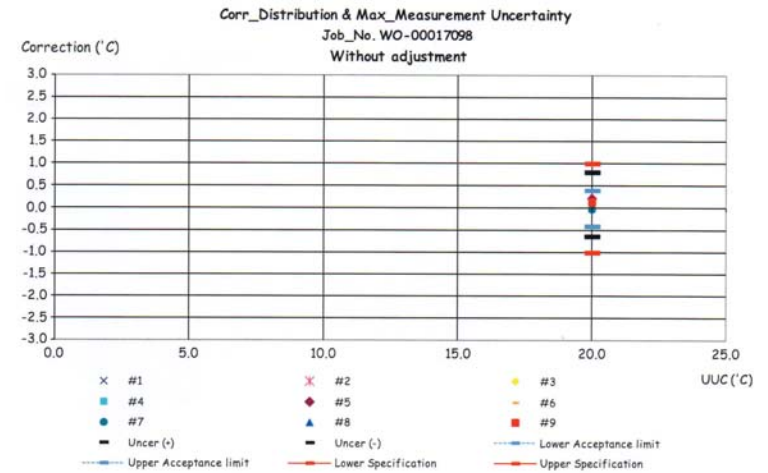
Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
20.0	20.0	20.0	#1	#2	#3	#4	#5	#6	#7	#8	#9	
			20.17	20.13	19.99	19.98	20.21	20.17	19.97	20.07	20.13	0.60

**Chamber Characterization**

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
20.0	0.47	0.48	1.13

Note: \* Maximum uncertainty of the each position

**The End of Certificate**





## ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

ชนิดเครื่องมือ: Cooled Incubator  
รุ่น: KB 240  
หมายเลขเครื่อง: 20180000012164(WW-16-001)

เลขที่ใบงาน: WO-00017098

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
14 Feb 2024			14 Feb 2024		
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. สภาพ Lever of Ventilation valve	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<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 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. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ชื่อเจ้าหน้าที่ :

Mr. Ampol Srisumphan  
Service Engineer

บริษัท ดิเคช เทคโนโลยี จำกัด  
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2533 ถนนสุขุมวิท แขวงบางจาก เขตพญาไท กรุงเทพมหานคร 10260  
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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## Certificate of Calibration

Equipment: Hot Air Oven  
Model: UF 55  
Serial No.(or ID): B219.0142 ( WW-05-002 )  
Manufacturer: Memmert  
Condition: In Condition  
Shelves(pc.): 2  
Certificate No.: C31240372  
Issued Date: 15 February 2024  
Job No.: WO-00017098  
Page: 1 of 5  
Ventilation Valve: Closed

Customer: C.E.M Technology (Thailand) Co., Ltd.  
31/8 Moo 13, Tambon Raikhing,  
Amphur Sampran, Nakhonpathom 73210 Thailand.

Environment Condition: Temperature: 29 °C ± 0.6 °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 Petchkasam Road,  
Omnoi Krathum Baen, Samut Sakhon 74130 Thailand

Calibration By: Mr. Ampol Srisumphan

Calibration Date: 14 February 2024

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. C10240001

อัมพล ศรีสุมพันธ์

(Mr. Ampol Srisumphan)

Person in charge

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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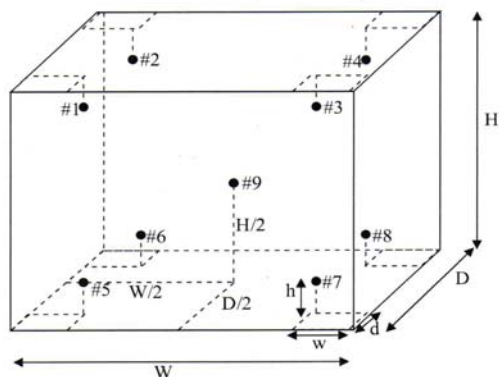
อูดอน ศรีชนะ

(Mr. Udon Srichana)

Authorized signatory

CAL-FM-C31-10: 12 Sep 2022





#### Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

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

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

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

#9: Geometric center of the chamber

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

#### Definitions

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

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

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

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

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

#### 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	104.38	0.38	0.39
#2	104.15	0.15	0.39
#3	104.39	0.39	0.39
#4	104.26	0.26	0.39
#5	103.88	-0.12	0.39
#6	104.13	0.13	0.39
#7	104.47	0.47	0.39
#8	104.41	0.41	0.39
#9	104.65	0.65	0.39

#### Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.0	104.0	104.38	104.15	104.39	104.26	103.88	104.13	104.47	104.41	104.65	0.39

#### Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	0.83	0.12	0.96

Note: \* Maximum uncertainty of the each position

**Without adjustment (Cont.)**

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

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	180.34	0.34	0.56
#2	179.98	-0.02	0.56
#3	180.46	0.46	0.56
#4	180.34	0.34	0.56
#5	180.63	0.63	0.56
#6	180.33	0.33	0.56
#7	179.22	-0.78	0.56
#8	179.80	-0.20	0.56
#9	180.74	0.74	0.56

**Temperature Distribution**

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
180.0	180.0	180.0	180.34	179.98	180.46	180.34	180.63	180.33	179.22	179.80	180.74	0.56

**Chamber Characterization**

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180.0	1.59	0.08	1.66

Note: \* Maximum uncertainty of the each position

**The End of Certificate**
**Without adjustment (Cont.)**

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 110.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	110.40	0.40	0.46
#2	110.15	0.15	0.46
#3	110.45	0.45	0.46
#4	110.37	0.37	0.46
#5	110.42	0.42	0.46
#6	110.29	0.29	0.46
#7	109.86	-0.14	0.46
#8	110.12	0.12	0.46
#9	110.51	0.51	0.46

**Temperature Distribution**

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
110.0	110.0	110.0	110.40	110.15	110.45	110.37	110.42	110.29	109.86	110.12	110.51	0.46

**Chamber Characterization**

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
110.0	0.71	0.11	0.86

Note: \* Maximum uncertainty of the each position

## 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 : 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	104.38	0.38	0.39	1.0	Pass
#2	104.15	0.15	0.39	1.0	Pass
#3	104.39	0.39	0.39	1.0	Pass
#4	104.26	0.26	0.39	1.0	Pass
#5	103.88	-0.12	0.39	1.0	Pass
#6	104.13	0.13	0.39	1.0	Pass
#7	104.47	0.47	0.39	1.0	Pass
#8	104.41	0.41	0.39	1.0	Pass
#9	104.65	0.65	0.39	1.0	Condition 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 : 110.0°C Tolerances : 5.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 110.0 °C

Locations	Measured (°C)	Correction* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	110.40	0.40	0.46	5.0	Pass
#2	110.15	0.15	0.46	5.0	Pass
#3	110.45	0.45	0.46	5.0	Pass
#4	110.37	0.37	0.46	5.0	Pass
#5	110.42	0.42	0.46	5.0	Pass
#6	110.29	0.29	0.46	5.0	Pass
#7	109.86	-0.14	0.46	5.0	Pass
#8	110.12	0.12	0.46	5.0	Pass
#9	110.51	0.51	0.46	5.0	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

### Without adjustment

Desired Temperature : 180.0°C Tolerances : 2.0 °C

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

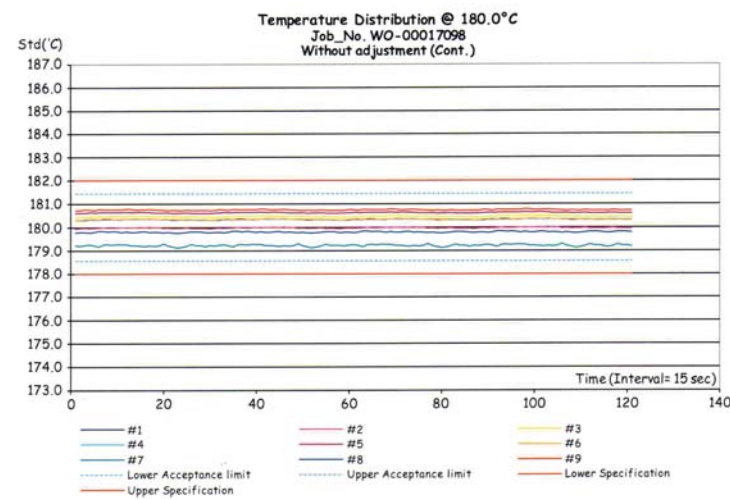
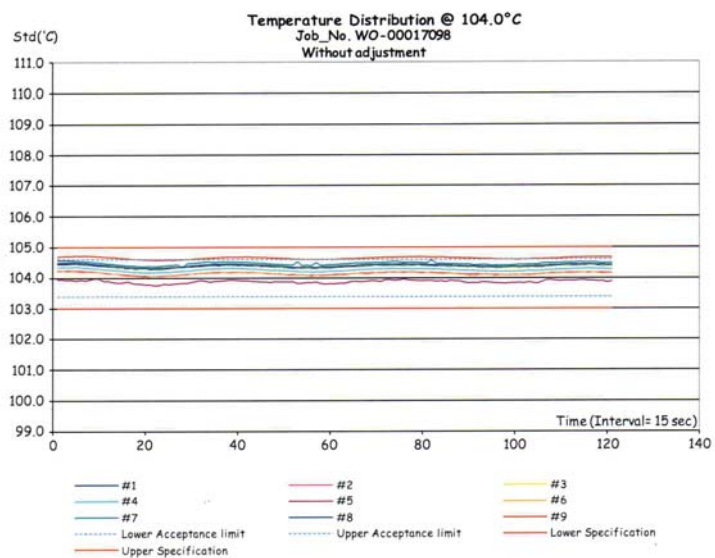
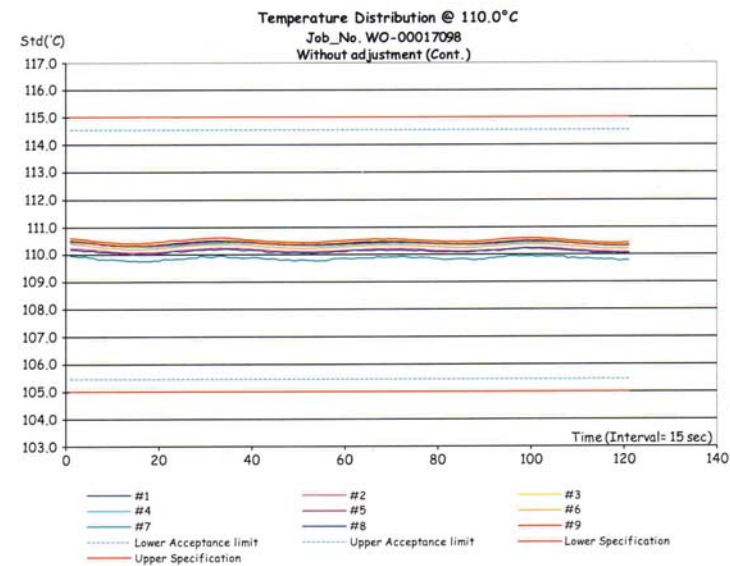
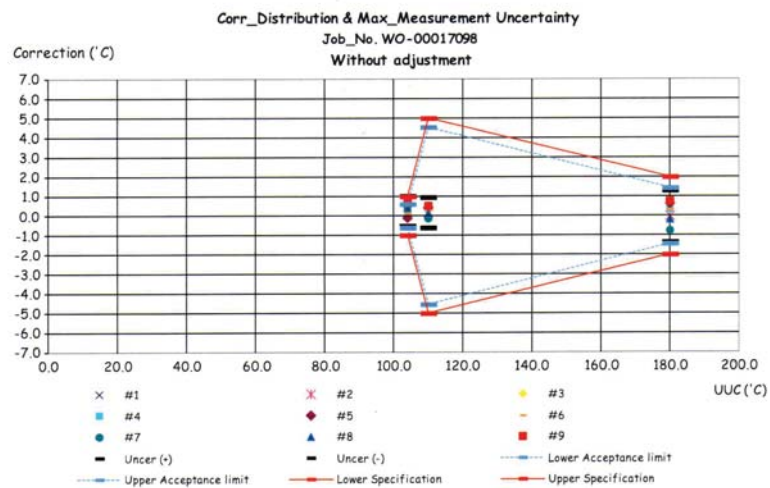
Locations	Measured (°C)	Correction* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	180.34	0.34	0.56	2.0	Pass
#2	179.98	-0.02	0.56	2.0	Pass
#3	180.46	0.46	0.56	2.0	Pass
#4	180.34	0.34	0.56	2.0	Pass
#5	180.63	0.63	0.56	2.0	Pass
#6	180.33	0.33	0.56	2.0	Pass
#7	179.22	-0.78	0.56	2.0	Pass
#8	179.80	-0.20	0.56	2.0	Pass
#9	180.74	0.74	0.56	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

เลขที่ใบงาน: WO-00017098

ชนิดเครื่องมือ: Hot Air Oven

รุ่น: UF 55

หมายเลขเครื่อง: B219.0142 ( WW-05-002 )

ตรวจระบบ (รับ)		รายการตรวจเช็ค	ตรวจระบบ (ส่ง)		หมายเหตุ
14 Feb 2024			14 Feb 2024		
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 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. การทำงานของระบบทำความชื้น	<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. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อเสนอแนะ :

Mr. Ampol Srisumphan  
Service Engineer

บริษัท ดีเคเอสเอช (ประเทศไทย) จำกัด  
DKSH Technology Limited  
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
2533 Sukhumvit Road, Bangchak, Phra Khanong, Bangkok 10260  
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth – in Asia and Beyond.



CERT.No.: HS-U059H

Calibration Date : 28 Aug 23

Submitted by : C.E.M TECHNOLOGY (THAILAND) Co., LTD.

219/43 Moo 12, Petchkasem Road, Omnoi, Krathumban,

Samutsakom 74130

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 760.00 mmHg

Salinity : 0 ppt

Model : YSI 5000

S/N : 18L109487

Probe : YSI 5010

S/N : 22G100123

ID NO. :

Air Temp ref : S/N. F8065C26

Barometric ref : S/N. F8065C26

Water Temp ref : S/N. 11430

Technician : Kittipong M.

### Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.08	(PASS)	-
Measurement 2 (mg/l)	9.08	(PASS)	-
Measurement 3 (mg/l)	9.08	(PASS)	-
Measurement 4 (mg/l)	9.08	(PASS)	-
Measurement 5 (mg/l)	9.08	(PASS)	-
Measurement 6 (mg/l)	9.08	(PASS)	-
Measurement 7 (mg/l)	9.08	(PASS)	-
Measurement 8 (mg/l)	9.08	(PASS)	-
Measurement 9 (mg/l)	9.09	(PASS)	-
Measurement 10 (mg/l)	9.09	(PASS)	-

Mean Measurement	9.08	mg/l	-	-
Inaccuracy	0.01	mg/l	-	-

Overall Status (PASS)

### Manufacturer Specification

Accuracy = +/- 0.02 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.

Technician Signature

(Kittipong Maekwong)

Harikul Science Co.,Ltd.  
694 Soi Ratchadaniwet 24, Pracharatbamphen,  
Samsaennok, Huaikhwang, Bangkok 10310  
Tel: 0-2274-2456 Fax: 0-2274-2443  
Email: info@harikul.com www.harikul.com

Certificate of Calibration

Laboratory Manager

(Supreecha Sumaritam)





# Avio200 Preventive Maintenance Report

Company Name: CEM TECNOLOGY  
Instrument Location: 219/43 Krathum Baen District  
Samut Sakhon 74130  
Instrument Serial No.: M79S2103051  
Date: 02-Aug-2023

## ICP-OES/Avio200 Preventive Maintenance (PM)

Company Name:	CEM TECNOLOGY.		
Address (Instrument Location):	219/43 Krathum Baen District Samut Sakhon 74130		
Serial Number:	M79S2103051	PM Number:	4 of 4 Warranty
Customer Name (if applicable):	K. Wichuda	Telephone Number:	086 9054664
Service Engineer Name:	K. Chayanan	Service Order Number:	WO-02409475
Date PM Performed: (DD-MMM-YYYY)	02-Aug-2023	Next PM Due Date: (DD-MMM-YYYY)	02-Feb-2024
Standard Labor Hours to Complete PM :		4 hours	

Part Number	Release	Publication Date	
09370140 Rev.5	B	January 2018	

### Scope

The purpose of this PM is to ensure the continued functionality of the PerkinElmer/Avio200 by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

The customer should save their method before the PM begins.

### General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM. Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files. The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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## Component List

Component / Specific Model	Serial #	Configuration Notes
Avio200	M79S2103051	Syngistix V 5.1.0.0293
S23 Autosampler	0121106S23	

## Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
09995098	Air Filter-Spectrometer	Not Applicable
N077520	Air Filter-RF Generator	Not Applicable
09992731	Axial Window	Not Applicable
B0810377	Radial Window	Not Applicable
N0770438	O-ring kit, injector support adapter	Not Applicable
N0780437	O-ring kit, torch	Not Applicable

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date: (MM/YY)
N0691579	Multi-Element Standard (N069-1579 diluted 10X)	1	57-024CRX1	Oct-2024
N9300221	Instrument Calibration-4 (N9300221 diluted 100X)	1	54-134CRY1	Jun-2024

## Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

### 1. General:

- ☒ Ask customer about unit's performance since last visit.
- ☒ Check incoming AC line voltage under load for proper levels and grounding.
- ☒ Is the instrument operational?

### 2. Mechanical:

- ☒ Inspect and clean all fans and filters.
- ☒ Inspect and replace torch components and necessary.

Torch Components Replaced: ☐ Yes ☒ No

If yes, list components replaced:

- ☒ Inspect all tubing for signs of cracking or leaking and replace as necessary.

Tubing Replaced: ☒ Yes ☐ No

If yes, list tubing replaced:

- ☒ Inspect the peristaltic pump for proper operation.
- ☒ Check and adjust if necessary, the external nitrogen, argon shear gas and water supply pressures.
- ☒ Check and adjust if necessary, the internal nitrogen, main argon, torch argon and shear gas pressures

Regulator	Measured Pressure	Set Pressure
Nitrogen	N/A	NA (calibrated in Factory)
Main Argon	76	76psig
Torch Argon	67	67psig
Shear Gas	65	65psig
Water	35	35psi

- ☒ Check the shear gas nozzle for blockages and proper, uniform flow.
- ☒ Inspect nitrogen Hi/Low purge and shear gas solenoids for proper function.
- ☒ Inspect the function of all spectrometer motors. Drive the motors from the Spectrometer DCM. Check all motors, couplings, set screws, gears or drive assembly located on the spectrometer (prism/grating wavelength drives, slits, shutter, DV mirror, X/Y mirror) if problems are found.
- ☒ Perform preventative maintenance on the chiller as required. Make the customer aware of the importance of maintaining the chiller fluid level and filter replacement.
- ☒ Drain air compressor surge tank.
- ☒ Clean exterior of instrument.

### 3. Electrical:

- ☒ Visually inspect all PC boards for cleanliness and signs of corrosion.
  - ☒ Check all RF generator and spectrometer power supply voltages.
  - ☒ Run instrument diagnostic checks from the appropriate Device Control Module.

#### RF Generator:

- ☒ Check the RF generator status screens.
- ☒ Check the function of all interlocks.

#### Spectrometer:

- ☒ Check the spectrometer status screens.
- ☒ Check for proper function of all motors from the Motor Control window.

### 4. Optical:

- ☒ Check the neon lamp for proper operation.
- ☒ Ensure that neon initialization passes at power up.
- ☒ Ensure that there is a single, well defined peak of sufficient intensity (approximately 15,000 to 60,000 cts.) for the 703.241nm neon line viewed in the DCM Collect Spectra window. Re-generate the neon correction table if problems are encountered. If problems are still exhibited after the table is re-generated, replace the neon lamp assembly.

Neon Lamp Replaced: ☐ Yes ☒ No

- ☒ Perform the Initialize Optics routine from the Spectrometer Control window.
- ☒ Insure that the routine passes with no error codes. If it fails, run a manual prism scan from the spectrometer DCM.
- ☒ Insure the Dark Current measurement (Detector Calibration) passes at initialization.
- ☒ Check the shutter home sensor position.
- ☒ Check prism/electronics temperature sensor readback values from the DCM. It is normal for these readings to be shown in red. A typical prism temperature is approximately 29.5 degree C. A typical electronics temperature is approximately 35 degree C.
- ☒ Check the detector temperature from the DCM for -7.0 to -8.5 degree C. If outside of this range the detector cooling fan may not be operational. Further inspection may be necessary.
- ☒ Inspect for proper function of the transfer optics. 1) shutter 2) DV mirror 3) X/Y mirror.
- ☒ Clean or replace the axial and radial view windows as necessary.
  - Axial Window Replaced: ☒ Yes ☐ No
  - Radial Window Replaced: ☒ Yes ☐ No

### 5. Post PM Performance Tests:

- ☒ Perform View Align.

#### 5.1 Spectral Resolution:

- ☒ Measure the spectrometers ability to separate two adjacent wavelengths.

Parameter	Specification	Test Result	Pass/Fail
As 193.696 - Resolution	≤0.009	0.007	Passed
Ni 231.604 - Resolution	≤0.011	0.009	Passed
Ni 341.476 - Resolution	≤0.015	0.013	Passed
Ba 455.403 - Resolution	≤0.020	0.017	Passed

#### 5.2 Precision:

- ☒ Test for reproducibility of a set of measurement.

Parameter	Specification	Test Result	Pass/Fail
Zn 213.856	%RSD ≤ 1 %	0.46	Passed
Mg 280.856	%RSD ≤ 1 %	0.25	Passed
Mg 285.207	%RSD ≤ 1 %	0.22	Passed
Ba 455.403	%RSD ≤ 1 %	0.15	Passed

#### 5.3 Mn BEC:

- ☒ Run Axial and Radial BEC according to the A&T spec, or the commissioning test procedure.

#### Mn Background Equivalent Concentration:

Method "MnBEC" For Samples "IB (2%HNO3)" and "IS (N069-1579/10)", record intensities.

Calculated BEC: BEC = (IB \* Conc of Std) / (IS - IB). Where Conc of Std = 1,000 PPB

Element	Mode	Conc.	IB	IS	
Mn 257.610	Radial	1,000 ppb	66993.5	1909809.2	
Mn 257.610	Axial	1,000 ppb	152396.8	10817525.8	
Mn 257.610	IB*Conc.	IS - IB	BEC	Spec	Pass/Fail
Radial	66993500	1842815.7	20.25	<30 PPB	Passed
Axial	152396800	10665129	13.12	<30 PPB	Passed

### 6. Review:

- ☒ Review with the customer PM work performed.
- ☒ Discuss recommended customer supplied materials to have on hand.
- ☒ Attach PM sticker.

### Additional Comments

Additional Comments Regarding the PM

### Review

*The preventive maintenance checks and if applicable performance tests for ICP-OES/Avio200 have been completed.*

*This ICP-OES/Avio200 Passes ☒ Fails ☐ the preventive maintenance.*

#### Review of Preventive Maintenance:

Authorized PerkinElmer Representative: <i>Chayamark</i>	Date: 02-Aug-2023 (DD-MMM-YYYY)
Authorized Customer Representative: <i>Don</i>	Date: 02-Aug-2023 (DD-MMM-YYYY)



**THAI HEART CALIBRATION CO., LTD.**

112/1 Moo 5, Phraek Sa, Muang, Samut Prakan 10280  
Tel. 0-2394-2162, 0-2757-8435; 0-2757-8496 Fax: 0-2757-8507



## CERTIFICATE OF CALIBRATION

Certificate No.: T0-2109034/23 Page 1 of total 4 pages

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

**Equipment** Thermo Reactor  
**Manufacturer** Spectroquant **Model** TR 420  
**Serial No.** 23290802 **ID No.** -  
**Description** Resolution of UUC : 1 °C

**Environmental Conditions** Ambient Temperature: (23 ± 3) °C  
Relative Humidity: (50 ± 15) %  
Atmospheric Pressure: -

**Calibration Location** Blue Devils Laboratory (TL)

**Received Date** 21 September 2023

**Calibration Date** 22 September 2023

**Date of Issue** 23 September 2023

**Condition of Artifacts** Used conditions but can be calibrated

Checked by *[Signature]*  
Act as Technical Manager

Approved by *[Signature]*  
Representative of Managing Director

( ) ( Krisyosl K. ) ( ) ( Sakda Y. )  
( ) ( Patiphan K. ) ( ) ( Onnapa P. )  
(✓) ( Pongsak H. ) ( ) ( Nitiphong K. )  
( ) ( Kanung C. ) ( ) ( Nonthachai K. )  
( ) ( Pramong P. ) ( ) ( Noppol P. )

( Dr. Ekachai Puttitwong )

This calibration certificate shall not be reproduced other than in full except with the prior written approval of the Thai Heart Calibration Co., Ltd.

Certificate No.: T0-2109034/23

Page 2 of total 4 pages

**Reference Method :**

- The calibration method used was CP-142 based on an in-house method.
- The temperature scale used was an ITS-90.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

**Reference Standard Instruments:**

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Data Logger with Sensors	34972A/ 34901A	MY59002120/ MY41211040	10-0302002/23	Feb. 3, 2024	THC

**Remark:** This certificate is traceable to the International System of Unit (SI Unit) through:

- THC, Thai Heart Calibration Co., Ltd.

**Measurement Results:**

# L

Hole No.	UUC Setting (°C)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Stability of UUC (± °C)	Uncertainty (± °C)
# 1	150	149.9	150	-0.1	0.22	0.68
# 2	150	149.8	150	-0.2	0.14	
# 3	150	149.5	150	-0.5	0.21	
# 4	150	149.8	150	-0.2	0.20	
# 5	150	149.1	150	-0.9	0.16	
# 6	150	149.6	150	-0.4	0.32	
# 7	150	149.2	150	-0.8	0.14	
# 8	150	149.7	150	-0.3	1.80	
# 9	150	149.5	150	-0.5	0.18	
# 10	150	149.1	150	-0.9	0.16	
# 11	150	149.1	150	-0.9	0.16	
# 12	150	149.2	150	-0.8	0.17	

UUC : Unit Under Calibration

Calibrated by Pongsak  
REV.02 02/24/21

FE-169

Certificate No.: T0-2109034/23

Page 3 of total 4 pages

**Measurement Results (Cont.):**

# R

Hole No.	UUC Setting (°C)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Stability of UUC (± °C)	Uncertainty (± °C)
# 1	150	150.2	150	0.2	0.25	0.68
# 2	150	150.2	150	0.2	0.29	
# 3	150	150.0	150	0.0	0.29	
# 4	150	149.6	150	-0.4	0.18	
# 5	150	149.1	150	-0.9	0.13	
# 6	150	149.5	150	-0.5	0.25	
# 7	150	149.1	150	-0.9	0.16	
# 8	150	149.1	150	-0.9	0.13	
# 9	150	149.7	150	-0.3	0.20	
# 10	150	149.5	150	-0.5	0.20	
# 11	150	149.2	150	-0.8	0.13	
# 12	150	149.6	150	-0.4	0.23	

UUC : Unit Under Calibration

Calibrated by Pongsak  
REV.02 02/24/21

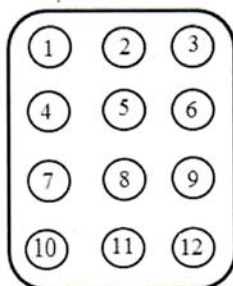
FE-169



Certificate No.: T0-2109034/23

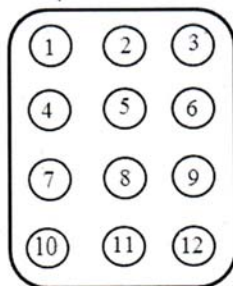
Page 4 of total 4 pages

Measurement Results (Cont.):



Front View

L



Front View

R

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2.00$ , providing a level of confidence approximately 95%.

- End of Certificate -

Calibrated by: Pongsak  
REV.02 02/24/21

FE-169

## Performance Verification Certificate

Job No. LSPR2306369

Equipment : AA SPECTROMETER

Serial No. : A7310

Manufacturer : GBC Scientific

Verification Date : 23-Jun-2023

Model Type : SavantAA

Customer : บริษัท ซี.อี.เอ็ม เทคโนโลยี (ไทยแลนด์) จำกัด

219/43 หมู่12 ถนนเพชรเกษม ตำบลอ้อมน้อย อำเภอกระทุ่มแบน จังหวัดสมุทรสาคร 74130

### Result of Verification

Test Description	Criteria	Reading	Result
1. EHT	< 350 V	332 V	PASS
Photometric Noise (if >350 V)	Std. Dev <0.0002	-	
2. Wavelength Accuracy , Cu 324.75 nm	$\pm 0.20$ nm	324.65 nm	PASS
3. Wavelength Accuracy , Cs 852.10 nm	$\pm 0.20$ nm	852.30 nm	PASS
4. Slit Width 0.2 nm	$\pm 0.02$ nm	0.22 nm	PASS
5. Slit Width 0.5 nm	$\pm 0.05$ nm	0.51 nm	PASS
6. Slit Width 1.0 nm	$\pm 0.10$ nm	0.99 nm	PASS
7. Standard Gauze Screen <u>0.49</u> Abs*	$\pm 0.02$ Abs.	0.4888 Abs.	PASS
BC mode with gauze		-0.0001 Abs.	
BC mode without gauze		-0.0004 Abs.	
Difference between With gauze and without gauze	< 0.004 Abs.	0.0003 Abs.	PASS
8. ABS Reading 5ppm,Cu	> 0.7 Abs.	0.740 Abs.	PASS
9. %RSD	< 0.5 %	0.48 %	PASS

\* Write in the criteria column the Abs reading on the gauze screen calibration label

We hereby certify that instrument complies with GBC factory specifications

Your satisfaction is our promise @ DKSH Technology Limited

Verification By : Mr. NIWAT SUPATANIT

Signatory : 

Issued Date : 3-Jul-2023

DKSH Technology Limited  
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260  
Phone +662 639 7000, [www.dksh.com](http://www.dksh.com)

Delivering growth – in Asia and beyond

ศูนย์บริการลูกค้าและการขาย: technology service call center

☎ 02 639 7000

This is to certify that  
**Niwat Supatanit**

From

**DKSH Technology Limited  
Thailand**

has successfully completed GBC Service  
Training including hardware and software training,  
installation and repair on the following instruments:

AAS Instruments and Accessories

UV-Vis Instruments and Accessories

ICP-OES Quantima and Accessories

Introduction to:

ICP-TOFMS OptiMass

High Performance Liquid Chromatography

X-ray Equipment Emma

Training conducted in Penang, Malaysia

From 22 July to 2 August 2019

Geoff Condick  
CEO



**Supelco**

www.sigmaaldrich.com

**Certified Reference Material**  
Reference material certificate

**Copper Standard for AAS**

**TraceCERT®**  
Traceable Certified Reference Materials

**Product no.:** 38996  
**Lot no.:** BCCH9264  
**Description of CRM:** Copper metal (pure material) in 2% HNO<sub>3</sub> (prepared with HNO<sub>3</sub> suitable for trace analysis and high-purity water, 18.2 MΩ·cm, 0.22 µm filtered).  
**Expiry date:** JUN 2025  
**Storage:** Store at 5°C-25°C  
**Density (certified) at 20°C:** 1011.3 kg m<sup>-3</sup> ± 0.5 kg m<sup>-3</sup>

Constituent Certified values at 20°C and expanded uncertainties,  $U = k \cdot u$  ( $k = 2$ ) [1][2]

Constituent	Certified values at 20°C and expanded uncertainties, $U = k \cdot u$ ( $k = 2$ ) [1][2]
Copper	989 mg kg <sup>-1</sup> ± 4 mg kg <sup>-1</sup> 1000 mg L <sup>-1</sup> ± 4 mg L <sup>-1</sup>

**Metrological traceability:** Certified values are traceable to the International System of units (SI) through a metrologically valid weighing process. Details see "Details on metrological traceability".[3]

**Measurement method:** The certified value is determined by high-precision weighing of thoroughly characterized starting materials and verified by measurement against NIST SRMs or similar CRMs in accordance with ISO/IEC 17025.[4]

**Intended use:** Calibration of AAS, ICP, spectrophotometry or any other analytical technique.

**Instructions for handling and correct use:** The bottle's temperature must be 20°C. Shake well before every use. If storage of a partially used bottle is necessary (at the user's risk), the cap should be tightly sealed and the bottle should be stored at reduced temperature (e.g. refrigerator) to minimize transpiration rate.

**Health and safety information:** Please refer to the Safety Data Sheet for detailed information about the nature of any hazard and appropriate precautions to be taken.

**Packaging:** 250 mL HDPE bottle

**Accreditation:** Sigma-Aldrich Production GmbH is accredited by the Swiss Accreditation Service SAS as reference material producer under no. SRMS 0001 in accordance with international standard ISO 17034[5]

**Certificate issue date:** 29 JUL 2022



ISO 17034  
SRMS 0001

S. Matt - CRM Operations

Dr. P. Zell - Approving Officer

Sigma-Aldrich Production GmbH, Industriestrasse 25, 9471 Buchs, Switzerland;  
Tel +41-81-755-2511; Fax +41-81-756-5449; www.sigmaaldrich.com  
Sigma-Aldrich Production GmbH is a subsidiary of Merck KGaA, Darmstadt, Germany.

Certificate Page 1 of 3

Certificate version 01





## CERTIFICATE OF CONFORMANCE

Equipment name : Gauze membrane  
Serial Number : F104  
Procedure Used : NIST neutral density filter: 8661/SRM 930D (1210)  
Reference Standard : Spectrophotometer, LIBRA S70  
Serial Number : 136821

### Result :

Wavelength (mm)	Measured Value (A.U.)
440	0.489

Valid for 12 months from date of issue.

Issue Date : 5 March 2023  
Operator by : Mr. Niwat Supatanit

## PREVENTIVE MAINTENANCE AND PERFORMANCE VERIFICATION REPORT

### ATOMIC ABSORPTION SPECTROPHOTOMETER (AAS)

Issued Date: 23/06/23

Customer : บริษัท ซี.อี.เอ็ม เทคโนโลยี (ไทยแลนด์) จำกัด  
Address : 219/43 หมู่ 12 ถนนเพชรเกษม ตำบลอ้อมน้อย  
อำเภอกระทุ่มแบน จังหวัดสมุทรสาคร 74130  
Contract :  
Manufacturer : GBC Scientific Equipment Pty Ltd.  
Model : SavantAA  
Serial No : A7310  
Location :

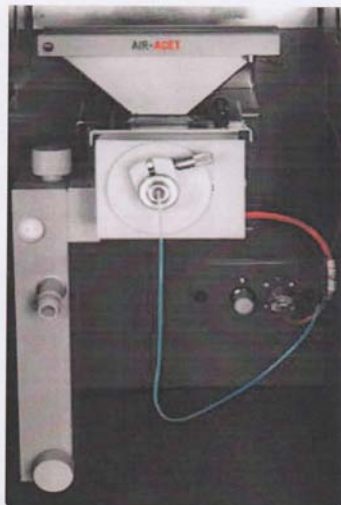
### Power on switch and initial status

*Instrument Ready for use*

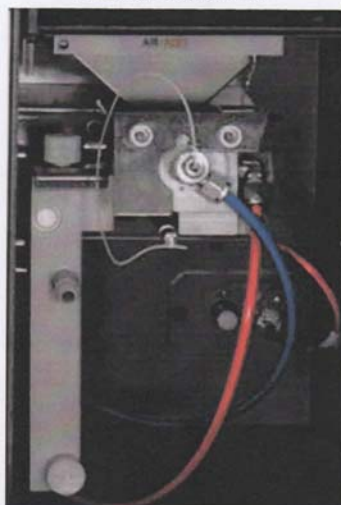
Preventive Maintenance	Pass	Fail	Remarks
<b>Electrical Voltage</b>			
- Main voltage ( power supply check 220V $\pm$ 10V ).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	220.1 V
- Power indicator light (Replace if faulty).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
- Power core (Clean or replace as appropriate).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
- Fan (Clean or replace filter element as appropriate).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
<b>Environment</b>			
- Temperature (10 to 35 deg.C)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	25.1 C
- Humidity (8 to 80%).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	47 %
- Air Quality (No Dust)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
- No corrosive vapours present from laboratory sample preparation or external sources.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
<b>Optics</b>			
- Windows lens (Clean or replace as appropriate).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Light Source (Check operation. Replace if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- D2 Lamp (Check operation. Replace if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
<b>Gas system</b>			
- General (Tube and Fitting /Check for leaks).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Air Zero (Inlet pressure range 300-400 kPa).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	400kPa
- Acetylene (Inlet pressure range 55-96 kPa).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0.9kPa
- Nitrous oxide (Inlet pressure range 300-400 kPa).	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Computer</b>			
- Operating system	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Windows 7
- Software Version	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Savant 3.0
- Verify that all computer links and installed software operate correctly	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready

Spray Chamber Type

☐ ABR Spray Chamber



☒ Standard Spray Chamber



Preventive Maintenance	Pass	Fail	Remark
<b>Flame system</b>			
- <b>Burner head</b> (Clean the jaws using GBC Burner Cleaning Card).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Burner mount</b> (Check for wear. Replace the burner retaining plate if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Spray chamber</b> (Visually inspect the bead for cracks, pitting or solid deposits. Check or replace O-ring kit).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Safety interlocks</b>			
➢ Burner (Check for Interlocks connector)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
➢ Spray chamber (Check for Interlocks connector)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Pressure relief bung.</b> (Check or replace O-ring)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Nebulizer</b> (Clean and check operation / Replace the O-ring)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Gas connections</b> (Check for leaks).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Capillary tube</b> (Check bends and clog).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Liquid trap</b> (Drain / clean and replace O-ring ).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready

Gas Flow Optimisation	Pass	Fail	Remark
- <b>Bleed gas lines</b> ( Relieve pressure in the spray chamber).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Ignitor</b> (Ignite the flame several times to check ignition reliability. Replace the glow plug if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Extinguish</b> (Check operation).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Horizontal movement</b> (Check operation for STD. Spray Chamber).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Vertical movement</b> (Check operation for STD. Spray Chamber).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Burner Adjuster</b> ( Check operation for ABR Spray Chamber)			
➢ Burner Angle (° C)	<input type="checkbox"/>	<input type="checkbox"/>	
➢ Angle Zero (mm)	<input type="checkbox"/>	<input type="checkbox"/>	
➢ Work head Height (mm)	<input type="checkbox"/>	<input type="checkbox"/>	
➢ Work head Centre (mm)	<input type="checkbox"/>	<input type="checkbox"/>	

Note:

N/A

Signature	
<b>Customer :</b> ..... ( ..... )	<b>Date :</b> .....
<b>Service Engineer :</b> Nivat S. ( Mr. NIWAT SUPATANIT )	<b>Maintenance Date :</b> 23 / Jun / 2023



Performance Verification	Specification	Actual Value	Pass	Failed	Remarks
1. Wavelength accuracy (optic calibration check).	Cu 324.75 nm $\pm$ 0.2 nm	324.65 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	Cs 852.10 nm $\pm$ 0.2 nm	852.30 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
2. Slit width accuracy (0.2 nm ,0.5 nm,1.0 nm)	0.2 nm $\pm$ 0.02 nm	0.216 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	0.5 nm $\pm$ 0.05 nm	0.51 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	1.0 nm $\pm$ 0.10 nm	0.99 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3. EHT	<350V	332V	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4. Absorbance accuracy (absorbance calibration check). ➢ Gauze 0.49 A.U.	Reading $\pm$ 10% of calibrated value.	0.4988 Abs.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
5. Background correction (optics alignment check). difference between measurement with and without 0.49 A.U. gauze for 10 samples.	SavantAA <1%	BC on with gauze: -0.0001 Abs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	SensAA/XplorAA <2%	BC on without gauze: -0.0004 Abs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
6. Sensitivity /noise flame test (aqueous Cu solution test under air-acetylene flame).	Cu 5 ppm >0.7 A.U.	0.7396 Abs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	<0.5% RSD	0.48%	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Note:

N/A

Signature	
Customer : ..... ( ..... )	Date :
Service Engineer : Niwat S. ( Mr. NIWAT SUPATANIT )	Maintenance Date : 23 / Jun / 2023



## Certificate of Calibration

**Aquion RFIC: Anion (ID#1084)**

This certificate is to verify that instrument below are calibrated

by Archemica International Co., Ltd.

**Aquion S/N: 221280114**

**AS-DV S/N: 2205880126**

For

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



Operator Signature: Itsaraphap Bumrungeam

Date: Jan 25 ,2024

(Mr.Itsaraphap Bumrungeam)

Applications Chemist



## การดูแลบำรุงรักษาเชิงป้องกัน

### Preventive Maintenance



บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

ฝ่ายบริการหลังการขาย

โทร 0 2 639 7000 E-mail: [service.tec.th@dksh.com](mailto:service.tec.th@dksh.com)

ฝ่ายขายและการตลาด

โทร 0 2 639 7000 E-Mail : [marketing.tec.th@dksh.com](mailto:marketing.tec.th@dksh.com)

Website : [www.dksh.co.th/technology/scientific-thailand](http://www.dksh.co.th/technology/scientific-thailand)

#### เงื่อนไขการให้บริการ Preventive Maintenance

บริษัทฯ จะส่งวิศวกรผู้ชำนาญ เพื่อให้บริการตามขอบข่ายของการบริการ เฉพาะ ในวันและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากวัน เวลา ราชการ (วันหยุดเสาร์ – อาทิตย์ หรือวันหยุด นักชดถุภษ) บริษัทฯ จะคิดค่าบริการเพิ่มเติมตามอัตราที่กฎหมายแรงงานกำหนดไว้

#### ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายการผลการตรวจสอบเครื่องมือ

#### หมายเหตุ

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



### ช่องทางการติดต่อ

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



Call center 0 2 639 7000



DKSH Scientific



[www.dksh.com/scientific-thailand](http://www.dksh.com/scientific-thailand)



[marketing.tec.th@dksh.com](mailto:marketing.tec.th@dksh.com)



@dkshscientific

### Preventive Maintenance Contract

จำนวนในการทำสัญญาบริการ .....ครั้งต่อปี

ครั้งที่ 1, วันที่ 15/05/2024.....

### รายละเอียดผู้รับบริการ


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

### ผู้ติดต่อ

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

### รายละเอียดผู้ให้บริการ

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด (ฝ่ายบริการหลังการขาย) (สำนักงานใหญ่)			
เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260			
โทรศัพท์ 0 2 693 7000 Email: <a href="mailto:sudarat.sk@dksh.com">sudarat.sk@dksh.com</a>			
เจ้าหน้าที่ประสานงาน : คุณสุดารัตน์ ศิริรัตน์ โทรศัพท์ 090 678 6925			
เจ้าหน้าที่ผู้ให้บริการ	นายจิรายุช สลอาด		
ตำแหน่ง	Specialist, Technical Service.		
โทรศัพท์	0938138736	แฟกซ์	-
E-mail	Jirayut.js@dksh.com		

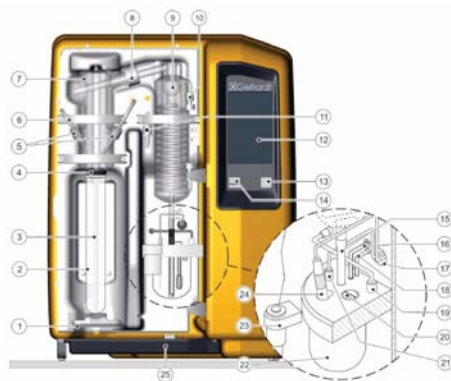
ลงนามผู้รับบริการ		ลงนามผู้ให้บริการ	
ตัวบรรจง	(.....)	ตัวบรรจง	(นายจิรายุช สลอาด)
ตำแหน่ง		ตำแหน่ง	Specialist, Technical Service.
วันที่ / ประทับตราบริษัท		วันที่ / ประทับตราบริษัท	15/05/2024

JOB: LSPR2403415.....MODEL: VAP 200.....S/N: GER5200180181

# Operational Qualification (OQ)

ตรวจสอบสภาพเครื่อง

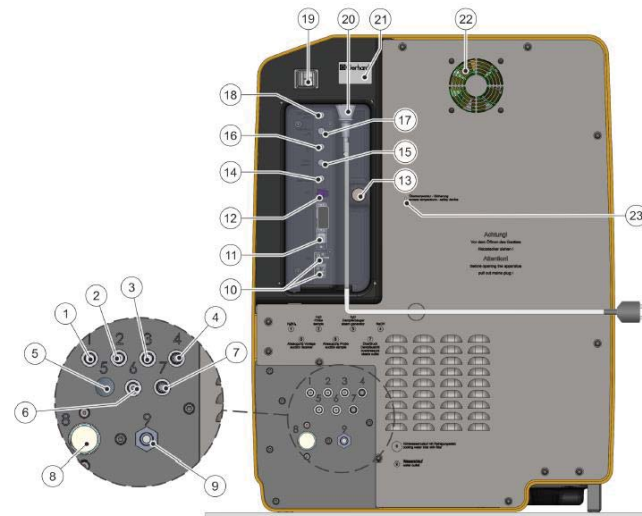
## FRONT



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"/>

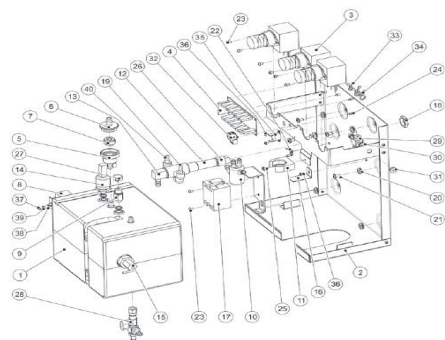
\*\* only VAP 450

## REAR



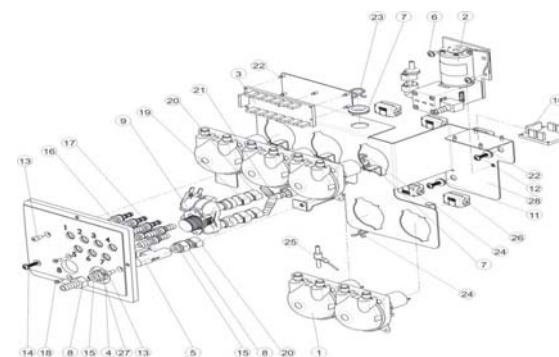
No		PASS	FAIL	N/A
1	Tube connection for sample H3BO3 supply	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2	Tube connection for sample H2O supply	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3	Tube connection for steam generator 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)

- ความต้านทานทางไฟฟ้าของเครื่องกับกราวด์
- กระแสไฟฟ้าที่ใช้งาน

ตรวจสอบสภาพเครื่อง (Optical Test)

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

ตรวจสอบ Function การทำงาน (The FunctionTest)

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

รายงานผลการให้บริการ

1. TECHNICAL DATA

	Pass	Fail	N/A	Remark
Main Supply 220 volt + 10% 50 Hz with ground	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Normal current	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....8a.....

1.1 COOLING WATER BATH

	Pass	Fail	N/A	Remark
Temperature 15-20 °C	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Cooling Water Outlet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Control Temperature	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....

1.2 OPTICAL TEST VAP200

	Pass	Fail	N/A	Remark
Screw cap GL14	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Screw cap GL18	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Screw cap GL32	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Distillation Head	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Condensor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Viton Cone	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....
Ventilation Valve BV	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Micro Switch Sample	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Agitator motor for propeller	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	.....

2. SYSTEM COOLING WATER INLET

	Pass	Fail	N/A	Remark
Cooling Water Inlet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Cooling Water Outlet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Flow control valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....

3.SYSTEM CONTROL

	Pass	Fail	N/A	Remark
Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Adding NaOH	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Adding H2O	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	.....
Adding H3BO3	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	.....
Suction Sample	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	.....
Suction Receiver	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	.....

4.SYSTEM DISTILLATION

	Pass	Fail	N/A	Remark
Boiler	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Level Sensor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Novopren	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Solenoid Valve Shut-Off	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Solenoid Valve Steam	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Solenoid Valve soft steam	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Ventilation Valve Premount	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Excess Pressure Detector	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Heating Element	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....

5. PUMP

	Pass	Fail	N/A	Remark
Pump H <sub>2</sub> O Steam	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
- Non-Return Valve	-	-	-	.....
Pump H <sub>2</sub> O Sample	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	.....
- Non-Return Valve	-	-	-	.....
Pump NaOH	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
- Non-Return Valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Pump H3BO3	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	.....
- Non-Return Valve	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	.....
Pump suction	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	.....
Pump suction receiver	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	.....

6. The Following Program Run :

	Pass	Fail	N/A	Remark
Addition H2O 0-999 ml.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	.....
Addition NaOH 0-999 ml.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Addition H3BO3 0-999 ml.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	.....
Reaction Time 0-108 min	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Distillation Time 0-108 min	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Steam Capacity 10%-100%	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
Suction Sampe	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	.....
Suction Receiver	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	.....

7. Measured pumps

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

Remark : .....

.....

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 <sub>2</sub> O addition	150 ml
NaOH addition	0 ml
Distillation time	7 min
Steam power	100 %
Reaction time	0 s
Suction sample	30 s

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

General error message

Fault description	Cause	Remedy
'Cooling water flow volume too low'	Cooling water pressure under 1 bar	<ul style="list-style-type: none"><li>Open water tap.</li><li>Check coolant pressure.</li><li>Check coolant tube.</li></ul> Program continues automatically once error has been fixed.
'Sample tube missing'	Sample tube missing.	<ul style="list-style-type: none"><li>Insert sample tube.</li></ul> Continue program or restart.
'Distillation room protective door open'	Protection door not closed	<ul style="list-style-type: none"><li>Close protection door.</li></ul> Program continues automatically once error has been fixed.
'Reagent storage/waste'	One or more storage tanks are empty	<ul style="list-style-type: none"><li>Fill storage tank.</li><li>Check correct seating of the universal sensors.</li></ul> The running program can be continued after rectification of the error.
	The sample waste tank is full.	<ul style="list-style-type: none"><li>Empty sample waste tank.</li><li>Check correct seating of the universal sensors.</li></ul> 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"><li>Detailed checking of the chemicals.</li><li>Determination of a blank value.</li><li>Replace the chemicals if necessary.</li></ul>
	Violent reaction in the digestion tube, sodium hydroxide drops get into the receiver.	<ul style="list-style-type: none"><li>Increase of the water addition amount.</li></ul>
	Glass bridge of the condenser is broken or worn out, sodium hydroxide drops get into the receiver.	<ul style="list-style-type: none"><li>Replacement of the glass condenser.</li></ul>
	Glass cleaning agents in the digestion tube.	<ul style="list-style-type: none"><li>Clean digestion tube in advance with distilled water.</li></ul>
	Entrainment of ammonia from the previous sample.	<ul style="list-style-type: none"><li>Increase distillation time.</li><li>Check whether the sample was previously sufficiently alkalinised.</li></ul>
Analyte result too low or no result	Incomplete distillation; distillation time too short.	<ul style="list-style-type: none"><li>No quantitative expulsion of the ammonia content.</li><li>The distillation amount should be 100 ml.</li></ul>
	Ammonia escapes at leaking places.	<ul style="list-style-type: none"><li>Solled or defective Viton plugs; clean or replace.</li><li>Check seals (GL screw connections) on the distribution head; replace if necessary.</li><li>Check valve at the condenser is gummed up; clean or replace.</li><li>Digestion tube is damaged at the neck extension.</li><li>Distribution head glass leaks; replace.</li></ul>
	Addition amount of the sodium hydroxide too little; no ammonia development.	<ul style="list-style-type: none"><li>Check the constant flow rate of the NaOH pump (see Technical Data).</li></ul>
	Too low boric acid amount in the receiver; escaping ammonia is not completely bonded.	<ul style="list-style-type: none"><li>Increase of the boric acid amount.</li></ul>
	Tube not completely immersed in the acid receiver.	<ul style="list-style-type: none"><li>Increase of the add amount.</li></ul>
	Formation of stable ammonia compounds which are not destroyed with sodium hydroxide.	<ul style="list-style-type: none"><li>This problem only occurs with catalysts containing mercury. Sodium sulphate solution destroys these compounds.</li></ul>

## การดูแลบำรุงรักษาเชิงป้องกัน

### Preventive Maintenance



บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

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#### เงื่อนไขการให้บริการ Preventive Maintenance

บริษัทฯ จะส่งวิศวกรผู้ชำนาญ เพื่อให้บริการตามขอบข่ายของการบริการ เฉพาะ ในวันและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากวัน เวลา ราชการ (วันหยุดเสาร์ – อาทิตย์ หรือวันหยุด นักชดถุญ) บริษัทฯ จะคิดค่าบริการเพิ่มเติมตามอัตราที่กฎหมายแรงงานกำหนดไว้

#### ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายการผลการตรวจสอบเครื่องมือ

#### หมายเหตุ

- ราคาไม่รวมถึงค่าบริการซ่อม หรือ เปลี่ยนอะไหล่ที่ชำรุดเสียหาย หรือหมดสภาพการใช้งาน
- ในกรณีที่ผู้รับบริการอยู่นอกเขตพื้นที่ให้บริการ บริษัทฯ จำเป็นต้องคิดค่าใช้จ่ายเพิ่มเติม ได้แก่ ค่าเดินทาง เป็นต้น
- บริษัท ฯ 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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@dkshscientific

## Preventive Maintenance Contract

จำนวนในการทำสัญญาบริการ ...1...ครั้งต่อปี

ครั้งที่ ...1... วันที่ 15/05/2024.....

### รายละเอียดผู้รับบริการ

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

### ผู้ติดต่อ

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

### รายละเอียดผู้ให้บริการ


บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด (ฝ่ายบริการหลังการขาย) (สำนักงานใหญ่)

เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260

โทรศัพท์ 0 2 693 7000 Email: [sudarat.sk@dksh.com](mailto:sudarat.sk@dksh.com)

เจ้าหน้าที่ประสานงาน : คุณสุดาร์ณ ศิริรัตน์ โทรศัพท์ 090 678 6925

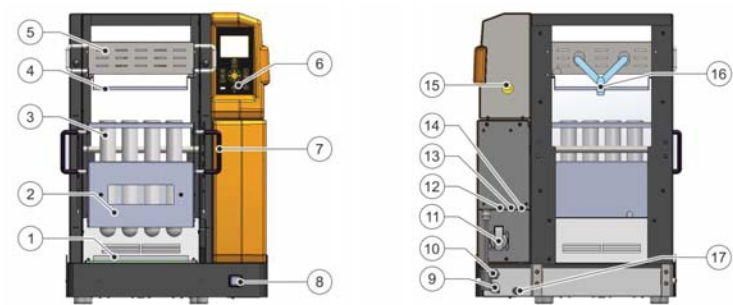
เจ้าหน้าที่ผู้ให้บริการ	นายจิรายุทธ สเลอาด		
ตำแหน่ง	Specialist, Technical Service.		
โทรศัพท์	0938138736	แฟกซ์	-
E-mail	Jirayut.js@dksh.com		

ลงนามผู้รับบริการ		ลงนามผู้ให้บริการ	
ตัวบรรจง	(.....)	ตัวบรรจง	(นายจิรายุทธ สเลอาด)
ตำแหน่ง		ตำแหน่ง	Specialist, Technical Service.
วันที่ / ประทับตราบริษัท		วันที่ / ประทับตราบริษัท	15/05/2024

JOB No: LSPR2403414.....MODEL: KT 20s S/N: GER5720180118

Part 3: ตรวจสอบเช็คสภาพเครื่อง

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: ละเอียดและรายงานผลการให้บริการ Preventive Maintenance

4.1 ตรวจสอบระบบไฟฟ้า

	Pass	Fai	N/A	Remark
ใช้ไฟ 220 V50 Hz	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
กระแสไฟฟ้าตามพิกัดเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....

4.2 ตรวจสอบสภาพอุปกรณ์ภายนอก

	Pass	Fail	N/A	Remark
สายไฟของเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
ท่อแก๊วรวมไอกรด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
สายยางต่อกับท่อแก๊วรวม ไอกรด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
สภาพของ Aluminum block	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	เสื่อมสภาพ
การขึ้นลงของ 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"/>	.....

4.3 ตรวจสอบระบบการทำงาน



	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"/>	.....
COOLWATER 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"/>	.....
การขึ้นของอุณหภูมิมากกว่า10องศาต่อหน้าที่ที่250องศา	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
การทำงานของตัวป้องกันอุณหภูมิสูงเกิน	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....
การทำงานของระบบควบคุมอุณหภูมิ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....

การบำรุงรักษาทั่วไป (Basic maintenance)

- การย้อยตัวอย่างเกิดการเดือดที่รุนแรงอันเนื่องจากตัวอย่งนั้นสามารถป้องกันได้โดยแนะนำให้ย้อยด้วยการตั้งการเพิ่มอุณหภูมิเป็นระดับเช่น ย้อยที่ระดับอุณหภูมิ 250 C ระยะเวลา 15 นาทีจึงเปลี่ยนเป็นอุณหภูมิ 380 C เพื่อป้องกันการล้นออกมา
- เมื่อใช้เสร็จไม่ควรปล่อยให้ Tube เย็นกับตัวเครื่อง
- ต้องนำเอาคลองไอกรดใส่ทุกครั้งหลังจากใช้งานเสร็จ เพื่อป้องกันการหยดของไอกรดที่จะหยดลงมาที่ตัวเครื่อง
- ทำความสะอาดตัวหลุมย้อยด้วยน้ำหรือผ้าชุบน้ำในกรณีที่มีคราบกรดหยดลงมาติดอยู่ในหลุม เพื่อป้องกันไม่ให้เกิดคราบดังกล่าวไปกั้นการแผ่อุณหภูมิ