

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

Ambient temperature : ( 20 ± 2 ) °C

Manufacturer : ACO

Relative humidity : ( 50 ± 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

Approved By :

☐ Ms. Bhacharin Phanangkaew (MD)

Reviewed By : ☐ Mr. Sompong Srisert

☒ Mr. Boonyarit Auejirakarn

☒ Ms. Natthaparakarn 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	94.0	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. : 66S0205-3

Job No. : 66S0205

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. : 222186

Date of received : 03-Feb-2023

Identity No. : NS-03-016

Date of calibration : 07-Feb-2023

Range : See to Data

Date of issued : 09-Feb-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

[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	104.2	0.2	0.20
	114	114.1	0.1	0.20
B	94	94.4	0.4	0.20
	104	104.2	0.2	0.20
	114	113.9	-0.1	0.20
Z	94	94.4	0.4	0.20
	104	104.1	0.1	0.20
	114	113.9	-0.1	0.20

UUC\* = Unit Under Calibration

- The End -



## CERTIFICATE OF CALIBRATION

Certificate No. : 66S0205-4

Job No. : 66S0205

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. : 222187

Date of received : 03-Feb-2023

Identity No. : NS-03-017

Date of calibration : 07-Feb-2023

Range : See to Data

Date of issued : 09-Feb-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. Natthaparakarn 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	104.0	0.0	0.20
	114	113.9	-0.1	0.20
B	94	94.2	0.2	0.20
	104	104.1	0.1	0.20
	114	113.8	-0.2	0.20
Z	94	94.2	0.2	0.20
	104	104.1	0.1	0.20
	114	113.8	-0.2	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, 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. : 222191

Date of received : 30-Mar-2023

Identity No. : NS-03-021

Date of calibration : 03-Apr-2023

Range : See to Data

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. Natthaparakarn 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. : 66S0420-24

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

Ambient temperature : ( 20 ± 2 ) °C

Manufacturer : ACO

Relative humidity : ( 50 ± 15 ) %

Model : 6236

Atmospheric pressure : -

Serial No. : 222193

Date of received : 30-Mar-2023

Identity No. : NS-03-023

Date of calibration : 03-Apr-2023

Range : See to Data

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 :

Reviewed By : [ ] Mr. Sompong Srisert

[ ] Ms. Bhacharin Phanangkaew (MD)

[ ] Mr. Boonyarit Auejirakarn

[x] Ms. Natthaparakarn 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	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

[x] Mr. Boonyarit Auejirakarn

[x] Ms. Natthaparakarn 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 OF CALIBRATION****Certificate No. :** 66S0330-1**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**Manufacturer :** ACO**Model :** 6236**Serial No. :** 222196**Identity No. :** NS-03-026**Range :** See to Data**Ambient temperature :**  $(20 \pm 2) ^\circ\text{C}$ **Relative humidity :**  $(50 \pm 15) \%$ **Atmospheric pressure :** -**Date of received :** 08-Mar-2023**Date of calibration :** 10-Mar-2023**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	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

[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	94.1	0.1	0.20
	104	103.8	-0.2	0.20
	114	113.6	-0.4	0.20
C	94	94.0	0.0	0.20
	104	103.8	-0.2	0.20
	114	113.7	-0.3	0.20
Z	94	94.0	0.0	0.20
	104	103.8	-0.2	0.20
	114	113.6	-0.4	0.20

*UUC\* = Unit Under Calibration*

- The End -



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0714

MTC No. EEL. BP. 78/0865

## CALIBRATION CERTIFICATE

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

**Address** : 31/8 Moo. 13 Raikhing Samphran Nakhornparthom 73210.

**Calibrated at** : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

### Instrument Calibrated :

Description : Sound Level Meter  
Manufacturer : BSWA  
Model : BSWA 309  
Serial No. : 590102 (NS-04-003)  
Microphone : MP309 No.395590  
Preamplifier : BSWA MA231T No.590600

### Ambient Environment

Temperature :  $(23 \pm 3) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 15) \%$   
Ambient Pressure :  $(101.325 \pm 1.5) \text{ kPa}$

### Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2633526.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

**Date of Receipt** : 24 Aug. 2022

**Date of Calibration** : 19-21 Sep. 2022

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The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.4

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Amphoe Muang, Changwat Samutprakan 10280, Thailand  
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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

**Request No.** 21-65/0714

**MTC No.** EEL. BP. 78/0865

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

**Calibration Procedure :**

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a level of confidence of approximately 95%.

**Date of Calibration** : 19-21 Sep. 2022

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Request No. 21-65/0714

MTC No. EEL. BP. 78/0865

**1. Absolute Sensitivity**

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.91	114.1	113.9	0.0	1.0	0.30	N/A

**Note:** The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 113.9 dB.

**2. Self-generated noise**

**2.1 Normal test**

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
19.3	0.10	N/A

**2.2 The microphone of the sound level meter was replaced by electrical signal input device**

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	8.6	0.10	N/A
C-Weight	13.1	0.10	N/A
Flat	20.1	0.10	N/A

**Date of Calibration** : 19-21 Sep. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0714

MTC No. EEL. BP. 78/0865

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.0	0.1	0.1	1.5	0.45	0.6
1 000	-0.5	-0.5	-0.5	1.0	0.45	0.6
8 000	-0.4	-0.3	0.2	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	0.0	0.0	0.0	2.0	0.20	0.6
125	-0.1	0.0	0.0	1.5	0.20	0.6
250	-0.1	0.0	0.0	1.5	0.20	0.6
500	0.0	0.0	0.0	1.5	0.20	0.6
1 000	0.0	0.0	0.0	1.0	0.20	0.6
2 000	0.0	0.0	0.0	2.0	0.20	0.6
4 000	-0.1	0.0	0.0	3.0	0.20	0.6
8 000	-0.5	-0.5	0.0	5.0	0.20	0.7

Date of Calibration : 19-21 Sep. 2022

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The results relate only to the items tested/calibrated or value assigned.

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Request No. 21-65/0714

MTC No. EEL. BP. 78/0865

5. Long-term stability

Time	Measured Value	Deviated value	Acceptance limit	Uncertainty	Maximum-permitted uncertainty of measurement
	(dB)	(dB)	class 2 (±dB)	(±dB)	(±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value	Deviated value	Acceptance limit	Uncertainty	Maximum-permitted uncertainty of measurement
	(dB)	(dB)	class 2 (±dB)	(±dB)	(±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value	Deviated value	Acceptance limit	Uncertainty	Maximum-permitted uncertainty of measurement
	(dB)	(dB)	class 2 (±dB)	(±dB)	(±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 19-21 Sep. 2022

5/9

The results relate only to the items tested/calibrated or value assigned.

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FM.BL.MTC.002 Rev.4

Head Office

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E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

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Fax. (66) 0 2323 9165  
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Fax. (66) 0 2579 8592  
E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0714

MTC No. EEL. BP. 78/0865

7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (+dB)	Uncertainty (+dB)	Maximum-permitted uncertainty of measurement (+dB)
133	133.0	0.0	1.1	0.30	0.3
132	132.0	0.0	1.1	0.30	0.3
131	131.0	0.0	1.1	0.30	0.3
130	130.0	0.0	1.1	0.30	0.3
129	129.0	0.0	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	68.9	-0.1	1.1	0.30	0.3
64	63.9	-0.1	1.1	0.30	0.3
59	58.9	-0.1	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3

Date of Calibration : 19-21 Sep. 2022

6/9

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FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0714

MTC No. EEL. BP. 78/0865

7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
49	49.0	0.0	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	39.0	0.0	1.1	0.30	0.3
34	34.0	0.0	1.1	0.30	0.3
29	29.1	0.1	1.1	0.30	0.3
28	28.1	0.1	1.1	0.30	0.3
27	27.1	0.1	1.1	0.30	0.3
26	26.2	0.2	1.1	0.30	0.3
25	25.1	0.1	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
21-135	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 19-21 Sep. 2022

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FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0714

MTC No. EEL. BP. 78/0865

**8. Level linearity including the level range control**

At reference level at 5 dB greater than the signal level that first clause an indication of under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
21-135	26.0	26.0	0.0	1.1	0.30	0.3

**9. Tone burst response**

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	131.0	0.0	±1.0	0.20	0.3
	2	113.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	104.8	-0.2	+1.5; -5.0	0.20	0.3
Slow	200	124.5	-0.1	±1.0	0.20	0.3
	2	104.9	-0.1	+1.0; -5.0	0.20	0.3
SEL	200	124.9	-0.1	±1.0	0.20	0.3
	2	104.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	95.8	-0.2	+1.5; -5.0	0.20	0.3

Date of Calibration : 19-21 Sep. 2022

8 / 9

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FM.BL.MTC.002 Rev.4

**Head Office**

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Request No. 21-65/0714

MTC No. EEL. BP. 78/0865

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	130.4	130.2	-0.2	3.0	0.20	0.35
Positive half cycle	129.4	129.2	-0.2	2.0	0.20	0.35
Negative half cycle	129.4	129.2	-0.2	2.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle				
133.5	133.5	0.0	1.5	0.20	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	134.0	0.0	0.3	0.10	0.1
End	134.0				

Calibrated by :



(Mr. Tawikiat Iamsamran)

Approved by :

  
(Mr. Prawate Kluaypa)  
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 19-21 Sep. 2022

Date of Issue : 22 Sep. 2022

Ref : 2011265082403762003

End of Certificate

9 / 9

The results relate only to the items tested/calibrated or value assigned.

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FM.BL.MTC.002 Rev.4

Head Office

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## CERTIFICATE OF CALIBRATION

Certificate No. : 66S0330-5

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 : Tenmars

Relative humidity : ( 50 ± 15 ) %

Model : ST-109R

Atmospheric pressure : -

Serial No. : 221201934

Date of received : 08-Mar-2023

Identity No. : NS-11-001

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	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

[x] Mr. Boonyarit Auejirakarn

[x] Ms. Natthaparakarn 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	94.5	0.5	0.20
	104	104.5	0.5	0.20
	114	114.4	0.4	0.20
C	94	94.4	0.4	0.20
	104	104.4	0.4	0.20
	114	114.5	0.5	0.20
Z	94	94.4	0.4	0.20
	104	104.4	0.4	0.20
	114	114.5	0.5	0.20

*UUC\* = Unit Under Calibration*

- The End -



## CERTIFICATE OF CALIBRATION

Certificate No. : 66S0330-7

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

Manufacturer : Scarlet Tech

Model : ST-11D

Serial No. : 820388

Identity No. : NS-12-001

Range : See to Data

Ambient temperature : ( 20 ± 2 ) °C

Relative humidity : ( 50 ± 15 ) %

Atmospheric pressure : -

Date of received : 08-Mar-2023

Date of calibration : 10-Mar-2023

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	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 :

Reviewed By : ☐ Mr. Sompong Srisert

☒ Ms. Natthaparakarn Thammaphan

☐ Ms. Bhacharin Phanangkaew (MD)

☒ Mr. Boonyarit Auejirakarn



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	104.3	0.3	0.20
	114	114.2	0.2	0.20
B	94	94.0	0.0	0.20
	104	103.8	-0.2	0.20
	114	113.6	-0.4	0.20
Z	94	94.3	0.3	0.20
	104	103.8	-0.2	0.20
	114	113.6	-0.4	0.20

*UUC\* = Unit Under Calibration*

- The End -

## CERTIFICATE OF CALIBRATION

Certificate No. : 66S0330-6

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 : Scarlet Tech

Relative humidity : ( 50 ± 15 ) %

Model : ST-11D

Atmospheric pressure : -

Serial No. : 820891

Date of received : 08-Mar-2023

Identity No. : NS-12-002

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	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. Natthaparakarn 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	94.0	0.0	0.20
	104	104.0	0.0	0.20
	114	114.0	0.0	0.20
B	94	94.4	0.4	0.20
	104	104.0	0.0	0.20
	114	113.8	-0.2	0.20
Z	94	94.0	0.0	0.20
	104	104.0	0.0	0.20
	114	113.8	-0.2	0.20

*UUC\* = Unit Under Calibration*

- The End -



## CERTIFICATE OF CALIBRATION

Certificate No. : 66S0330-8

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 : Scarlet Tech

Relative humidity : ( 50 ± 15 ) %

Model : ST-11D

Atmospheric pressure : -

Serial No. : 820892

Date of received : 08-Mar-2023

Identity No. : NS-12-003

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	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. Natthaparakarn 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	94.1	0.1	0.20
	104	104.0	0.0	0.20
	114	114.0	0.0	0.20
B	94	93.8	-0.2	0.00
	104	103.7	-0.3	0.00
	114	113.7	-0.3	0.00
Z	94	93.9	-0.1	0.00
	104	103.9	-0.1	0.00
	114	113.9	-0.1	0.00

*UUC\* = Unit Under Calibration*

- The End -

# G.Ruamkit Panich Co.,Ltd.

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

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

**APPROVED BY** :   
DHUDIT P.

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



# G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 17 E 30062

PAGE : 2 OF 2

## 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

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

INSTRUMENT	MODEL	SERIAL No.	CERTIFICATTE No.	DUE DATE
1) MULTIFUNCTION SOUND CALIBRATOR.	1986	01827	EEL.BP.55/0974	12-Jan-24

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

### RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

#### 1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

#### 2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

#### 3. SOUND LEVEL LINEARITY TEST AT 1000 Hz

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

UUC\* : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

# G.Ruamkit Panich Co.,Ltd.

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


CERTIFICATE No : GR 17 E 30064

PAGE : 1 OF 2

## Certificate of Calibration

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

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

**APPROVED BY** :   
DHUDIT P.

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

# G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 17 E 30064

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : SOUND LEVEL METER  
MANUFACTURER : ACO  
MODEL : TYPE 6226 SERIAL NUMBER : 090057  
ID No. : CEM-SI-02  
RECEIVED DATE : 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.	CERTIFICATTE No.	DUE DATE
1) MULTIFUNCTION SOUND CALIBRATOR.	1986	01827	EEL.BP.55/0974	12-Jan-24

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

**RESULT OF CALIBRATION :** WITHOUT ADJUSTMENT

### 1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

### 2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

### 3. SOUND LEVEL LINEARITY TEST AT 1000 Hz

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

UUC\* : UNIT UNDER CALIBRATION

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

**END OF CALIBRATION REPORT**



# G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 17 E 30067

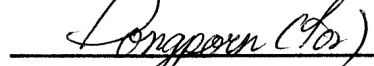
PAGE : 1 OF 2

## *Certificate of Calibration*

**EQUIPMENT** : SOUND LEVEL METER  
**MANUFACTURER** : ACO  
**MODEL** : TYPE 6226  
**SERIAL No.** : 150007  
**ID No.** : CEM-SI-07  
  
**SUBMITTED BY** : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.  
219/43 MOO 12, PETCHKASEM RD., OMNOI,  
KRATHUMBAN SAMUTSAKORN 74130

**CALIBRATED BY** :   
SURAWIT K.

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

**APPROVED BY** :   
PHUDIT P.

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

# G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 17 E 30067

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : SOUND LEVEL METER  
MANUFACTURER : ACO  
MODEL : TYPE 6226 SERIAL NUMBER : 150007  
ID No. : CEM-SI-07  
RECEIVED DATE : 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.	CERTIFICATL No.	DUE DATE
1) MULTIFUNCTION SOUND CALIBRATOR.	1986	01827	EEL.BP.55/0974	12-Jan-24

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

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

5. THIS CERTIFICATE IS TRACEABLE TO :-

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

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

### 1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

### 2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

### 3. SOUND LEVEL LINEARITY TEST AT 1000 Hz

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

UUC\* : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

# G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 17 E 30068


PAGE : 1 OF 2

## Certificate of Calibration

**EQUIPMENT** : SOUND LEVEL METER  
**MANUFACTURER** : ACO  
**MODEL** : TYPE 6226  
**SERIAL No.** : 150008  
**ID No.** : CEM-SI-08  
  
**SUBMITTED BY** : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.  
219/43 MOO 12, PETCHKASEM RD., OMNOI,  
KRATHUMBAN SAMUTSAKORN 74130

**CALIBRATED BY** :   
SURAWIT K.

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

**APPROVED BY** :   
PHUDIT P.

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



# G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 17 E 30068

PAGE : 2 OF 2

## Calibration Report

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

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

INSTRUMENT	MODEL	SERIAL No.	CERTIFICATL No.	DUE DATE
1) MULTIFUNCTION SOUND CALIBRATOR.	1986	01827	EEL.BP.55/0974	12-Jan-24

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

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

#### 1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

#### 2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

#### 3. SOUND LEVEL LINEARITY TEST AT 1000 Hz

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

UUC\* : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

# G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 17 E 30069

PAGE : 1 OF 2

## *Certificate of Calibration*

**EQUIPMENT** : SOUND LEVEL METER  
**MANUFACTURER** : ACO  
**MODEL** : TYPE 6226  
**SERIAL No.** : 150009  
**ID No.** : CEM-SI-09  
  
**SUBMITTED BY** : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.  
219/43 MOO 12, PETCHKASEM RD., OMNOI,  
KRATHUMBAN SAMUTSAKORN 74130

**CALIBRATED BY** :   
SURAWIT K.

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

**APPROVED BY** :   
PHUDIT P.

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

# G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 17 E 30069

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : SOUND LEVEL METER  
MANUFACTURER : ACO  
MODEL : TYPE 6226 SERIAL NUMBER : 150009  
ID No. : CEM-SI-09  
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

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

INSTRUMENT	MODEL	SERIAL No.	CERTIFICATL No.	DUE DATE
1) MULTIFUNCTION SOUND CALIBRATOR.	1986	01827	EEL.BP.55/0974	12-Jan-24

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

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

#### 1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

#### 2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

#### 3. SOUND LEVEL LINEARITY TEST AT 1000 Hz

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

UUC\* : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT



เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในบรรยากาศ



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

**Site Information**

<b>Location:</b> -	<b>Site ID:</b> -	<b>Date:</b> 9 Jan 23
<b>Sampler:</b> TE-5000 TSP	<b>Serial No:</b> 3263	<b>Tech:</b> Tong.P

**Site Conditions**

<b>Barometric Pressure (in Hg):</b> 28.00	<b>Corrected Pressure (mm Hg):</b> 711.2
<b>Temperature (deg F):</b> 76.0	<b>Temperature (deg K):</b> 297.6
<b>Average Press. (in Hg):</b> 26.00	<b>Corrected Average (mm Hg):</b> 660.4
<b>Average Temp (Deg F):</b> 75.1	<b>Average Temp: (Deg K):</b> 297.1

**Calibration Orifice**

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

**Calibration Information**

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	5.80	1.482	60.0	58.08	<b>Slope:</b> 28.6275
2	4.00	1.233	53.0	51.31	<b>Intercept:</b> 15.8460
3	2.60	0.996	46.0	44.53	<b>Corr. Coeff:</b> 0.9996
4	2.10	0.896	43.0	41.62	
5	1.50	0.759	38.5	37.27	

**# of Observations:** 5

**Calculations**

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

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

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

m = sampler slope

b = sampler intercept

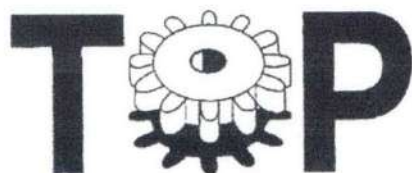
I = chart response

Tav = daily average temperature

Pav = daily average pressure

<b>enter Average I (chart):</b>	44.0
<b>Average Flow Calculation m3/min</b>	0.881394911
<b>Average Flow Calculation in cfm</b>	31.12270125
<b>Sample Time (Hrs):</b>	24.0
<b>Total flow in 24 hours m3/min</b>	1269.208672
<b>Total flow in 24 hours cfm</b>	44816.6898

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



Trade & Engineering

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

### Site Information

<b>Location:</b> -	<b>Site ID:</b> -	<b>Date:</b> 9 Jan 23
<b>Sampler:</b> TE-5000 TSP	<b>Serial No:</b> 3265	<b>Tech:</b> Tong.P

### Site Conditions

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

### Calibration Orifice

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

### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	9.80	1.924	65.1	63.02	<b>Slope:</b> 43.1008
2	8.00	1.739	58.4	56.53	<b>Intercept:</b> -19.2099
3	6.60	1.581	51.2	49.56	<b>Corr. Coeff:</b> 0.9957
4	6.10	1.520	48.0	46.47	
5	5.50	1.444	43.5	42.11	

**# of Observations:** 5

### Calculations

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

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

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

m = sampler slope

b = sampler intercept

I = chart response

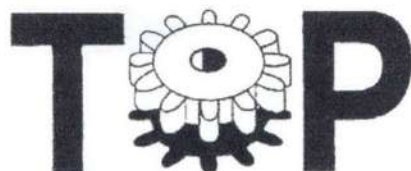
Tav = daily average temperature

Pav = daily average pressure

<b>nter Average I (chart):</b>	44.0
<b>Average Flow Calculation m3/min</b>	1.416920496
<b>Average Flow Calculation in cfm</b>	50.03250272
<b>Sample Time (Hrs):</b>	24.0
<b>Total flow in 24 hours m3/min</b>	2040.365514
<b>Total flow in 24 hours cfm</b>	72046.80391

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





Trade & Engineering

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

### Site Information

<b>Location:</b> -	<b>Site ID:</b> -	<b>Date:</b> 9 Jan 23
<b>Sampler:</b> TE-5000 TSP	<b>Serial No:</b> 3266	<b>Tech:</b> Tong.P

### Site Conditions

<b>Barometric Pressure (in Hg):</b> 28.00	<b>Corrected Pressure (mm Hg):</b> 711.2
<b>Temperature (deg F):</b> 76.0	<b>Temperature (deg K):</b> 297.6
<b>Average Press. (in Hg):</b> 27.00	<b>Corrected Average (mm Hg):</b> 685.8
<b>Average Temp (Deg F):</b> 75.3	<b>Average Temp: (Deg K):</b> 297.2

### Calibration Orifice

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

### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.20	1.761	63.6	61.57	<b>Slope:</b> 38.1692
2	6.40	1.557	56.9	55.08	<b>Intercept:</b> -5.0169
3	5.00	1.377	49.7	48.11	<b>Corr. Coeff:</b> 0.9967
4	4.50	1.307	46.5	45.01	
5	3.90	1.217	42.0	40.66	

**# of Observations:** 5

### Calculations

$$Q_{std} = 1/m[\text{Sqrt}(H_2O(P_a/P_{std})(T_{std}/T_a)) - b]$$
$$IC = I[\text{Sqrt}(P_a/P_{std})(T_{std}/T_a)]$$

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:

$$1/m((I)[\text{Sqrt}(298/T_{av})(P_{av}/760)] - b)$$

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure

<b>enter Average I (chart):</b>	44.0
<b>Average Flow Calculation m3/min</b>	1.22794512
<b>Average Flow Calculation in cfm</b>	43.35964351
<b>Sample Time (Hrs):</b>	24.0
<b>Total flow in 24 hours m3/min</b>	1768.240973
<b>Total flow in 24 hours cfm</b>	62437.88665

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



Trade & Engineering

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

### Site Information

<b>Location:</b> -	<b>Site ID:</b> -	<b>Date:</b> 9 Jan 23
<b>Sampler:</b> TE-5000 TSP	<b>Serial No:</b> 3267	<b>Tech:</b> Tong.P

### Site Conditions

<b>Barometric Pressure (in Hg):</b> 28.00	<b>Corrected Pressure (mm Hg):</b> 711.2
<b>Temperature (deg F):</b> 76.0	<b>Temperature (deg K):</b> 297.6
<b>Average Press. (in Hg):</b> 27.00	<b>Corrected Average (mm Hg):</b> 685.8
<b>Average Temp (Deg F):</b> 75.0	<b>Average Temp (Deg K):</b> 297.0

### Calibration Orifice

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

### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	6.80	1.604	62.2	60.21	<b>Slope:</b> 33.1580
2	5.00	1.377	55.5	53.73	<b>Intercept:</b> 7.5236
3	3.60	1.170	48.3	46.76	<b>Corr. Coeff:</b> 0.9980
4	3.10	1.086	45.1	43.66	
5	2.50	0.976	40.6	39.30	
					<b># of Observations:</b> 5

### Calculations

$Q_{std} = 1/m[\sqrt{H_2O(P_a/P_{std})(T_{std}/T_a)}] - b$   
 $IC = I[\sqrt{P_a/P_{std}}(T_{std}/T_a)]$

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

$1/m((I)[\sqrt{298/T_{av}}(P_{av}/760)] - b)$

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure

<b>nter Average I (chart):</b>	44.0
<b>Average Flow Calculation m3/min</b>	1.035675716
<b>Average Flow Calculation in cfm</b>	36.57046973
<b>Sample Time (Hrs):</b>	24.0
<b>Total flow in 24 hours m3/min</b>	1491.373032
<b>Total flow in 24 hours cfm</b>	52661.47642

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





Trade & Engineering

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

### Site Information

<b>Location:</b> -	<b>Site ID:</b> -	<b>Date:</b> 9 Jan 23
<b>Sampler:</b> TE-5000 TSP	<b>Serial No:</b> 3268	<b>Tech:</b> Tong.P

### Site Conditions

<b>Barometric Pressure (in Hg):</b> 27.60	<b>Corrected Pressure (mm Hg):</b> 701.0
<b>Temperature (deg F):</b> 76.0	<b>Temperature (deg K):</b> 297.6
<b>Average Press. (in Hg):</b> 27.00	<b>Corrected Average (mm Hg):</b> 685.8
<b>Average Temp (Deg F):</b> 75.2	<b>Average Temp (Deg K):</b> 297.2

### Calibration Orifice

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

### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	7.30	1.650	62.7	60.26	<b>Slope:</b> 35.0463
2	5.50	1.433	56.0	53.82	<b>Intercept:</b> 2.9864
3	4.10	1.239	48.8	46.90	<b>Corr. Coeff:</b> 0.9975
4	3.60	1.162	45.6	43.83	
5	3.00	1.061	41.1	39.50	

**# of Observations:** 5

### Calculations

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

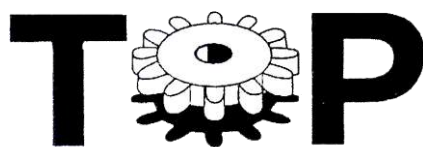
Qstd = standard flow rate  
IC = corrected chart response  
I = actual chart response  
m = calibrator Qstd slope  
b = calibrator Qstd intercept  
Ta = actual temperature during calibration (deg K)  
Pa = actual pressure during calibration (mm Hg)  
Tstd = 298 deg K  
Pstd = 760 mm Hg  
For subsequent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

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

<b>Enter Average I (chart):</b>	49.0
<b>Average Flow Calculation m3/min</b>	1.244829703
<b>Average Flow Calculation in cfm</b>	43.95585051
<b>Sample Time (Hrs):</b>	24.0
<b>Total flow in 24 hours m3/min</b>	1792.554772
<b>Total flow in 24 hours cfm</b>	63296.42474

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





Trade & Engineering

**TSP High Volume Sampler  
TE-5000 TSP Sampler Verification  
Site Information**

<b>Location:</b> -	<b>Site ID:</b> -	<b>Date:</b> 16 Oct 23
<b>Sampler:</b> TE-5000 TSP	<b>Serial No:</b> 3269	<b>Tech:</b> Tong.P

**Site Conditions**

<b>Barometric Pressure (in Hg):</b> 27.80	<b>Corrected Pressure (mm Hg):</b> 706.1
<b>Temperature (deg F):</b> 76.1	<b>Temperature (deg K):</b> 297.7
<b>Average Press. (in Hg):</b> 27.30	<b>Corrected Average (mm Hg):</b> 693.4
<b>Average Temp (Deg F):</b> 75.0	<b>Average Temp: (Deg K):</b> 297.0

**Calibration Orifice**

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

**Calibration Information**

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	7.50	1.678	59.7	57.58	<b>Slope:</b> 35.4041
2	6.30	1.539	55.4	53.43	<b>Intercept:</b> -2.1709
3	5.20	1.399	47.9	46.20	<b>Corr. Coeff:</b> 0.9834
4	4.50	1.302	43.7	42.15	
5	3.10	1.112	40.1	38.68	
					<b># of Observations:</b> 5

**Calculations**

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

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

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

m = sampler slope

b = sampler intercept

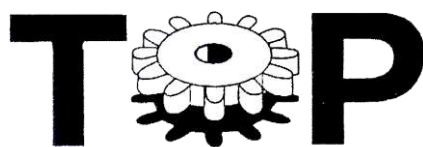
I = chart response

Tav = daily average temperature

Pav = daily average pressure

<b>Enter Average I (chart):</b>	49.4
<b>Average Flow Calculation m3/min</b>	1.395189676
<b>Average Flow Calculation in cfm</b>	49.26517152
<b>Sample Time (Hrs):</b>	24.0
<b>Total flow in 24 hours m3/min</b>	2009.073133
<b>Total flow in 24 hours cfm</b>	70941.84699

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



Trade & Engineering

**TSP High Volume Sampler  
TE-5000 TSP Sampler Verification  
Site Information**

<b>Location:</b> -	<b>Site ID:</b> -	<b>Date:</b> 16 Oct 23
<b>Sampler:</b> TE-5000 TSP	<b>Serial No:</b> 3272	<b>Tech:</b> Tong.P

**Site Conditions**

<b>Barometric Pressure (in Hg):</b> 27.00	<b>Corrected Pressure (mm Hg):</b> 685.8
<b>Temperature (deg F):</b> 76.0	<b>Temperature (deg K):</b> 297.6
<b>Average Press. (in Hg):</b> 27.00	<b>Corrected Average (mm Hg):</b> 685.8
<b>Average Temp (Deg F):</b> 75.0	<b>Average Temp: (Deg K):</b> 297.0

**Calibration Orifice**

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

**Calibration Information**

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	6.80	1.575	62.1	59.03	<b>Slope:</b> 39.9337
2	5.50	1.418	58.4	55.51	<b>Intercept:</b> -2.7031
3	4.40	1.269	50.6	48.10	<b>Corr. Coeff:</b> 0.9857
4	4.00	1.211	48.7	46.29	
5	3.50	1.133	43.5	41.35	
					<b># of Observations:</b> 5

**Calculations**

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

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

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

m = sampler slope

b = sampler intercept

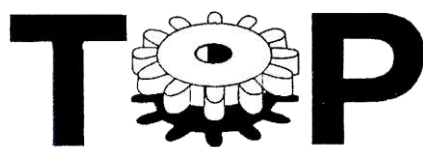
I = chart response

Tav = daily average temperature

Pav = daily average pressure

<b>Enter Average I (chart):</b>	52.7
<b>Average Flow Calculation m3/min</b>	1.322373774
<b>Average Flow Calculation in cfm</b>	46.69398859
<b>Sample Time (Hrs):</b>	24.0
<b>Total flow in 24 hours m3/min</b>	1904.218235
<b>Total flow in 24 hours cfm</b>	67239.34358

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



Trade & Engineering

**TSP High Volume Sampler  
TE-5000 TSP Sampler Verification  
Site Information**

<b>Location:</b> -	<b>Site ID:</b> -	<b>Date:</b> 16 Oct 23
<b>Sampler:</b> TE-5000 TSP	<b>Serial No:</b> 3273	<b>Tech:</b> Tong.P

**Site Conditions**

<b>Barometric Pressure (in Hg):</b> 27.50	<b>Corrected Pressure (mm Hg):</b> 698.5
<b>Temperature (deg F):</b> 76.0	<b>Temperature (deg K):</b> 297.6
<b>Average Press. (in Hg):</b> 27.00	<b>Corrected Average (mm Hg):</b> 685.8
<b>Average Temp (Deg F):</b> 75.5	<b>Average Temp: (Deg K):</b> 297.3

**Calibration Orifice**

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

**Calibration Information**

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	6.60	1.566	61.0	58.52	<b>Slope:</b> 39.0390
2	5.50	1.431	57.9	55.55	<b>Intercept:</b> -1.2149
3	4.20	1.252	51.3	49.21	<b>Corr. Coeff:</b> 0.9826
4	3.70	1.175	47.3	45.38	
5	3.00	1.059	40.0	38.37	
					<b># of Observations:</b> 5

**Calculations**

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

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

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

m = sampler slope

b = sampler intercept

I = chart response

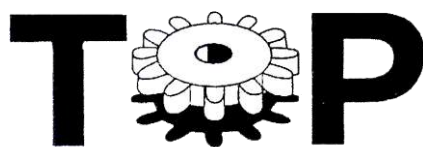
Tav = daily average temperature

Pav = daily average pressure

<b>Enter Average I (chart):</b>	51.5
<b>Average Flow Calculation m3/min</b>	1.28570333
<b>Average Flow Calculation in cfm</b>	45.39912828
<b>Sample Time (Hrs):</b>	24.0
<b>Total flow in 24 hours m3/min</b>	1851.412795
<b>Total flow in 24 hours cfm</b>	65374.74472

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





Trade & Engineering

**TSP High Volume Sampler  
TE-5000 TSP Sampler Verification  
Site Information**

<b>Location:</b> -	<b>Site ID:</b> -	<b>Date:</b> 17 Oct 23
<b>Sampler:</b> TE-5000 TSP	<b>Serial No:</b> 3275	<b>Tech:</b> Tong.P

**Site Conditions**

<b>Barometric Pressure (in Hg):</b> 28.00	<b>Corrected Pressure (mm Hg):</b> 711.2
<b>Temperature (deg F):</b> 76.0	<b>Temperature (deg K):</b> 297.6
<b>Average Press. (in Hg):</b> 25.50	<b>Corrected Average (mm Hg):</b> 647.7
<b>Average Temp (Deg F):</b> 76.1	<b>Average Temp: (Deg K):</b> 297.7

**Calibration Orifice**

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

**Calibration Information**

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	6.90	1.616	60.3	58.37	<b>Slope:</b> 40.3776
2	5.50	1.444	57.2	55.37	<b>Intercept:</b> -4.8617
3	4.40	1.292	51.5	49.85	<b>Corr. Coeff:</b> 0.9554
4	3.90	1.217	46.0	44.53	
5	3.50	1.154	40.3	39.01	
					<b># of Observations:</b> 5

**Calculations**

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

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

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

m = sampler slope

b = sampler intercept

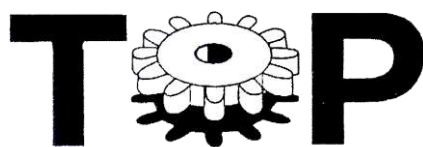
I = chart response

Tav = daily average temperature

Pav = daily average pressure

<b>Enter Average I (chart):</b>	51.1
<b>Average Flow Calculation m3/min</b>	1.288494786
<b>Average Flow Calculation in cfm</b>	45.49769664
<b>Sample Time (Hrs):</b>	24.0
<b>Total flow in 24 hours m3/min</b>	1855.432491
<b>Total flow in 24 hours cfm</b>	65516.68316

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



Trade & Engineering

**TSP High Volume Sampler  
TE-5000 TSP Sampler Verification  
Site Information**

<b>Location:</b> -	<b>Site ID:</b> -	<b>Date:</b> 13 Oct 23
<b>Sampler:</b> TE-5000 TSP	<b>Serial No:</b> 3278	<b>Tech:</b> Tong.P

**Site Conditions**

<b>Barometric Pressure (in Hg):</b> 28.00	<b>Corrected Pressure (mm Hg):</b> 711.2
<b>Temperature (deg F):</b> 75.8	<b>Temperature (deg K):</b> 297.5
<b>Average Press. (in Hg):</b> 26.00	<b>Corrected Average (mm Hg):</b> 660.4
<b>Average Temp (Deg F):</b> 76.3	<b>Average Temp: (Deg K):</b> 297.8

**Calibration Orifice**

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

**Calibration Information**

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	7.00	1.628	60.5	58.58	<b>Slope:</b> 48.3100
2	6.20	1.532	56.4	54.61	<b>Intercept:</b> -20.5901
3	5.70	1.470	50.7	49.09	<b>Corr. Coeff:</b> 0.9844
4	4.80	1.350	44.3	42.89	
5	3.80	1.202	40.1	38.82	
					<b># of Observations:</b> 5

**Calculations**

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

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

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

m = sampler slope

b = sampler intercept

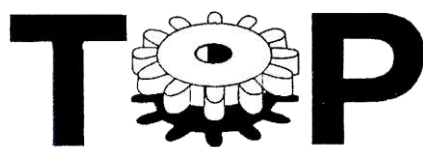
I = chart response

Tav = daily average temperature

Pav = daily average pressure

<b>Enter Average I (chart):</b>	50.4
<b>Average Flow Calculation m3/min</b>	1.399099132
<b>Average Flow Calculation in cfm</b>	49.40321728
<b>Sample Time (Hrs):</b>	24.0
<b>Total flow in 24 hours m3/min</b>	2014.70275
<b>Total flow in 24 hours cfm</b>	71140.63288

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



Trade & Engineering

**TSP High Volume Sampler  
TE-5000 TSP Sampler Verification  
Site Information**

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

**Site Conditions**

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

**Calibration Orifice**

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

**Calibration Information**

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

**Calculations**

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

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

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

m = sampler slope

b = sampler intercept

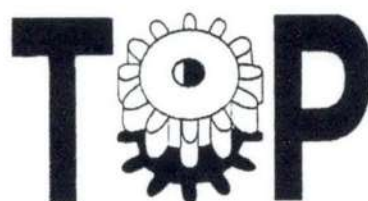
I = chart response

Tav = daily average temperature

Pav = daily average pressure

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

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



Trade & Engineering

## PM10 High Volume Sampler Verification

### Site Information

Location: - Site ID: -  
Sampler: TE-6070 PM10 Serial No: 1313

Date: 10 January 2023  
Tech: Tong P.

### Site Conditions

Barometric Pressure (in Hg): 28.10  
Temperature (deg F): 76.2  
Average Press. (in Hg): 27.00  
Average Temp. (deg F): 75.4

Corrected Pressure (mm Hg): 713.7  
Temperature (deg K): 297.6  
Corrected Average (mm Hg): 685.8  
Average Temp. (deg K): 297.1

### Calibration Orifice

Make: Tisch Environmental, Inc.  
Model: TE-5028A  
Serial#: 1179

Qstd Slope: 1.58304  
Qstd Intercept: -0.01520  
Calibration Due Date: 12 Dec 23

### Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.80	1.220	59.9	38.68	Slope 33.6928
2	7.00	1.089	54.9	35.45	Intercept -1.8198
3	5.80	0.992	49.9	32.22	Corr. Coeff 0.9945
4	5.00	0.922	44.8	28.93	SFR 1.087
5	3.80	0.805	38.7	24.99	SSP 53.92

# of Observations: 5

### Calculations

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

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

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

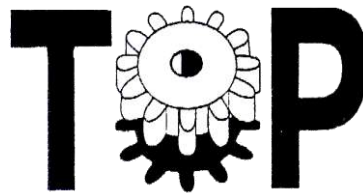
SFR = sampler set point flow rate  
SSP = sampler chart set point  
m = sampler slope  
b = sampler intercept  
Ta = actual temperature (deg K)  
Pa = actual pressure (mm Hg)  
Ts = Average temperature (deg K)  
Ps = Average pressure (mm Hg)

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

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

Average I(chart): 34.5  
Average Flow over Sample (m3/min)  
0.727985358  
Enter Total Time (Hrs): 24.0  
Total flow over sample (m3/min)  
1048.298915  
Total flow over sample (CFM)  
37015.43469





Trade & Engineering

## PM10 High Volume Sampler Verification

### Site Information

Location: - Site ID: - Date: 2 October 2023  
Sampler: TE-6070 PM10 Serial No: 3115 Tech: Tong P.

### Site Conditions

Barometric Pressure (in Hg): 26.60 Corrected Pressure (mm Hg): 675.6  
Temperature (deg F): 75.3 Temperature (deg K): 297.1  
Average Press. (in Hg): 26.65 Corrected Average (mm Hg): 676.9  
Average Temp. (deg F): 76.5 Average Temp. (deg K): 297.7

### 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
1	9.80	1.321	60.5	40.12	Slope 33.7625
2	7.35	1.145	55.7	36.93	Intercept -3.3283
3	6.60	1.086	50.8	33.68	Corr. Coeff 0.9758
4	5.35	0.978	45.5	30.17	SFR 1.130
5	4.60	0.908	39.3	26.06	SSP 52.50

# of Observations: 5

### Calculations

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

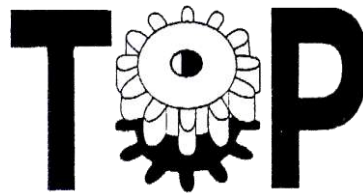
Qa = actual flow rate  
IC = corrected chart response  
m = calibrator slope  
b = calibrator intercept  
Ta = actual temperature (deg K)  
Pa = actual pressure (mm Hg)  
For subsequent calculation  
of sampler flow:

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

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

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

Average I(chart): 50.4  
Average Flow over Sample (m3/min)  
1.088579793  
Enter Total Time (Hrs): 24.0  
Total flow over sample (m3/min)  
1567.554902  
Total flow over sample (CFM)  
55350.36359



Trade & Engineering

## PM10 High Volume Sampler Verification

### Site Information

Location: - Site ID: - Date: 2 October 2023  
Sampler: TE-6070 PM10 Serial No: 3183 Tech: Tong P.

### Site Conditions

Barometric Pressure (in Hg): 27.02 Corrected Pressure (mm Hg): 686.3  
Temperature (deg F): 75.3 Temperature (deg K): 297.1  
Average Press. (in Hg): 26.70 Corrected Average (mm Hg): 678.2  
Average Temp. (deg F): 76.1 Average Temp. (deg K): 297.5

### 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
1	9.45	1.287	60.5	39.80	Slope 36.1461
2	7.75	1.167	55.3	36.38	Intercept -6.1754
3	6.50	1.069	50.7	33.36	Corr. Coeff 0.9935
4	5.75	1.006	45.3	29.80	SFR 1.115
5	4.60	0.901	39.6	26.05	SSP 51.87

# of Observations: 5

### Calculations

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

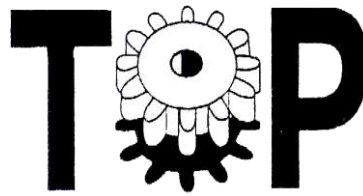
Qa = actual flow rate  
IC = corrected chart response  
m = calibrator slope  
b = calibrator intercept  
Ta = actual temperature (deg K)  
Pa = actual pressure (mm Hg)  
For subsequent calculation  
of sampler flow:

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

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

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

Average I(chart): 50.3  
Average Flow over Sample (m3/min)  
1.092521097  
Enter Total Time (Hrs): 24.0  
Total flow over sample (m3/min)  
1573.23038  
Total flow over sample (CFM)  
55550.76473



Trade & Engineering

## 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
1	9.60	1.295	60.7	39.87	Slope 34.8028
2	7.50	1.146	55.5	36.46	Intercept -4.2838
3	6.45	1.063	50.8	33.37	Corr. Coeff 0.9827
4	5.35	0.969	45.9	30.15	SFR 1.105
5	4.60	0.900	39.2	25.75	SSP 52.02

# of Observations: 5

### Calculations

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

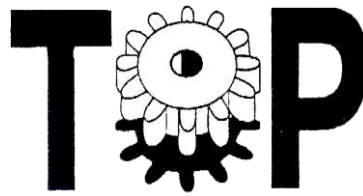
Qa = actual flow rate  
IC = corrected chart response  
m = calibrator slope  
b = calibrator intercept  
Ta = actual temperature (deg K)  
Pa = actual pressure (mm Hg)  
For subsequent calculation  
of sampler flow:

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

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

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

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



Trade & Engineering

## PM10 High Volume Sampler Verification

### Site Information

Location: - Site ID: - Date: 2 October 2023  
Sampler: TE-6070 PM10 Serial No: 3245 Tech: Tong P.

### Site Conditions

Barometric Pressure (in Hg): 27.50 Corrected Pressure (mm Hg): 698.5  
Temperature (deg F): 75.2 Temperature (deg K): 297.0  
Average Press. (in Hg): 26.48 Corrected Average (mm Hg): 672.6  
Average Temp. (deg F): 76.0 Average Temp. (deg K): 297.4

### 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
1	9.35	1.269	60.0	39.12	Slope 36.6800
2	7.65	1.149	55.4	36.12	Intercept -6.6541
3	6.55	1.064	50.9	33.19	Corr. Coeff 0.9908
4	5.70	0.993	45.5	29.67	SFR 1.086
5	4.65	0.898	39.4	25.69	SSP 50.91

# of Observations: 5

### Calculations

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

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

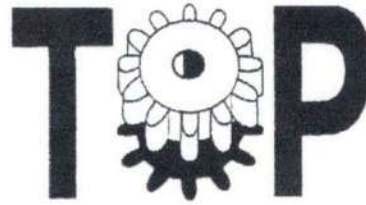
$SFR = 1.13(Ps/Pa)(Ta/Ts)$   
 $SSP = (m*SFR+b)(\text{Sqrt}(Pa/Ta))$   
SFR = sampler set point flow rate  
SSP = sampler chart set point  
m = sampler slope  
b = sampler intercept  
Ta = actual temperature (deg K)  
Pa = actual pressure (mm Hg)  
Ts = Average temperature (deg K)  
Ps = Average pressure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

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

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

Average I(chart): 50.2  
Average Flow over Sample (m3/min)  
1.091533108  
Enter Total Time (Hrs): 24.0  
Total flow over sample (m3/min)  
1571.807676  
Total flow over sample (CFM)  
55500.52903





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## PM10 High Volume Sampler Verification

### Site Information

Location: - Site ID: - Date: 10 January 2023  
Sampler: TE-6070 PM10 Serial No: 3260 Tech: Tong P.

### Site Conditions

Barometric Pressure (in Hg): 27.00 Corrected Pressure (mm Hg): 685.8  
Temperature (deg F): 75.5 Temperature (deg K): 297.2  
Average Press. (in Hg): 26.40 Corrected Average (mm Hg): 670.6  
Average Temp. (deg F): 75.0 Average Temp. (deg K): 296.9

### 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
1	8.10	1.193	59.2	38.97	Slope 31.6154
2	6.30	1.053	54.2	35.68	Intercept 1.8101
3	5.10	0.949	49.2	32.39	Corr. Coeff 0.9952
4	4.30	0.872	44.1	29.03	SFR 1.106
5	3.10	0.742	38.0	25.01	SSP 55.87

# of Observations: 5

### Calculations

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

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

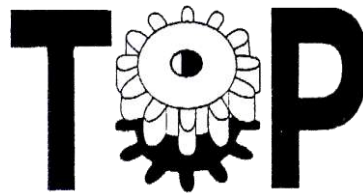
m = sampler slope  
b = sampler intercept  
I = chart response  
Tav = daily average temperature  
Pav = daily average pressure

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

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

Average I(chart): 53.1  
Average Flow over Sample (m3/min)  
1.060313912  
Enter Total Time (Hrs): 24.0  
Total flow over sample (m3/min)  
1526.852034  
Total flow over sample (CFM)  
53913.14532

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: 3286 Tech: Tong P.

### Site Conditions

Barometric Pressure (in Hg): 26.70 Corrected Pressure (mm Hg): 678.2  
Temperature (deg F): 75.4 Temperature (deg K): 297.1  
Average Press. (in Hg): 26.55 Corrected Average (mm Hg): 674.4  
Average Temp. (deg F): 76.5 Average Temp. (deg K): 297.7

### 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
1	9.60	1.305	60.3	39.91	Slope 33.9429
2	7.70	1.170	55.6	36.80	Intercept -3.6602
3	6.65	1.088	50.6	33.49	Corr. Coeff 0.9904
4	5.40	0.981	45.7	30.25	SFR 1.121
5	4.55	0.901	39.4	26.08	SSP 51.97

# of Observations: 5

### Calculations

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

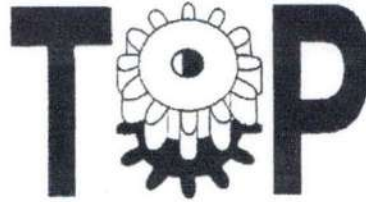
Qa = actual flow rate  
IC = corrected chart response  
m = calibrator slope  
b = calibrator intercept  
Ta = actual temperature (deg K)  
Pa = actual pressure (mm Hg)  
For subsequent calculation  
of sampler flow:

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

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

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

Average I(chart): 50.3  
Average Flow over Sample (m3/min)  
1.092468669  
Enter Total Time (Hrs): 24.0  
Total flow over sample (m3/min)  
1573.154884  
Total flow over sample (CFM)  
55548.09895



Trade & Engineering

## PM10 High Volume Sampler Verification

### Site Information

Location: - Site ID: - Date: 4 October 2022  
Sampler: TE-6070 PM10 Serial No: 3286 Tech: Tong P.

### Site Conditions

Barometric Pressure (in Hg): 27.00 Corrected Pressure (mm Hg): 760.1  
Temperature (deg F): 77.6 Temperature (deg K): 298.3  
Average Press. (in Hg): 30.00 Corrected Average (mm Hg): 761.2  
Average Temp. (deg F): 77.9 Average Temp. (deg K): 298.5

### 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
1	7.50	1.093	56.0	35.08	Slope 31.5206
2	5.90	0.971	51.0	31.95	Intercept 0.9099
3	4.60	0.858	45.0	28.19	Corr. Coeff 0.9973
4	3.80	0.781	40.0	25.06	SFR 1.131
5	2.90	0.684	36.0	22.55	SSP 58.36

# of Observations: 5

### Calculations

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

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

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

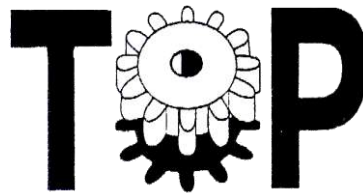
Qa = actual flow rate  
IC = corrected chart response  
m = calibrator slope  
b = calibrator intercept  
Ta = actual temperature (deg K)  
Pa = actual pressure (mm Hg)  
For subsequent calculation of sampler flow:

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

Average I(chart): 55.4  
Average Flow over Sample (m3/min)  
1.071752758  
Enter Total Time (Hrs): 24.0  
Total flow over sample (m3/min)  
1543.323972  
Total flow over sample (CFM)  
54494.76945

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: 3482 Tech: Tong P.

### Site Conditions

Barometric Pressure (in Hg): 26.65 Corrected Pressure (mm Hg): 676.9  
Temperature (deg F): 75.3 Temperature (deg K): 297.1  
Average Press. (in Hg): 26.50 Corrected Average (mm Hg): 673.1  
Average Temp. (deg F): 76.3 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
1	9.65	1.310	60.5	40.08	Slope 34.0516
2	7.50	1.156	55.5	36.77	Intercept -3.5657
3	6.45	1.072	50.6	33.52	Corr. Coeff 0.9827
4	5.35	0.978	45.8	30.34	SFR 1.122
5	4.60	0.907	39.4	26.10	SSP 52.27

# of Observations: 5

### Calculations

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

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

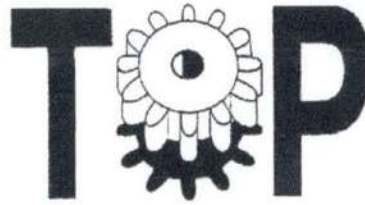
$SFR = 1.13(Ps/Pa)(Ta/Ts)$   
 $SSP = (m*SFR+b)(\text{Sqrt}(Pa/Ta))$   
SFR = sampler set point flow rate  
SSP = sampler chart set point  
m = sampler slope  
b = sampler intercept  
Ta = actual temperature (deg K)  
Pa = actual pressure (mm Hg)  
Ts = Average temperature (deg K)  
Ps = Average pressure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

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

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

Average I(chart): 50.4  
Average Flow over Sample (m3/min)  
1.088858164  
Enter Total Time (Hrs): 24.0  
Total flow over sample (m3/min)  
1567.955756  
Total flow over sample (CFM)  
55364.51773





Trade & Engineering

## PM10 High Volume Sampler Verification

### Site Information

Location: -

Site ID: -

Date: 4 October 2022

Sampler: TE-6070 PM10

Serial No: 3482

Tech: Tong P.

### Site Conditions

Barometric Pressure (in Hg): 28.00

Temperature (deg F): 77.9

Average Press. (in Hg): 29.00

Average Temp. (deg F): 77.4

Corrected Pressure (mm Hg): 760.1

Temperature (deg K): 298.5

Corrected Average (mm Hg): 760.4

Average Temp. (deg K): 298.2

### Calibration Orifice

Make: Tisch Environmental, Inc.

Model: TE-5028A

Serial#: 1179

Qstd Slope: 1.58304

Qstd Intercept: -0.01520

Calibration Due Date: 12 Dec 23

### Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	7.70	1.108	58.0	36.35	Slope 32.7750
2	5.90	0.971	52.0	32.59	Intercept 0.3409
3	4.70	0.868	46.0	28.83	Corr. Coeff 0.9987
4	3.90	0.791	42.0	26.32	SFR 1.131
5	2.90	0.684	36.0	22.56	SSP 59.72

# of Observations: 5

### Calculations

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

$$IC = I(\text{Sqrt}(Ta/Pa))$$

Qa = actual flow rate

IC = corrected chart response

m = calibrator slope

b = calibrator intercept

Ta = actual temperature (deg K)

Pa = actual pressure (mm Hg)

For subsequent calculation

of sampler flow:

$$SFR = 1.13(Ps/Pa)(Ta/Ts)$$

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

SFR = sampler set point flow rate

SSP = sampler chart set point

m = sampler slope

b = sampler intercept

Ta = actual temperature (deg K)

Pa = actual pressure (mm Hg)

Ts = Average temperature (deg K)

Ps = Average pressure (mm Hg)

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure

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

Average I(chart):	55.6
Average Flow over Sample (m3/min)	1.051981946
Enter Total Time (Hrs):	24.0
Total flow over sample (m3/min)	1514.854003
Total flow over sample (CFM)	53489.49483

## Certificate of Calibration

Calibrated Date : 2-Sep-22

Certificate No. : 0922-009

Page : 1/1

### Instruments

Instruments : PM2.5-PM10 Air Sampler

Manufacturer : Thermo Scientific PartisolFRM 2000- H

Model : 2000- H

Serial No. : 200FA201309704

### Environmental

Temperature : 26.4 °C

Humidity : 54.2 %RH

### Calibration System

Instruments : Drycal

Manufacturer : Bios

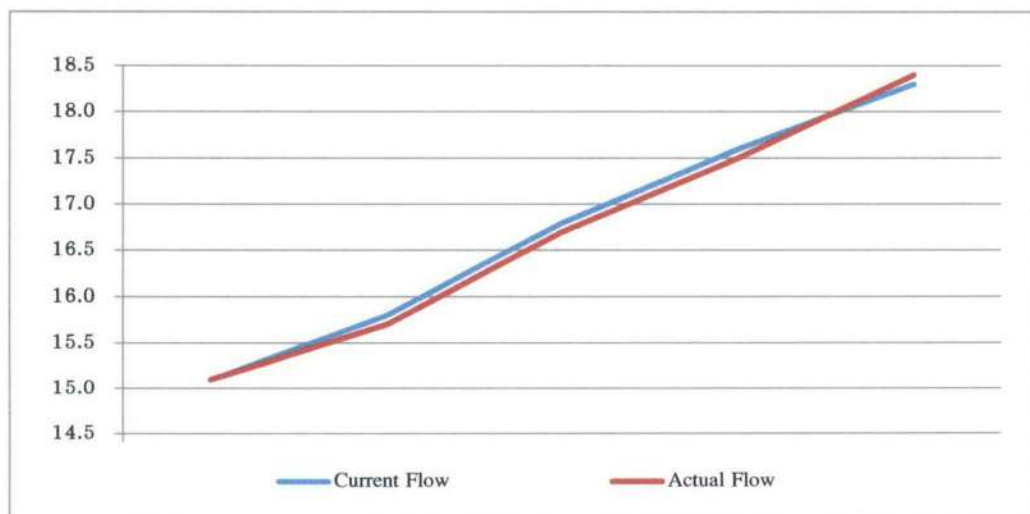
Model : DCL-H

Serial No. : 102591

Calibration due date : 7-Sep-22

### Flow Tetsing

Filter	Set Flow Instrument (L/min)	Current Flow Instrument reading (L/min)	Actual Flow Reference Standard (L/min)
47 mm.	16.7	16.8	16.7
	17.5	17.6	17.5
	15.8	15.8	15.7
	18.3	18.3	18.4
	15.0	15.1	15.1



Calibrated by :

  
(Mr. Tong Piima)

## Certificate of Calibration

Calibrated Date : 2-Sep-23

Certificate No. : 0223-002

Page : 1/1

### Instruments

Instruments : PM2.5-PM10 Air Sampler

Manufacturer : Thermo Scientific

Model : 2000-D

Serial No. : 200DA200310704

### Environmental

Temperature : 24.7 °C

Humidity : 52.8 %RH

### Calibration System

Instruments : Drycal

Manufacturer : Bios

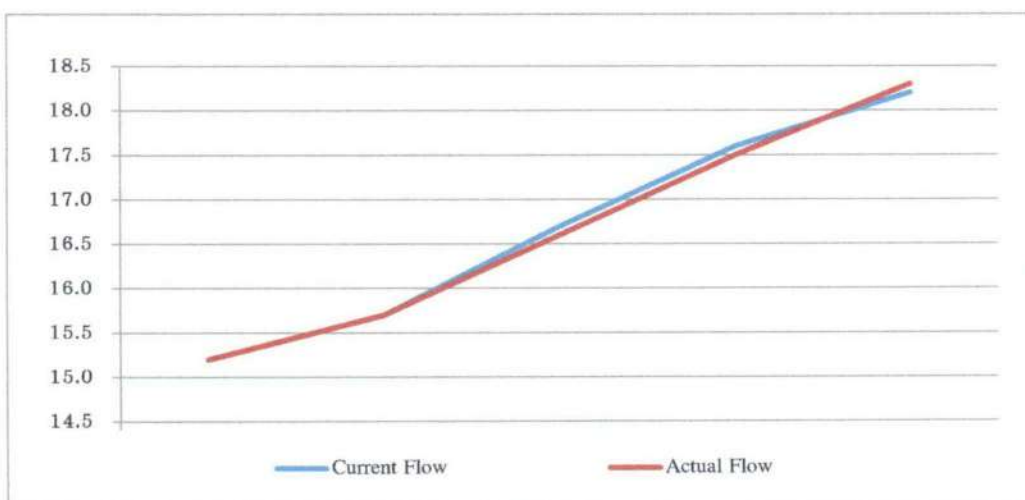
Model : DCL-H

Serial No. : 102591


Calibration due date : 24-Oct-23

### Flow Tetsing

Filter	Set Flow Instrument (L/min)	Current Flow Instrument reading (L/min)	Actual Flow Reference Standard (L/min)
47 mm.	16.7	16.7	16.6
	17.5	17.6	17.5
	15.8	15.7	15.7
	18.3	18.2	18.3
	15.0	15.2	15.2



Calibrated by :

  
 (Mr. Tong Piima)



## Certificate of Calibration

Calibrated Date : 11-Mar-23

Certificate No. : 0323-002

Page : 1/1

### Instruments

Instruments : PM2.5-PM10 Air Sampler

Manufacturer : Thermo Scientific

Model : 2000-H

Serial No. : 200FA201669708

### Environmental

Temperature : 24.3 °C

Humidity : 51.4 %RH

### Calibration System

Instruments : Drycal

Manufacturer : Bios

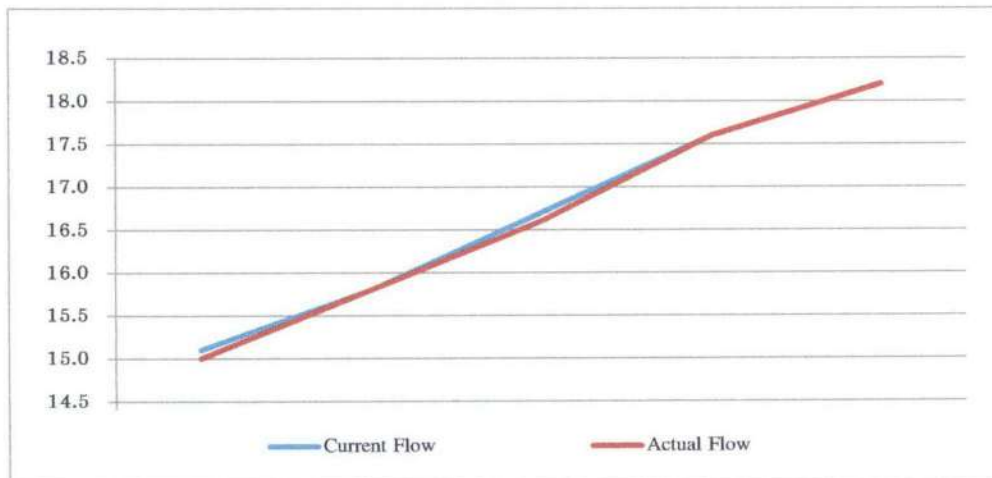
Model : DCL-H

Serial No. : 102591

Calibration due date : 24-Oct-23

### Flow Tetsing

Filter	Set Flow Instrument (L/min)	Current Flow Instrument reading (L/min)	Actual Flow Reference Standard (L/min)
47 mm.	16.7	16.7	16.6
	17.5	17.6	17.6
	15.8	15.8	15.8
	18.3	18.2	18.2
	15.0	15.1	15.0



Calibrated by :

  
 (Mr. Tong Piima)



## Certificate of Calibration

Calibrated Date : 1-Apr-23

Certificate No. : 0423-002

Page : 1/1

### Instruments

Instruments : PM2.5-PM10 Air Sampler

Manufacturer : Thermo Scientific

Model : 2000-H

Serial No. : 200FA201309703

### Environmental

Temperature : 25.2 °C

Humidity : 52.3 %RH

### Calibration System

Instruments : Drycal

Manufacturer : Bios

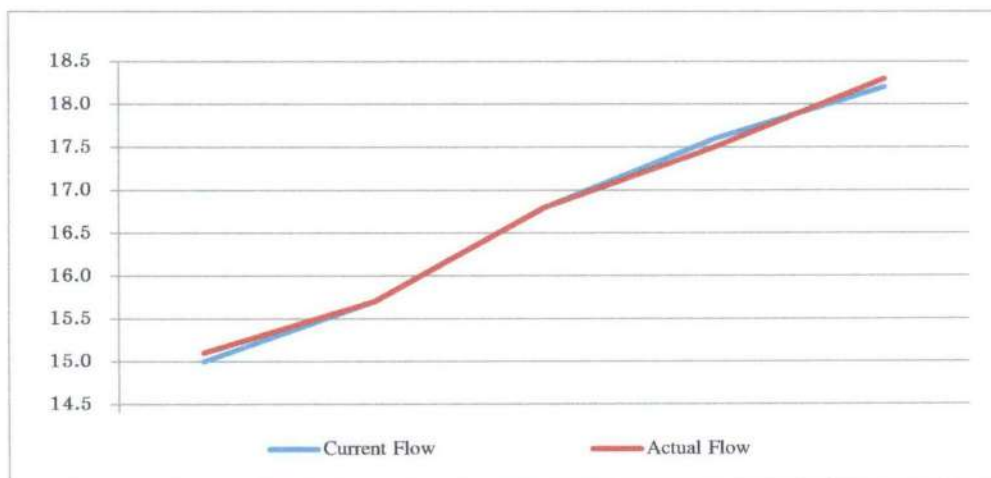
Model : DCL-H

Serial No. : 102591

Calibration due date : 24-Oct-23

### Flow Tetsing

Filter	Set Flow Instrument (L/min)	Current Flow Instrument reading (L/min)	Actual Flow Reference Standard (L/min)
47 mm.	16.7	16.8	16.8
	17.5	17.6	17.5
	15.8	15.7	15.7
	18.3	18.2	18.3
	15.0	15.0	15.1



Calibrated by :

  
 (Mr. Tong Piima)

## Certificate of Calibration

Calibrated Date : 2-Sep-22

Certificate No. : 0922-006

Page : 1/1

### Instruments

Instruments : PM2.5-PM10 Air Sampler

Manufacturer : BGI

Model : PQ-200

Serial No. : 140AB25409410

### Environmental

Temperature : 25.7 °C

Humidity : 54.1 %RH

### Calibration System

Instruments : Drycal

Manufacturer : Bios

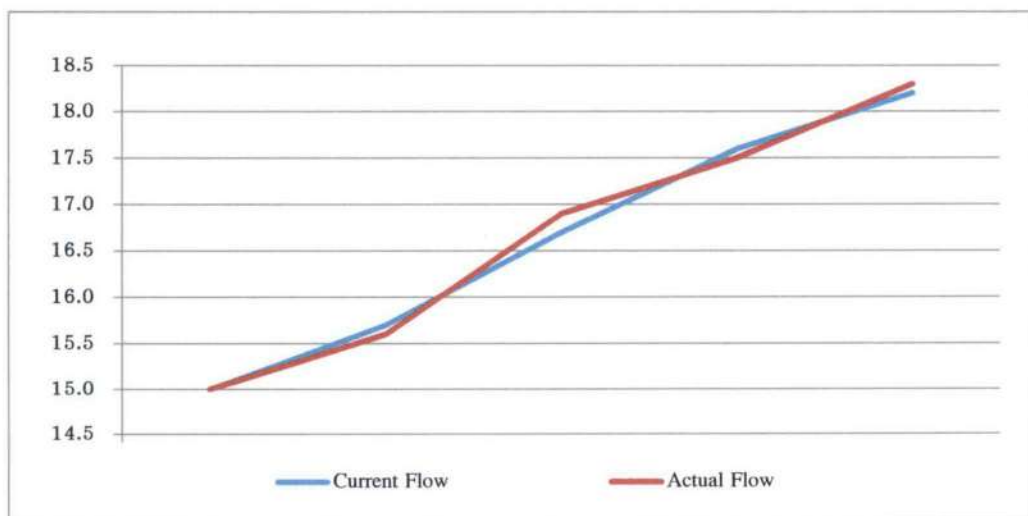
Model : DCL-H

Serial No. : 102591

Calibration due date : 7-Sep-22

### Flow Tetsing

Filter	Set Flow Instrument (L/min)	Current Flow Instrument reading (L/min)	Actual Flow Reference Standard (L/min)
47 mm.	16.7	16.7	16.9
	17.5	17.6	17.5
	15.8	15.7	15.6
	18.3	18.2	18.3
	15.0	15.0	15.0



Calibrated by :

  
 (Mr. Tong Piima)

## Certificate of Calibration

Calibrated Date : 5-Sep-23

Certificate No. : 0923-002

Page : 1/1

### Instruments

Instruments : PM2.5-PM10 Air Sampler

Manufacturer : BGI

Model : PQ-200

Serial No. : 140AB25409410

### Environmental

Temperature : 25.8 °C

Humidity : 41.9 %RH

### Calibration System

Instruments : Drycal

Manufacturer : Bios

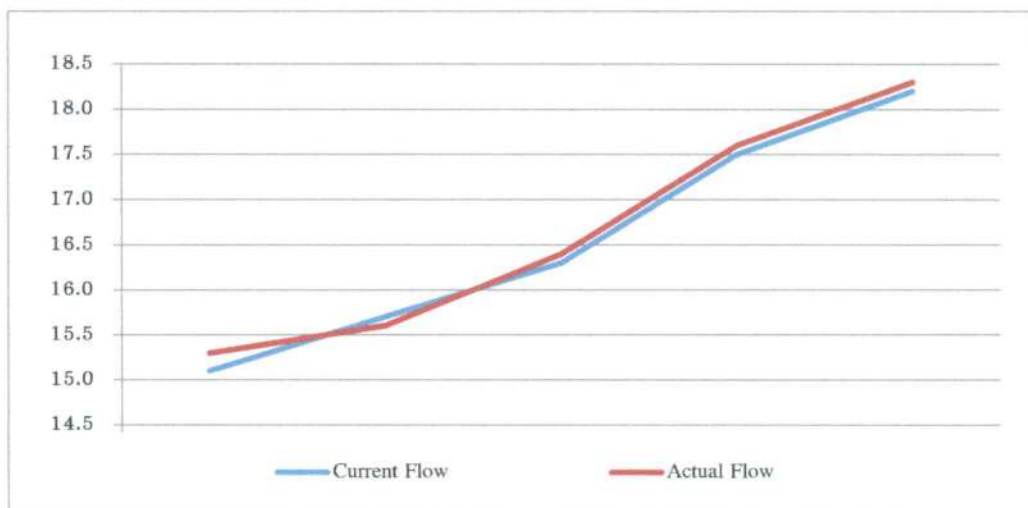
Model : DCL-H

Serial No. : 102591

Calibration due date : 20-Oct-22

### Flow Tetsing

Filter	Set Flow Instrument (L/min)	Current Flow Instrument reading (L/min)	Actual Flow Reference Standard (L/min)
47 mm.	16.2	16.3	16.4
	17.4	17.5	17.6
	15.6	15.7	15.6
	18.3	18.2	18.3
	15.2	15.1	15.3



Calibrated by :

  
(Mr. Tong Piima)

## Certificate of Calibration

Calibrated Date : 2-Sep-22

Certificate No. : 0922-007

Page : 1/1

### Instruments

Instruments : PM2.5-PM10 Air Sampler

Manufacturer : TEOM Control Unit (RP)

Model : 1400a

Serial No. : 140AB254490411

### Environmental

Temperature : 25.4 °C

Humidity : 52.9 %RH

### Calibration System

Instruments : Drycal

Manufacturer : Bios

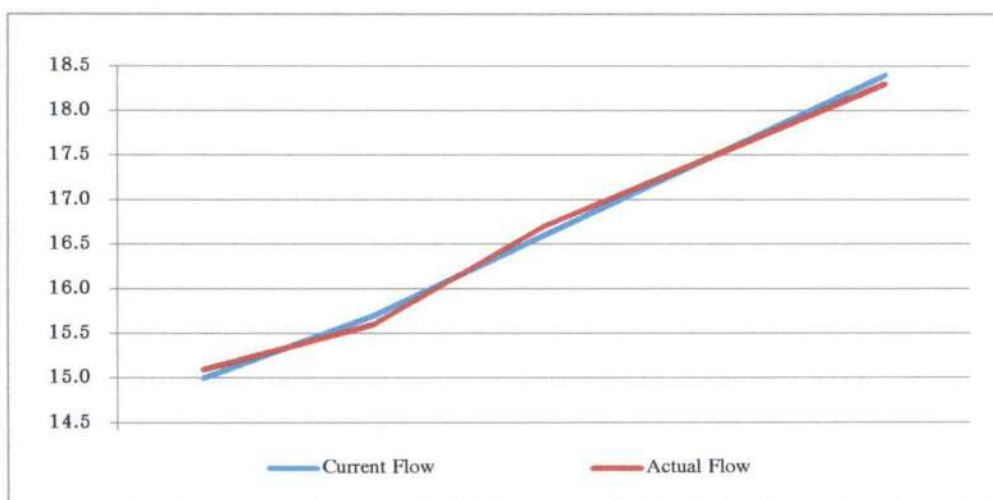
Model : DCL-H

Serial No. : 102591

Calibration due date : 7-Sep-22

### Flow Tetsing

Filter	Set Flow Instrument (L/min)	Current Flow Instrument reading (L/min)	Actual Flow Reference Standard (L/min)
47 mm.	16.7	16.6	16.7
	17.5	17.5	17.5
	15.8	15.7	15.6
	18.3	18.4	18.3
	15.0	15.0	15.1



Calibrated by :

  
 (Mr. Tong Piima)



## Certificate of Calibration

Calibrated Date : 5-Sep-23

Certificate No. : 0923-003

Page : 1/1

### Instruments

Instruments : PM2.5-PM10 Air Sampler

Manufacturer : TEOM Control Unit (RP)

Model : 1400a

Serial No. : 140AB254490411

### Environmental

Temperature : 26.2 °C

Humidity : 44.1 %RH

### Calibration System

Instruments : Drycal

Manufacturer : Bios

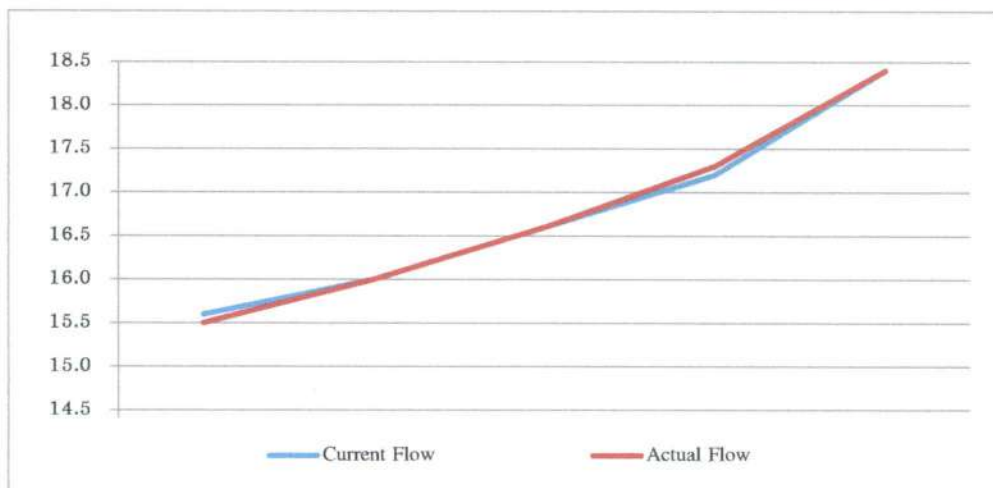
Model : DCL-H

Serial No. : 102591


Calibration due date : 20-Oct-22

### Flow Tetsing

Filter	Set Flow Instrument (L/min)	Current Flow Instrument reading (L/min)	Actual Flow Reference Standard (L/min)
47 mm.	16.5	16.6	16.6
	17.3	17.2	17.3
	15.9	16.0	16.0
	18.4	18.4	18.4
	15.5	15.6	15.5



Calibrated by :

  
 (Mr. Tong Piima)

## Certificate of Calibration

Calibrated Date : 2-Sep-22

Certificate No. : 0922-008

Page : 1/1

### Instruments

Instruments : PM2.5-PM10 Air Sampler

Manufacturer : TEOM Control Unit (RP)

Model : 1400a

Serial No. : 140AB254490412

### Environmental

Temperature : 24.1 °C

Humidity : 52.1 %RH

### Calibration System

Instruments : Drycal

Manufacturer : Bios

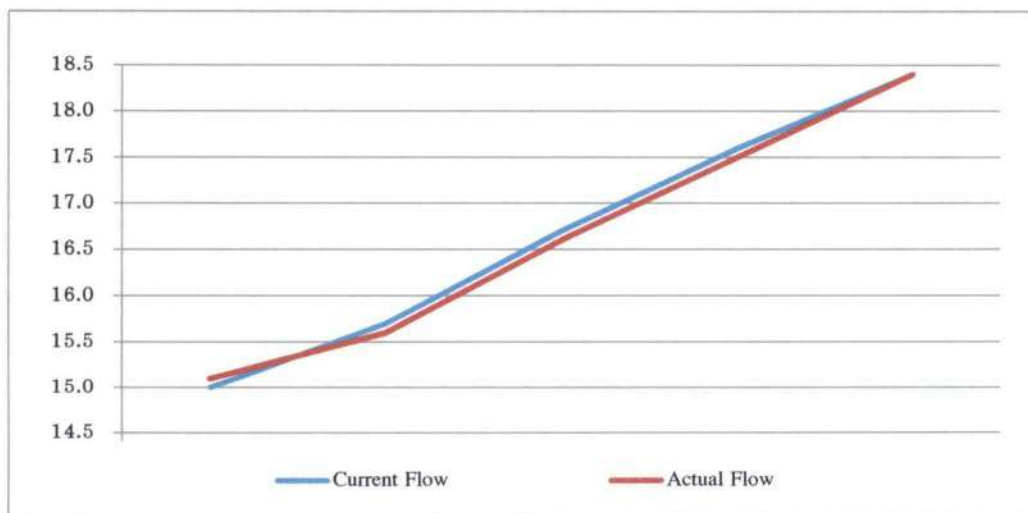
Model : DCL-H

Serial No. : 102591

Calibration due date : 7-Sep-22

### Flow Tetsing

Filter	Set Flow Instrument (L/min)	Current Flow Instrument reading (L/min)	Actual Flow Reference Standard (L/min)
47 mm.	16.7	16.7	16.6
	17.5	17.6	17.5
	15.8	15.7	15.6
	18.3	18.4	18.4
	15.0	15.0	15.1



Calibrated by :

*Tong Piima*

(Mr. Tong Piima)

## Certificate of Calibration

Calibrated Date : 5-Sep-23

Certificate No. : 0923-004

Page : 1/1

### Instruments

Instruments : PM2.5-PM10 Air Sampler

Manufacturer : TEOM Control Unit (RP)

Model : 1400a

Serial No. : 140AB254490412

### Environmental

Temperature : 23.8 °C

Humidity : 42.5 %RH

### Calibration System

Instruments : Drycal

Manufacturer : Bios

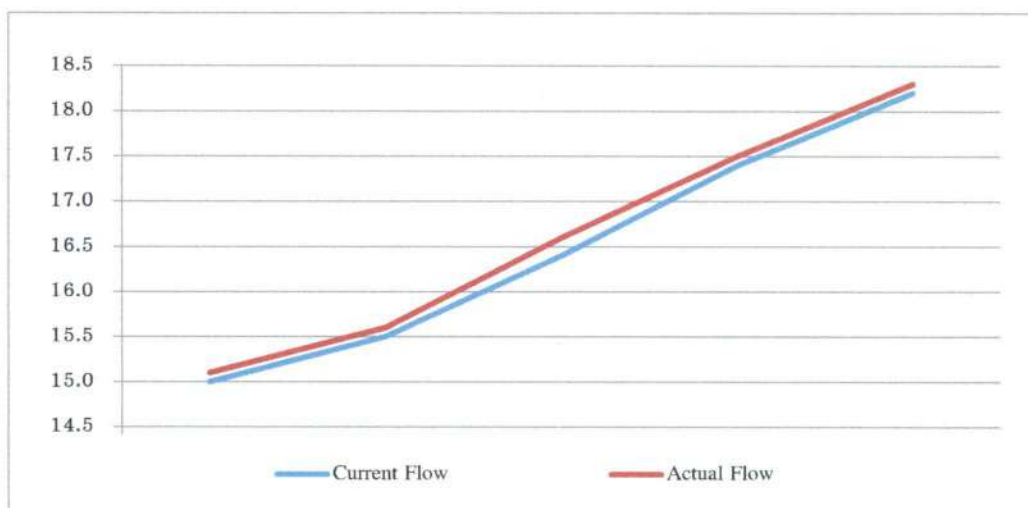
Model : DCL-H

Serial No. : 102591

Calibration due date : 20-Oct-22

### Flow Tetsing

Filter	Set Flow Instrument (L/min)	Current Flow Instrument reading (L/min)	Actual Flow Reference Standard (L/min)
47 mm.	16.5	16.4	16.6
	17.3	17.4	17.5
	15.6	15.5	15.6
	18.0	18.2	18.3
	15.1	15.0	15.1



Calibrated by :

  
 (Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 22-Jul-23

Certificate No. : 0723-001

Page : 1/1

### Analyzer Instruments

Analyzer Type : CO Analyzer

Manufacturer : Thermo Environmental

Model : 48C

Serial No. : 508011061

### Environmental

Temperature : 24.2 °C

Humidity : 52.0 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

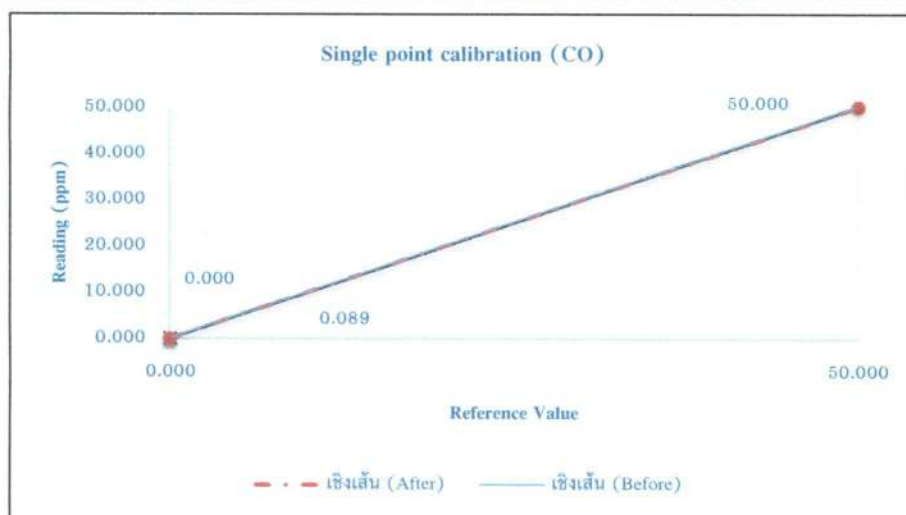
SO2 Conc. : 2 ppm

Expire Date : 21-Nov-23

CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
CO	0.089	0.000	0.09	50.2	50.000	0.40
After						
CO	0.000	0.000	0.00	50.0	50.000	0.00



Calibrated by :

  
 (Mr. Tong Piima)



## Certificate of Analyzer Performance Testing

Calibrated Date : 6-Apr-22

Certificate No. : 0422-054

Page : 1/1

### Analyzer Instruments

Analyzer Type : CO Analyzer

Manufacturer : Thermo Environmental

Model : 48C

Serial No. : 401304261

### Environmental

Temperature : 24.1 °C

Humidity : 49.3 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

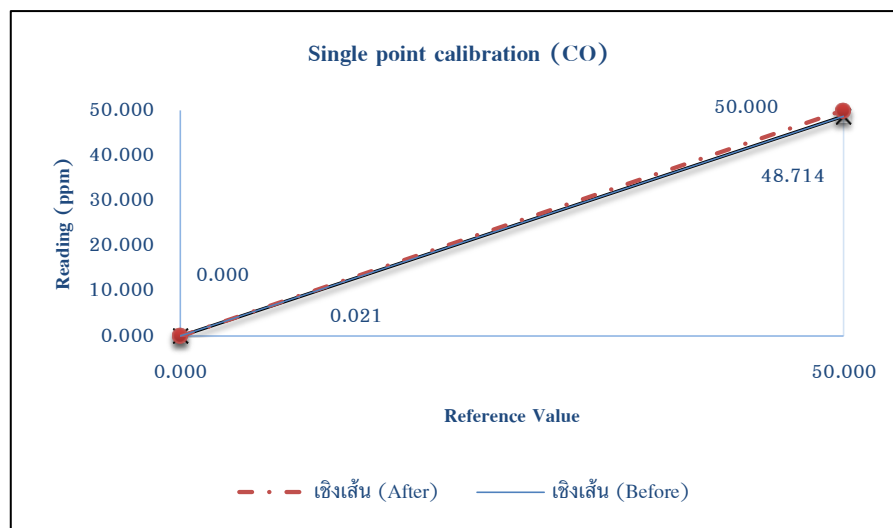
SO<sub>2</sub> Conc. : 2 ppm

Expire Date : 21-Nov-23


CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
CO	0.021	0.000	0.02	48.714	50.000	-2.57
After						
CO	0.000	0.000	0.00	50.000	50.000	0.00



Calibrated by :

  
 (Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 1-Sep-22

Certificate No. : 0922-004

Page : 1/1

### Analyzer Instruments

Analyzer Type : CO Analyzer

Manufacturer : Thermo Environmental

Model : 48C

Serial No. : 508011069

### Environmental

Temperature : 25.2 °C

Humidity : 51.2 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 140C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

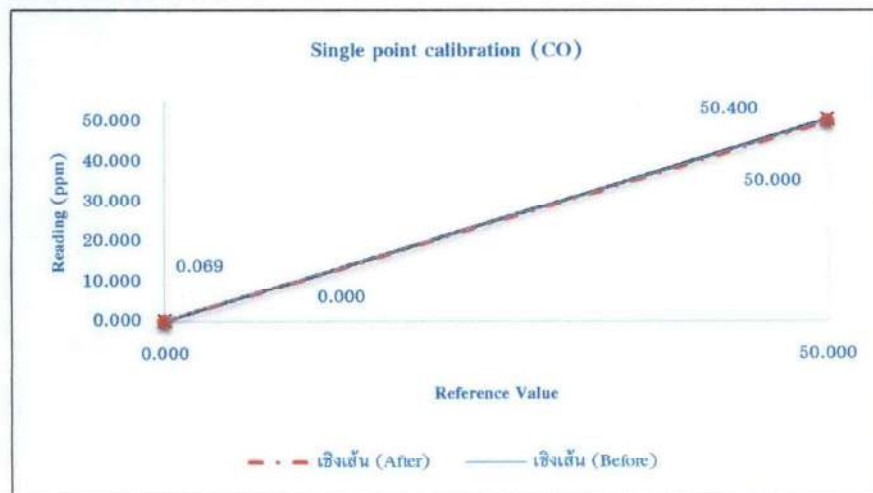
SO<sub>2</sub> Conc. : 2 ppm

Expire Date : 21-Nov-23

CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
CO	0.069	0.000	0.07	50.4	50.000	0.80
After						
CO	0.000	0.000	0.00	50.0	50.000	0.00



Calibrated by :

  
(Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 26-Aug-23

Certificate No. : 0823-005

Page : 1/1

### Analyzer Instruments

Analyzer Type : CO Analyzer

Manufacturer : Thermo Environmental

Model : 48C

Serial No. : 508011069

### Environmental

Temperature : 25.5 °C

Humidity : 53.7 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

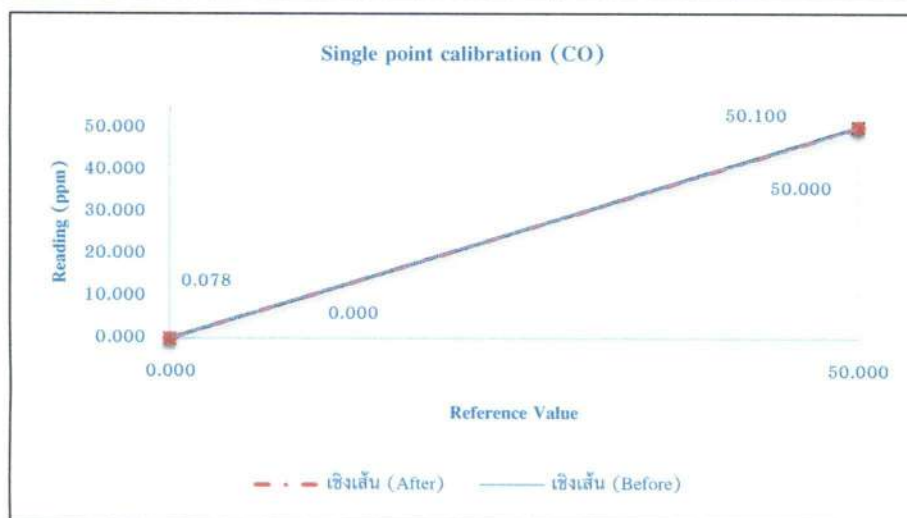
SO2 Conc. : 2 ppm

Expire Date : 21-Nov-23

CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
CO	0.078	0.000	0.08	50.1	50.000	0.20
After						
CO	0.000	0.000	0.00	50.0	50.000	0.00



Calibrated by :

  
 (Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 1-Sep-22

Certificate No. : 0922-005

Page : 1/1

### Analyzer Instruments

Analyzer Type : CO Analyzer

Manufacturer : Thermo Environmental

Model : 48C

Serial No. : 508011064

### Environmental

Temperature : 26.7 °C

Humidity : 56.9 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

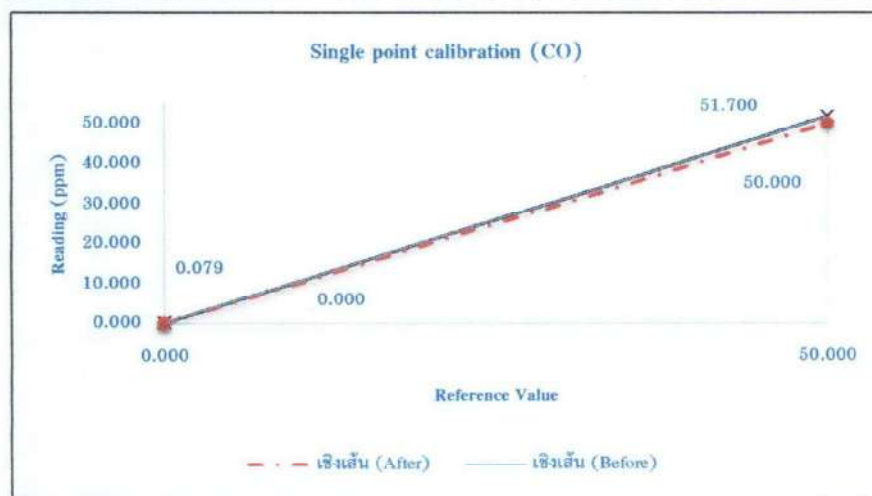
SO<sub>2</sub> Conc. : 2 ppm

Expire Date : 21-Nov-23

CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
CO	0.079	0.000	0.08	51.7	50.000	3.40
After						
CO	0.000	0.000	0.00	50.0	50.000	0.00



Calibrated by :

  
(Mr. Tong Piima)



## Certificate of Analyzer Performance Testing

Calibrated Date : 26-Aug-23

Certificate No. : 0823-006

Page : 1/1

### Analyzer Instruments

Analyzer Type : CO Analyzer

Manufacturer : Thermo Environmental

Model : 48C

Serial No. : 508011064

### Environmental

Temperature : 24.9 °C

Humidity : 41.3 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

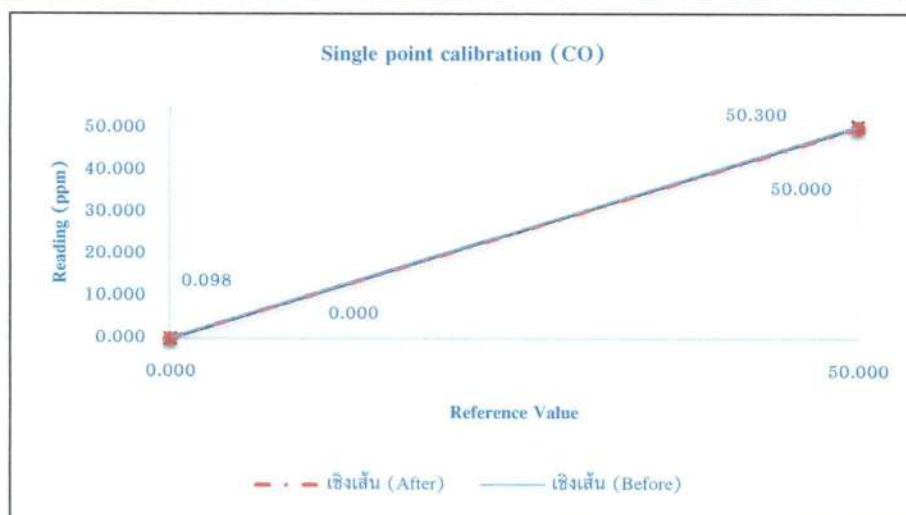
SO2 Conc. : 2 ppm

Expire Date : 21-Nov-23

CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
CO	0.098	0.000	0.10	50.3	50.000	0.60
After						
CO	0.000	0.000	0.00	50.0	50.000	0.00



Calibrated by :

  
(Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 10-Jun-23

Certificate No. : 0623-001

Page : 1/1

### Analyzer Instruments

Analyzer Type : CO Analyzer

Manufacturer : Thermo Environmental

Model : 48C

Serial No. : 508011068

### Environmental

Temperature : 25.2 °C

Humidity : 51.3 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

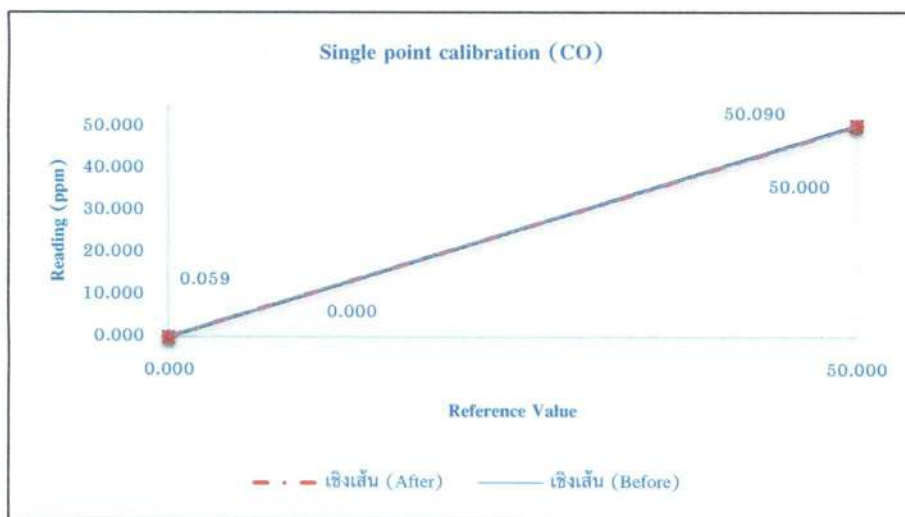
SO2 Conc. : 2 ppm

Expire Date : 21-Nov-23

CO Conc. : 50 ppm

### Calibration Check

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



Calibrated by :

  
 (Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 4-Feb-23

Certificate No. : 0223-001

Page : 1/1

### Analyzer Instruments

Analyzer Type : CO Analyzer

Manufacturer : Thermo Environmental

Model : 48i

Serial No. : 1172750062

### Environmental

Temperature : 24.7 °C

Humidity : 52.8 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

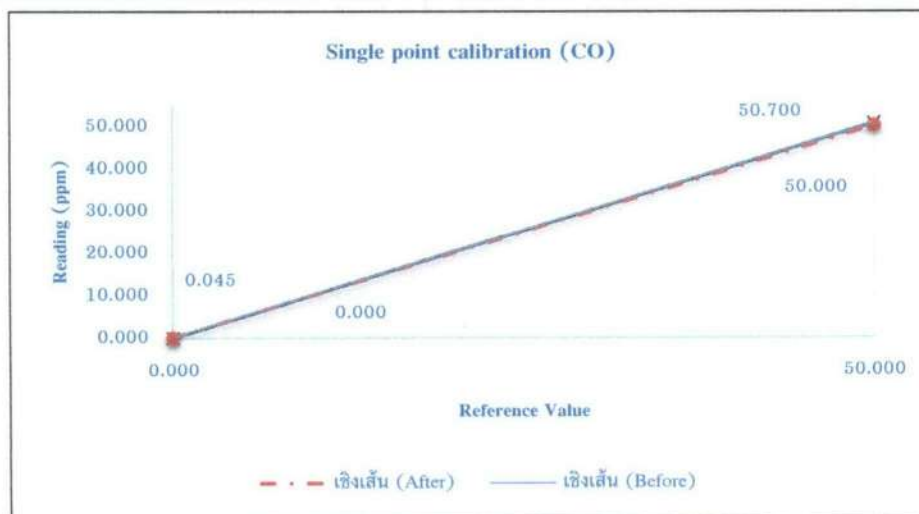
SO<sub>2</sub> Conc. : 2 ppm

Expire Date : 21-Nov-23

CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
CO	0.045	0.000	0.05	50.7	50.0	1.40
After						
CO	0.000	0.000	0.00	50.0	50.0	0.00



Calibrated by :

  
(Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 5-Aug-23

Certificate No. : 0823-001

Page : 1/1

### Analyzer Instruments

Analyzer Type : SO2 Analyzer

Manufacturer : Thermo Environmental

Model : 43C

Serial No. : 43C-62201-334

### Environmental

Temperature : 25.0 °C

Humidity : 51.9 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

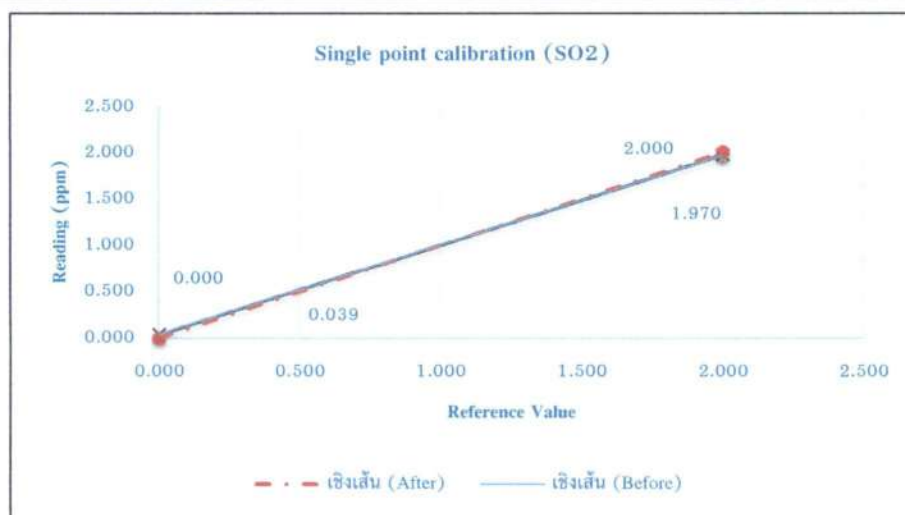
SO2 Conc. : 2 ppm

Expire Date : 21-Nov-23

CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
SO2	0.039	0.000	0.04	1.97	2.000	-1.50
After						
SO2	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by :

  
 (Mr. Tong Piima)



## Certificate of Analyzer Performance Testing

Calibrated Date : 26-Aug-23

Certificate No. : 0823-002

Page : 1/1

### Analyzer Instruments

Analyzer Type : SO2 Analyzer

Manufacturer : Thermo Environmental

Model : 43C

Serial No. : 43C-70853-367

### Environmental

Temperature : 25.1 °C

Humidity : 47.9 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

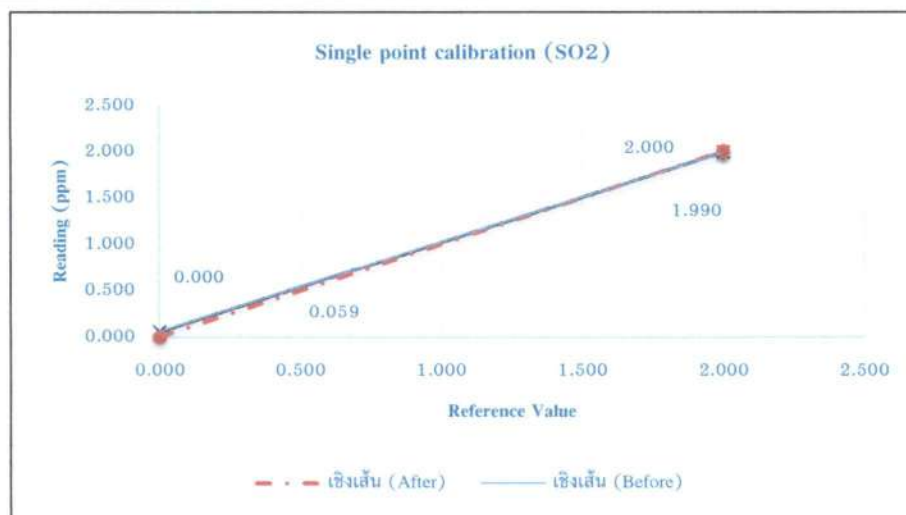
SO2 Conc. : 2 ppm

Expire Date : 21-Nov-23

CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
SO2	0.059	0.000	0.06	1.99	2.000	-0.50
After						
SO2	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by :

  
 (Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 30-Sep-23

Certificate No. : 0923-006

Page : 1/1

### Analyzer Instruments

Analyzer Type : SO2 Analyzer

Manufacturer : Thermo Environmental

Model : 43C

Serial No. : CTL63588-340

### Environmental

Temperature : 26.7 °C

Humidity : 44.0 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

#### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

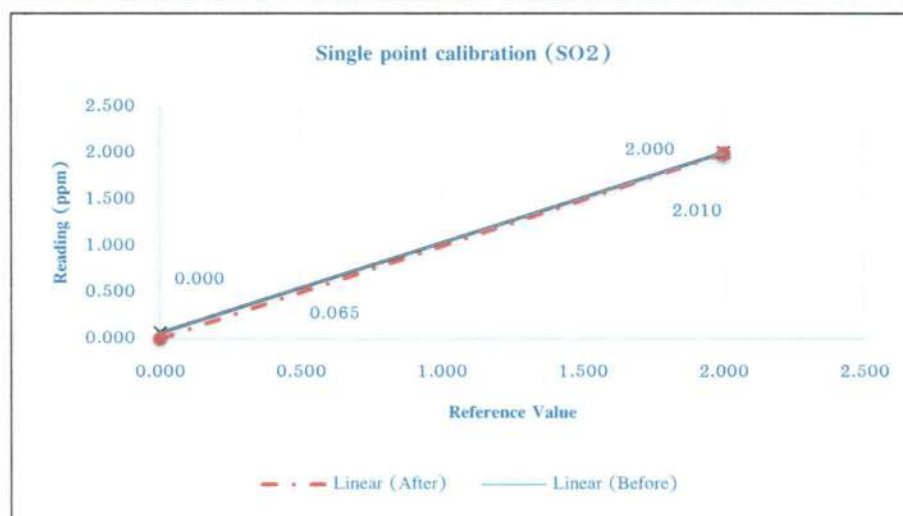
SO2 Conc. : 2 ppm

Expire Date : 21-Nov-23

CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
SO2	0.065	0.000	0.07	2.01	2.000	0.50
After						
SO2	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by :

*Tong Piima*  
(Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 26-Aug-23

Certificate No. : 0823-004

Page : 1/1

### Analyzer Instruments

Analyzer Type : SO2 Analyzer

Manufacturer : Thermo Environmental

Model : 43C

Serial No. : 43C-77419-385

### Environmental

Temperature : 25.1 °C

Humidity : 46.2 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

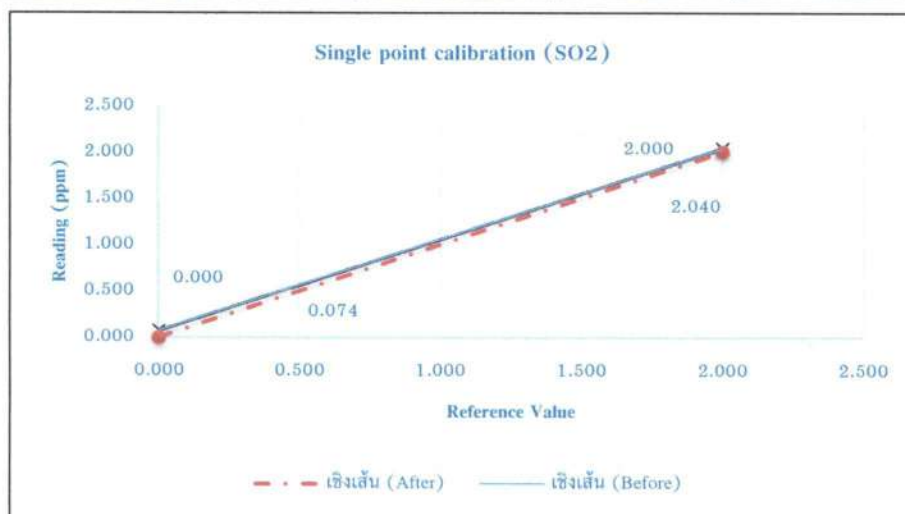
SO2 Conc. : 2 ppm

Expire Date : 21-Nov-23

CO Conc. : 50 ppm

### Calibration Check

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



Calibrated by :

  
(Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 1-Apr-23

Certificate No. : 0423-003

Page : 1/1

### Analyzer Instruments

Analyzer Type : SO2 Analyzer

Manufacturer : Thermo Environmental

Model : 43C

Serial No. : 69858-364

### Environmental

Temperature : 25.2 °C

Humidity : 52.3 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

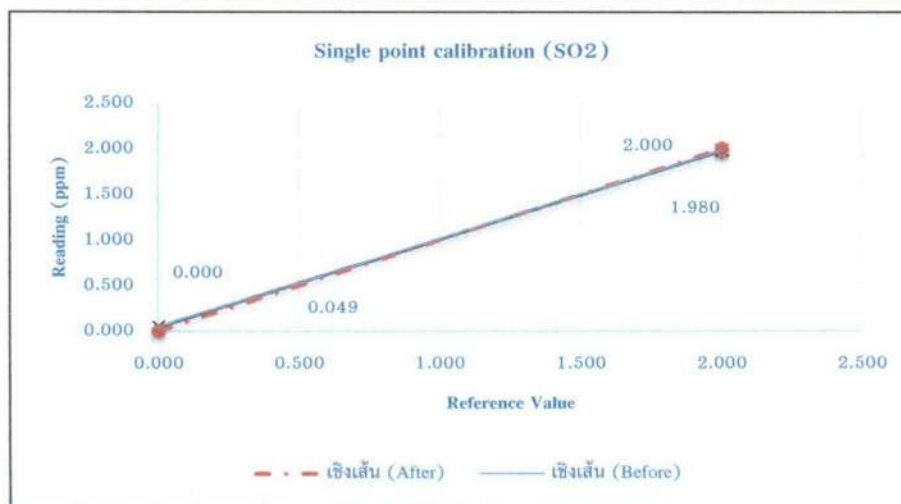
SO2 Conc. : 2 ppm

Expire Date : 21-Nov-23

CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
SO2	0.049	0.000	0.05	1.98	2.000	-1.00
After						
SO2	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by :

*Tong Piima*  
(Mr Tong Piima)



## Certificate of Analyzer Performance Testing

Calibrated Date : 30-Aug-22

Certificate No. : 0822-005

Page : 1/1

### Analyzer Instruments

Analyzer Type : SO2 Analyzer

Manufacturer : Thermo Environmental

Model : 43C

Serial No. : 70853-367

### Environmental

Temperature : 25.7 °C

Humidity : 54.1 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

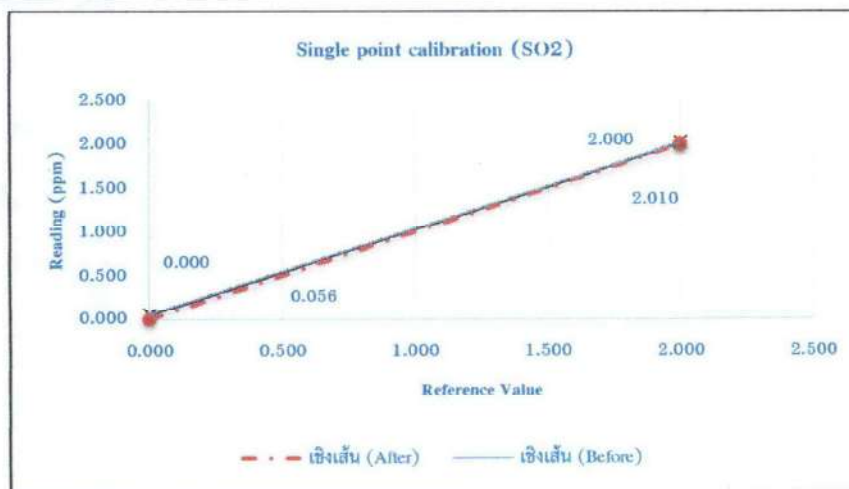
SO2 Conc. : 2 ppm

Expire Date : 21-Nov-23

CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
SO2	0.056	0.000	0.06	2.01	2.000	0.50
After						
SO2	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by :

  
(Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 3-Oct-22

Certificate No. : 1022-001

Page : 1/1

### Analyzer Instruments

Analyzer Type : SO2 Analyzer

Manufacturer : Thermo Environmental

Model : 43C

Serial No. : CTT 63588-340

### Environmental

Temperature : 24.1 °C

Humidity : 52.1 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

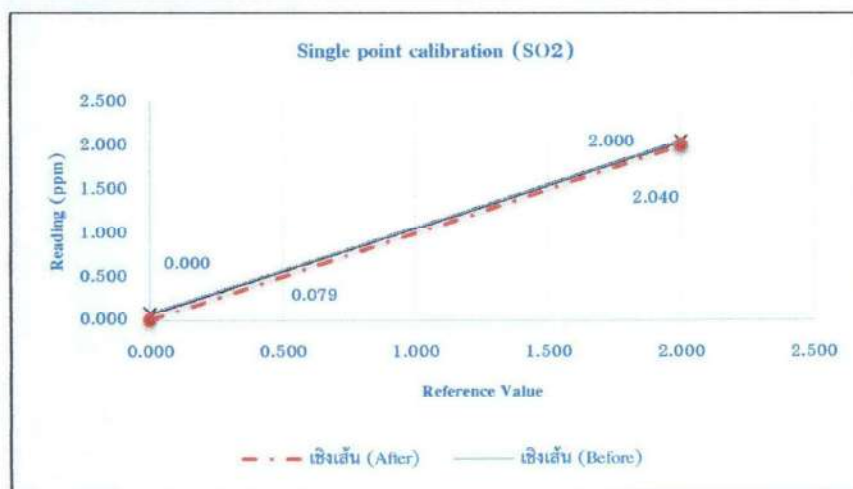
SO2 Conc. : 2 ppm

Expire Date : 21-Nov-23

CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
SO2	0.079	0.000	0.08	2.04	2.000	2.00
After						
SO2	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by :

  
 (Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 26-Aug-23

Certificate No. : 0823-001

Page : 1/1

### Analyzer Instruments

Analyzer Type : NO/NO/NO<sub>x</sub> Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial No. : 66193-351

### Environmental

Temperature : 25.3 °C

Humidity : 40.2 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

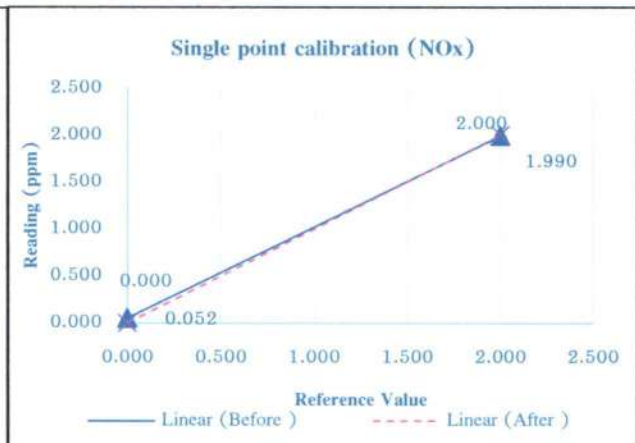
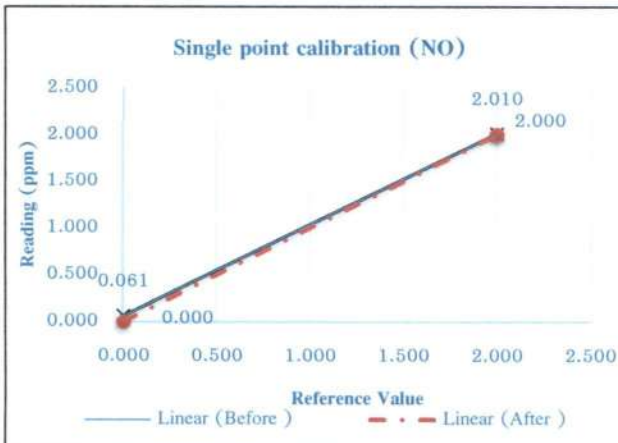
SO<sub>2</sub> : 2 ppm

Expire Date : 21-Nov-23


CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.061	0.000	0.06	2.01	2.00	0.50
NO <sub>x</sub>	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
NO <sub>x</sub>	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by :

  
(Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 11-Mar-23

Certificate No. : 0323-003

Page : 1/1

### Analyzer Instruments

Analyzer Type : NO/NO<sub>2</sub>/NO<sub>x</sub> Analyzer  
Model : 42C

Manufacturer : Thermo Environmental  
Serial No. : 58926-320

### Environmental

Temperature : 24.3 °C  
Humidity : 51.4 %RH

### Calibration System

#### Calibrator Units

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

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

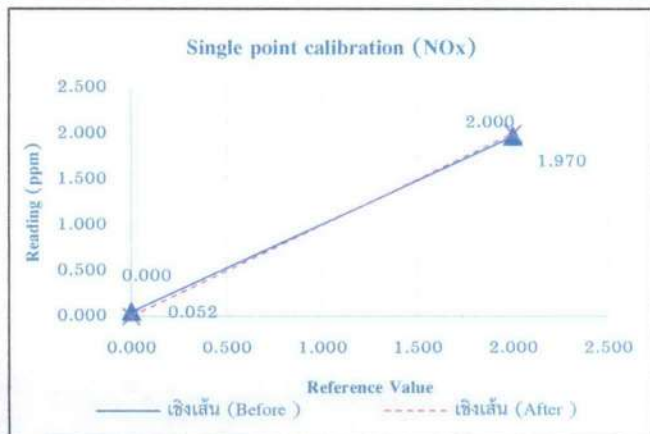
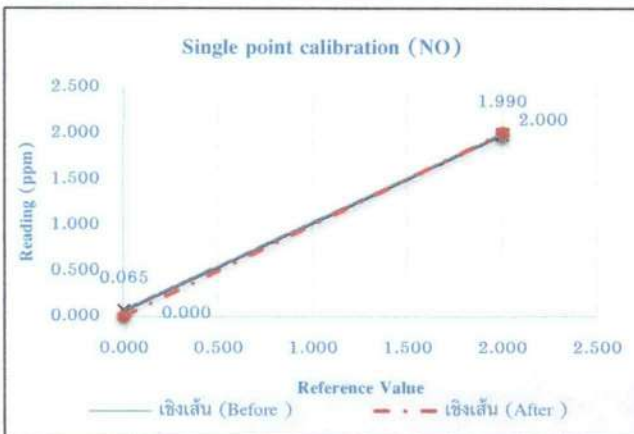
### Standard Gas

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	0.065	0.000	0.07	1.99	2.00	-0.50
NO <sub>x</sub>	0.052	0.000	0.05	1.97	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 Piima*  
(Mr. Tong Piima)



## Certificate of Analyzer Performance Testing

Calibrated Date : 1-Apr-23

Certificate No. : 0423-004

Page : 1/1

### Analyzer Instruments

Analyzer Type : NO/NO/NO<sub>x</sub> Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial No. : 72454-371

### Environmental

Temperature : 25.2 °C

Humidity : 52.3 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

#### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

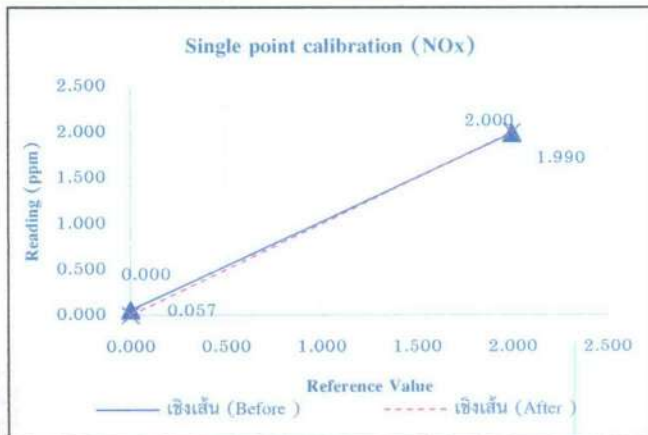
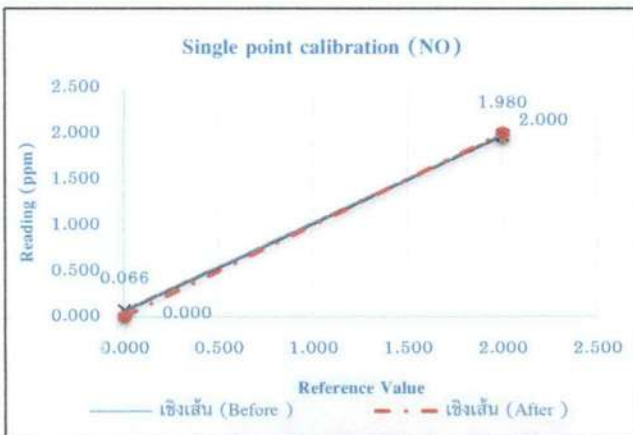
SO<sub>2</sub> : 2 ppm

Expire Date : 21-Nov-23

CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.066	0.000	0.07	1.98	2.00	-1.00
NO <sub>x</sub>	0.057	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 Piima*  
(Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 4-Jul-23

Certificate No. : 0723-001

Page : 1/1

### Analyzer Instruments

Analyzer Type : NO/NO/NO<sub>x</sub> Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial No. : 63470-339

### Environmental

Temperature : 25.1 °C

Humidity : 40.4 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

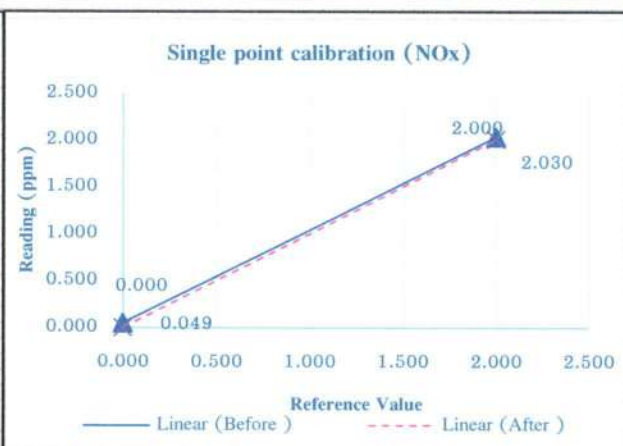
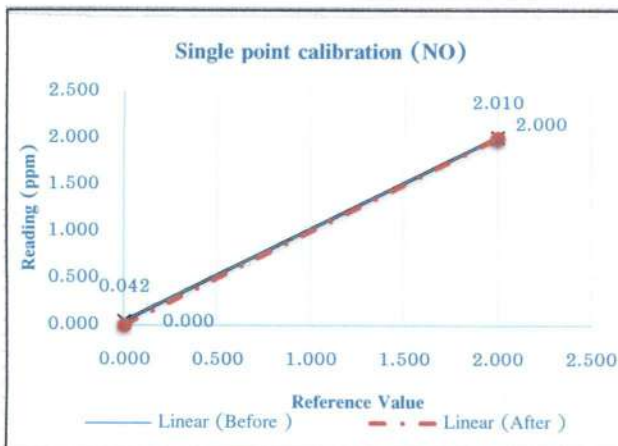
SO<sub>2</sub> : 2 ppm

Expire Date : 21-Nov-23

CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.042	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 Piima*  
(Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 4-Aug-23

Certificate No. : 0823-003

Page : 1/1

### Analyzer Instruments

Analyzer Type : NO/NO<sub>2</sub>/NO<sub>x</sub> Analyzer  
Model : 42C

Manufacturer : Thermo Environmental  
Serial No. : 59406-323

### Environmental

Temperature : 26.3 °C  
Humidity : 42.5 %RH

### Calibration System

#### Calibrator Units

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

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

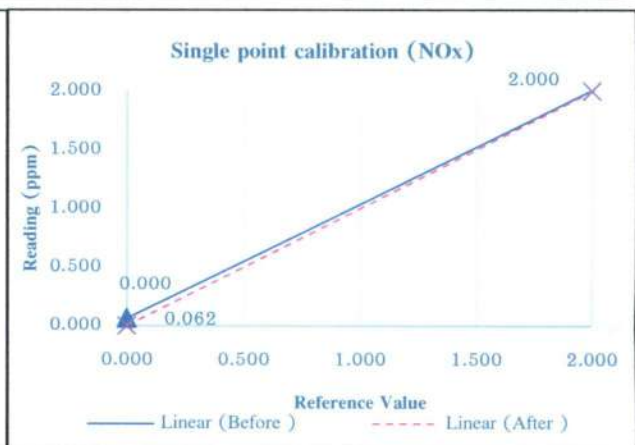
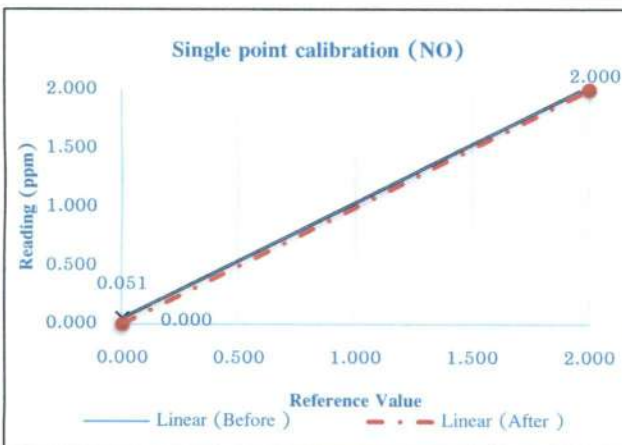
### Standard Gas

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	0.051	0.000	0.05	2.03	2.00	1.50
NO <sub>x</sub>	0.062	0.000	0.06	2.01	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 :

  
(Mr. Tong Piima)



## Certificate of Analyzer Performance Testing

Calibrated Date : 1-Sep-22

Certificate No. : 0922-003

Page : 1/1

### Analyzer Instruments

Analyzer Type : NO/NO/NOx Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial No. : 66193-351

### Environmental

Temperature : 26.7 °C

Humidity : 56.9 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

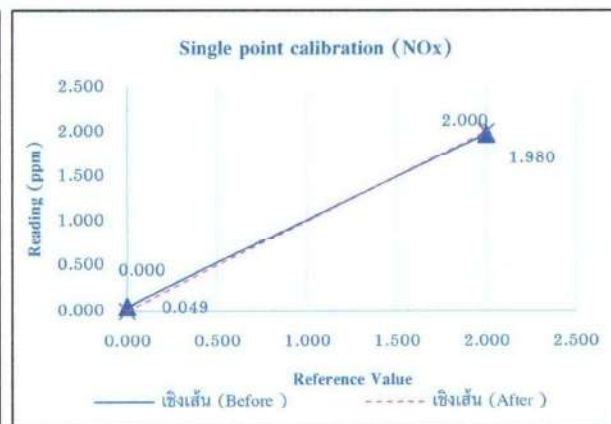
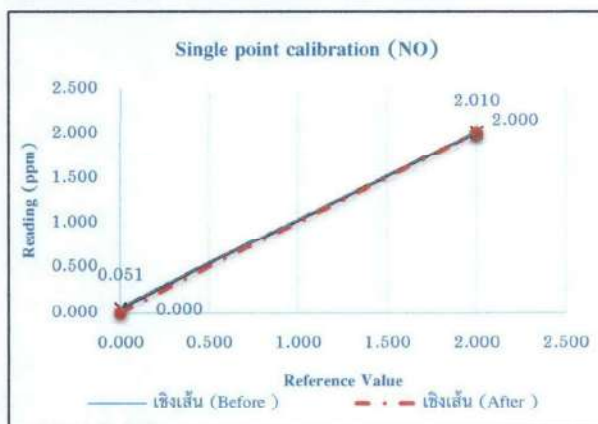
SO2 : 2 ppm

Expire Date : 21-Nov-23

CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.051	0.000	0.05	2.01	2.00	0.50
NOx	0.049	0.000	0.05	1.98	2.00	-1.00
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NOx	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by :

  
 (Mr. Tong Piima)



## Certificate of Analyzer Performance Testing

Calibrated Date : 6-Apr-22

Certificate No. : 0422-055

Page : 1/1

### Analyzer Instruments

Analyzer Type : NO/NO<sub>2</sub>/Nox Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial No. : 72454-371

### Environmental

Temperature : 25.4 °C

Humidity : 52.3 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

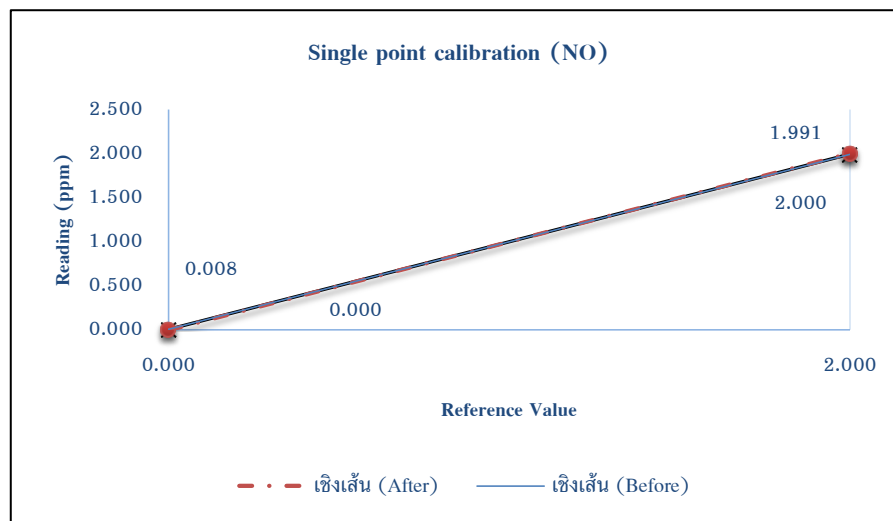
SO<sub>2</sub> Conc. : 2 ppm

Expire Date : 21-Nov-23


CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.008	0.000	0.01	1.991	2.000	-0.45
NO <sub>x</sub>	0.012	0.000	0.01	2.012	2.000	0.60
After						
NO	0.000	0.000	0.00	2.000	2.000	0.00
NO <sub>x</sub>	0.000	0.000	0.00	2.000	2.000	0.00



Calibrated by :

  
 (Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 30-Jan-23

Certificate No. : 0123-001

Page : 1/1

### Analyzer Instruments

Analyzer Type : THC Analyzer

Manufacturer : Thermo Environmental

Model : 51

Serial No. : 51HT-73244-373

### Environmental

Temperature : 24.7 °C

Humidity : 54.4 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

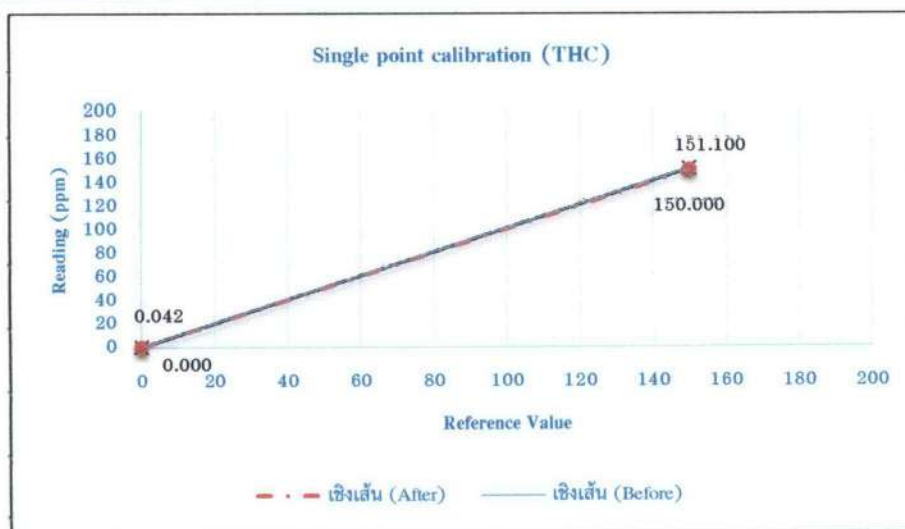
Propane Conc. : 150 ppm

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	0.042	0.000	0.042	151	150	0.733
After						
THC	0.000	0.000	0.000	150	150	0.000



Calibrated by :

*Tong Piima*

(Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 30-Jan-23

Certificate No. : 0123-002

Page : 1/1

### Analyzer Instruments

Analyzer Type : THC Analyzer

Manufacturer : Baseline

Model : Series 8800

Serial No. : 584

### Environmental

Temperature : 24.5 °C

Humidity : 56.3 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

### Standard Gas

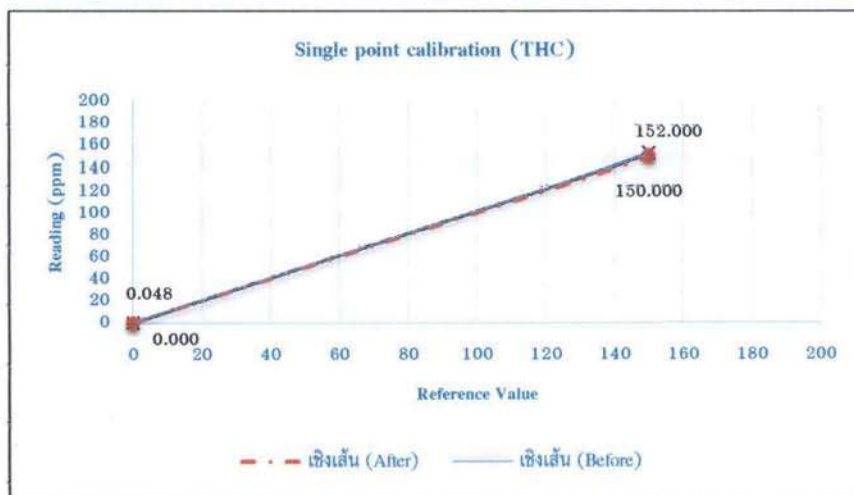
Propane Conc. : 150 ppm

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	0.048	0.000	0.048	152	150	1.333
After						
THC	0.000	0.000	0.000	150	150	0.000



Calibrated by :

  
(Mr. Tong Piima)

เอกสารการสอบเทียบเครื่องมือตรวจวัดความชื้นสะท้อน



# Calibration Certificate

Part Number: 721A2601

Description: Micromate with DIN Geophone

Serial Number: UM20453

Calibration Date: April 21, 2023

Calibration Reference Equipment: SRV-AFR 714J7401

\*Calibrated with Geo UM6231

*Instantel certifies that the above product was calibrated in accordance with the applicable Instantel procedures. These procedures are part of a quality system that is designed to assure that the product listed above meets or exceeds Instantel specifications.*

*Instantel further certifies that the measurement instruments used during the calibration of this product are traceable to the National Institute of Standards and Technology; or National Research Council of Canada. Evidence of traceability is on file at Instantel and is available upon request.*

*The environment in which this product was calibrated is maintained within the operating specifications of the instrument.*

*Please note that the sensor check function is intended to check that the sensors are connected to the unit, installed in the proper orientation and sufficiently level to operate properly. This function should not be confused with a formal calibration, which requires the sensors be checked against a reference that is traceable to a known standard.*

*Instantel recommends that products be returned to Instantel or an authorized service and calibration facility for annual calibration.*

Calibrated By: \_\_\_\_\_

Yaksh Patel

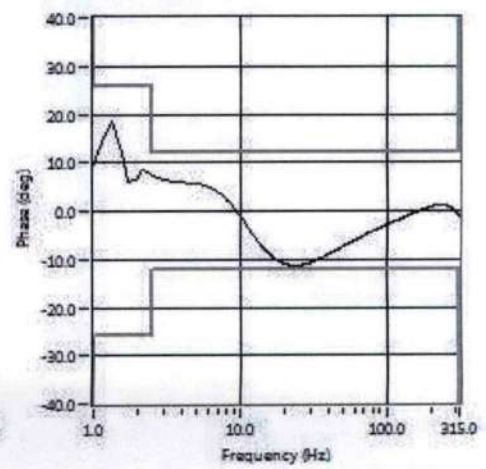
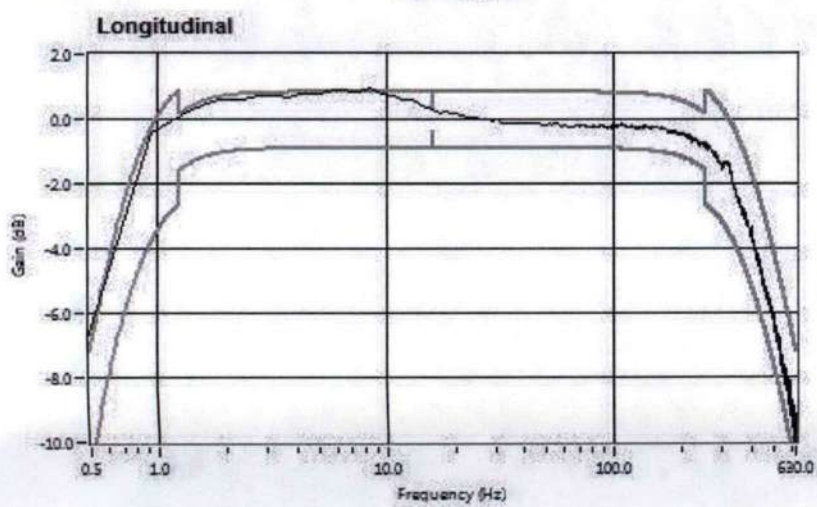
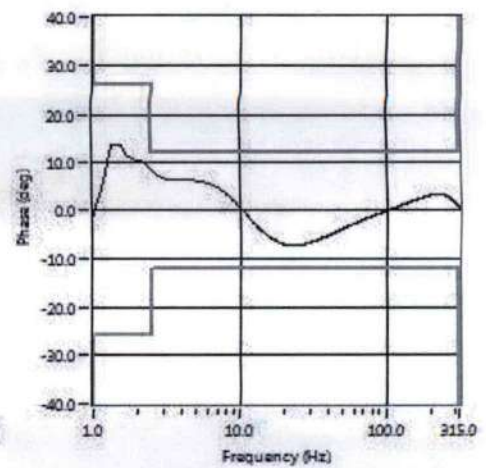
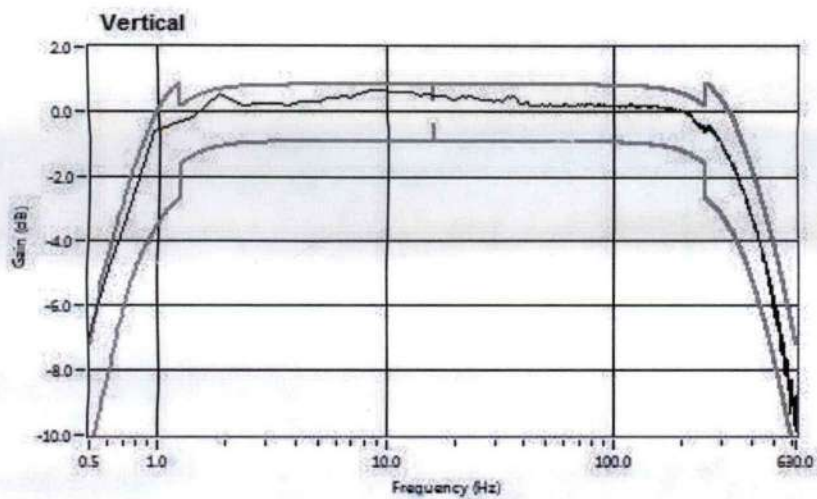
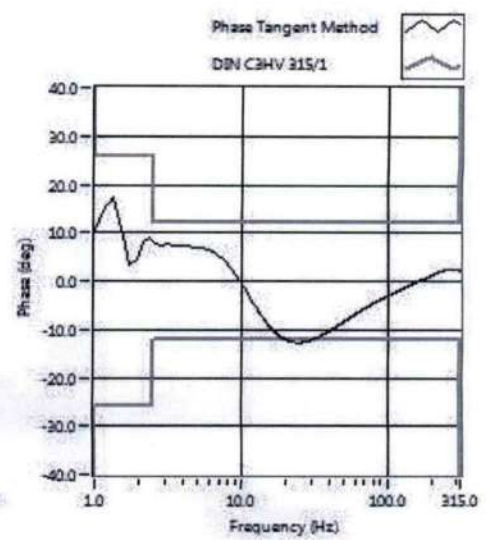
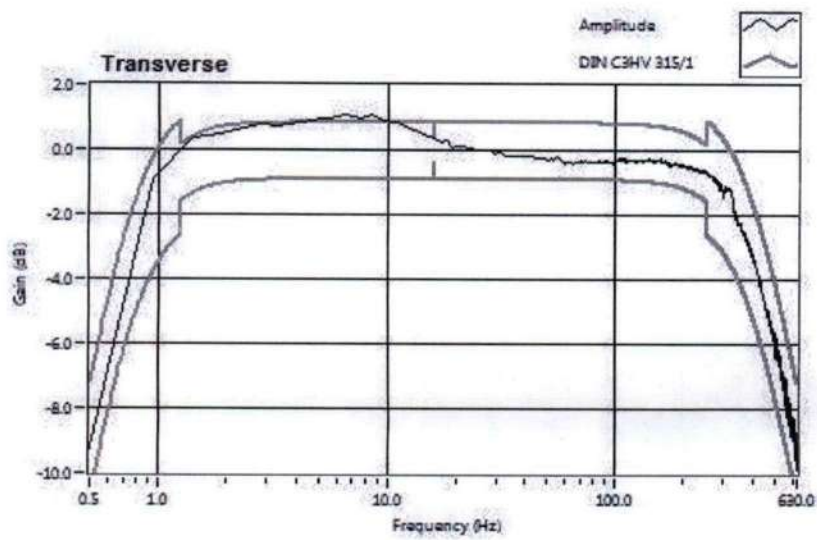


**Instantel®**

309 Legget Drive, Ottawa, Ontario, K2K 3A3, (613) 592-4642



# Frequency Response of UM20453 (As Found)





# Calibration Certificate

Part Number: 721A2601

Description: Micromate with DIN Geophone

Serial Number: UM21467

Calibration Date: MAY 29 2023

Calibration Reference Equipment: 714J7403

*Instantel certifies that the above product was calibrated in accordance with the applicable Instantel procedures. These procedures are part of a quality system that is designed to assure that the product listed above meets or exceeds Instantel specifications.*

*Instantel further certifies that the measurement instruments used during the calibration of this product are traceable to the National Institute of Standards and Technology; or National Research Council of Canada. Evidence of traceability is on file at Instantel and is available upon request.*

*The environment in which this product was calibrated is maintained within the operating specifications of the instrument.*

*Please note that the sensor check function is intended to check that the sensors are connected to the unit, installed in the proper orientation and sufficiently level to operate properly. This function should not be confused with a formal calibration, which requires the sensors be checked against a reference that is traceable to a known standard. Instantel recommends that products be returned to Instantel or an authorized service and calibration facility for annual calibration.*

Calibrated By: \_\_\_\_\_

Xiaoming Yang



309 Legget Drive, Ottawa, Ontario, K2K 3A3, (613) 592-4642





**Merci d'avoir choisi Instantel!**

Votre engagement avec  
**« les moniteurs les plus fiables au monde »**  
vous servira pour les années à venir.

Grâce à votre achat, vous êtes à la pointe de la technologie en matière de moniteurs. Au nom de tous les collaborateurs d'Instantel, nous vous remercions d'avoir fait choisir nos produits pour la réalisation de vos projets. Les produits Instantel incluent les éléments les plus aboutis du domaine tels que:

- 1) Plus de 30 années au service des secteurs du bâtiment, d'activités minières et de géotechnologie
- 2) Des conceptions durables et résistantes
- 3) Des produits faciles à utiliser grâce à une interface intuitive
- 4) Des options étendues de conformité réglementaire
- 5) Un programme d'assistance, un service technique et une aide en ligne complets
- 6) Logiciel THOR® disponible en téléchargement gratuit sur le site Web d'Instantel: [www.instantel.com](http://www.instantel.com)
- 7) Garantie d'un an sur les pièces; si un moniteur ou un capteur est ramené à l'usine pour étalonnage jusqu'à un an après la date d'achat, la garantie sera automatiquement prolongée d'un an supplémentaire

Instantel est **RESPECTUEUX DE L'ENVIRONNEMENT!** Instantel n'envoie plus de manuels en version papier. Les manuels de l'opérateur pour chaque produit et pour THOR sont disponibles en téléchargement sur le site Web d'Instantel à l'adresse [www.instantel.com/resources](http://www.instantel.com/resources).

Nous nous engageons pour que votre satisfaction en tant que client soit la meilleure possible. En cas de questions ou de commentaires, n'hésitez pas à nous contacter. Veuillez appeler notre numéro gratuit **+1 800 267 9111** ou nous envoyer un e-mail à [service@instantel.com](mailto:service@instantel.com) ou [sales@instantel.com](mailto:sales@instantel.com).

Nous vous remercions de nouveau et avons hâte de collaborer avec vous!



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.

Certificate No.: CP20230379EA

### Calibration Report

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

**Method of Calibration :-**

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

**Condition of this result of calibration**

1. Reference standards instrument :-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
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

### 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	

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	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 - -



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

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

Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

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

Certificate No.: CP20220309EA

Operation No.: CP2022090011

## 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: 15 September 2022

Calibrated Date: 4 - 6 October 2022

Issued Date: 12 October 2022

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: \_\_\_\_\_

( Mr. Sittichai Swaksuriyawong )

Group Manager

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

Certificate No.: CP20220309EA

### Calibration Report

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

**Method of Calibration :-**

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

**Condition of this result of calibration**

1. Reference standards instrument :-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Standard Accelerometer	8305	2708237	AV-0010-21	30-Nov-2022
2) Measuring Amplifier	2525	3016651	AV-0007-22	9-Jun-2023
3) PULSE Multi-analyzer system	3050-A-060	2705645	CQ20210015EA	1-Dec-2022
4) Pressure humidity and Temperature Transmitter	HMT331	K3810009	CD20220120EA	22-Apr-2023

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.: CP20220309EA

### 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	9.993	9.553	-0.440	1.5	Longitudinal (L)
5.0	10	9.994	9.742	-0.252	1.5	
6.3	10	10.013	10.049	0.036	1.5	
8.0	10	10.007	9.915	-0.092	1.5	
10.0	10	9.996	9.931	-0.065	1.5	
12.5	10	9.998	9.892	-0.106	1.5	
16.0	10	10.011	9.947	-0.064	1.5	
	20	19.983	19.917	-0.066	1.5	
	30	29.995	29.904	-0.091	1.5	
	50	50.021	49.955	-0.066	1.5	
20.0	10	10.001	9.939	-0.062	1.5	
25.0	10	9.997	9.947	-0.050	1.5	
31.5	10	9.997	9.907	-0.090	1.5	
40.0	10	10.010	9.876	-0.134	1.5	
50.0	10	10.015	9.837	-0.178	1.5	
52.0	10	10.008	9.789	-0.219	1.5	
63.0	10	10.013	9.781	-0.232	1.5	
80.0	10	10.001	9.710	-0.291	1.5	



Certificate No.: CP20220309EA

### 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	9.984	9.671	-0.313	1.5	Transverse (T)
5.0	10	10.024	9.876	-0.148	1.5	
6.3	10	9.989	10.223	0.234	1.5	
8.0	10	9.996	10.049	0.053	1.5	
10.0	10	10.010	10.112	0.102	1.5	
12.5	10	10.003	10.057	0.054	1.5	
16.0	10	10.008	10.018	0.010	1.5	
	20	19.997	20.107	0.110	1.5	
	30	29.995	30.116	0.121	1.5	
	50	49.978	50.239	0.261	1.5	
20.0	10	9.997	9.978	-0.019	1.5	
25.0	10	9.994	9.963	-0.031	1.5	
31.5	10	9.996	9.900	-0.096	1.5	
40.0	10	10.008	9.829	-0.179	1.5	
50.0	10	10.013	9.750	-0.263	1.5	
52.0	10	10.001	9.758	-0.243	1.5	
63.0	10	9.997	9.734	-0.263	1.5	
80.0	10	9.990	9.742	-0.248	1.5	

Certificate No.: CP20220309EA

### 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	10.004	9.797	-0.207	1.5	Vertical (V)
5.0	10	9.998	10.010	0.012	1.5	
6.3	10	10.003	10.428	0.425	1.5	
8.0	10	10.007	10.357	0.350	1.5	
10.0	10	10.004	10.388	0.384	1.5	
12.5	10	10.004	10.357	0.353	1.5	
16.0	10	10.004	10.333	0.329	1.5	
	20	19.997	20.832	0.835	1.5	
	30	30.010	31.173	1.163	1.5	
	50	49.964	51.957	1.993	1.5	
20.0	10	10.000	10.317	0.317	1.5	
25.0	10	10.001	9.931	-0.070	1.5	
31.5	10	10.001	10.215	0.214	1.5	
40.0	10	10.006	10.278	0.272	1.5	
50.0	10	10.003	10.357	0.354	1.5	
52.0	10	9.983	10.396	0.413	1.5	
63.0	10	9.977	10.483	0.506	1.5	
80.0	10	10.020	11.775	1.755	1.5	

Remark

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

-- End of Report --

Certificate No.: CP20230080EA

Operation No.: CP2022100031

## Certificate of Calibration

Equipment: Vibration Meter

Manufacturer: Instantel

Model/Type: Micromate

Serial No.: UM15904

ID No.: VB-01-002

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

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

Received Date: 26 October 2022

Calibrated Date: 7 - 9 February 2023

Issued Date: 15 February 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.

Certificate No.: CP20230080EA

## Calibration Report

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

Method of Calibration :-

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

### Condition of this result of calibration

1. Reference standards instrument :-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Standard Accelerometer	8305-001	30120	AV-0013-21	30-May-2023
2) Measuring Amplifier	2525	3016651	AV-0007-22	9-Jun-2023
3) PULSE Multi-analyzer system	3560-C	2705645	CQ20230003EA	25-Dec-2023
4) Humidity and Temperature Transmitter	HMT331	K3810009	CD20220120EA	22-Apr-2023

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.: CP20230080EA

### 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	9.997	10.514	0.517	1.50	Longitudinal (L)
5.0	10.000	10.027	10.908	0.881	1.50	
6.3	10.000	10.015	10.813	0.798	1.50	
8.0	10.000	10.027	10.489	0.462	1.50	
10.0	10.000	9.986	10.483	0.497	1.50	
12.5	10.000	10.003	10.341	0.338	1.50	
16.0	10.000	9.984	10.215	0.231	1.50	
	20.000	20.025	20.248	0.223	1.50	
	30.000	29.981	30.298	0.317	1.50	
	50.000	49.922	50.507	0.585	1.50	
20.0	10.000	9.996	10.199	0.203	1.50	
25.0	10.000	9.980	10.191	0.211	1.50	
31.5	10.000	9.974	10.183	0.209	1.50	
40.0	10.000	10.006	10.270	0.264	1.50	
50.0	10.000	10.000	10.199	0.199	1.50	
52.0	10.000	10.013	10.286	0.273	1.50	
63.0	10.000	9.976	10.325	0.349	1.50	
80.0	10.000	9.976	10.317	0.341	1.50	

Certificate No.: CP20230080EA

### Calibration Report

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

Frequency	Nominal	Standard	UUC	Deviation	Uncertainty	Direction
(Hz)	(mm/s)	(mm/s)	(mm/s)	(mm/s)	± (%)	
4.0	10.000	10.055	10.656	0.601	1.50	Transverse (T)
5.0	10.000	10.015	10.593	0.578	1.50	
6.3	10.000	9.979	10.743	0.764	1.50	
8.0	10.000	10.034	10.412	0.378	1.50	
10.0	10.000	9.969	10.341	0.372	1.50	
12.5	10.000	9.990	10.254	0.264	1.50	
16.0	10.000	9.998	10.238	0.240	1.50	
	20.000	19.983	20.304	0.321	1.50	
	30.000	29.995	30.455	0.460	1.50	
	50.000	50.007	50.633	0.626	1.50	
20.0	10.000	10.027	10.238	0.211	1.50	
25.0	10.000	9.984	10.183	0.199	1.50	
31.5	10.000	9.986	10.199	0.213	1.50	
40.0	10.000	9.994	10.215	0.221	1.50	
50.0	10.000	9.976	10.231	0.255	1.50	
52.0	10.000	9.980	10.286	0.306	1.50	
63.0	10.000	9.970	10.380	0.410	1.50	
80.0	10.000	9.994	10.467	0.473	1.50	

Certificate No.: CP20230080EA

### Calibration Report

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

Frequency	Nominal	Standard	UUC	Deviation	Uncertainty	Direction
(Hz)	(mm/s)	(mm/s)	(mm/s)	(mm/s)	± (%)	
4.0	10.000	9.966	9.718	-0.248	1.50	Vertical (V)
5.0	10.000	10.028	10.223	0.195	1.50	
6.3	10.000	9.969	10.388	0.419	1.50	
8.0	10.000	10.006	10.041	0.035	1.50	
10.0	10.000	9.993	9.971	-0.022	1.50	
12.5	10.000	9.979	9.947	-0.032	1.50	
16.0	10.000	10.004	10.049	0.045	1.50	
	20.000	19.969	20.012	0.043	1.50	
	30.000	29.981	29.888	-0.093	1.50	
	50.000	49.978	49.868	-0.110	1.50	
20.0	10.000	10.015	10.152	0.137	1.50	
25.0	10.000	9.977	9.655	-0.322	1.50	
31.5	10.000	10.014	10.081	0.067	1.50	
40.0	10.000	10.020	10.238	0.218	1.50	
50.0	10.000	10.031	10.380	0.349	1.50	
52.0	10.000	9.982	10.294	0.312	1.50	
63.0	10.000	9.987	10.428	0.441	1.50	
80.0	10.000	9.994	10.751	0.757	1.50	

**Remark**

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

-- End of Report --

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพน้ำ





# CERTIFICATE OF CONFORMITY

## Aquion System

This certificate is to verify that the instrument referenced below by serial number meets or exceeds all Thermo Scientific functional specification and release requirements.

Instrument Serial Number: 221280114

Firmware Version: 3.1.0

Instrument Module Type: 22176-60018

### Aquion Final Test

- ☒ Pump Calibration, Ripple and Accuracy
- ☒ Suppressor Current: Cal and Accuracy
- ☒ Column Heater: Cal and Check
- ☒ Detector Heater: Cal and Accuracy
- ☒ Conductivity Detector Cal, Noise and Linearity
- ☒ Degas Calibration

- ☒ Injection Valve Precision
- ☒ Relay and TTL I/O Test
- ☒ Injection Valve Functionality
- ☒ Leak Sensors
- ☒ Hi-Pot Test
- ☒ Eluent Generator Calibration

Tester's Signature: Angel Ruiz

Date: 22 Dec 2022

60-069566 Rev B



# Aquion Pump Summary Test Report

Instrument Name	Model	Serial Number	Moduleware	
Module	Aquion	221280114	3. 1. 0	
Pump				
Detector		221260053		

Sequence Name: 1\_Aquion\_Pump\_FOQ  
 Sequence Run Date: 22 Dec 2022  
 Sequence Comment: Aquion Pump Test Final

Flow Accuracy Test				
	Pressure	Flow Rate		
Test Run	Measured	Measured	Accuracy	<= 0.80%
Flow Accuracy: 1mL/min	2132	0.9988	0.115%	Pass
Flow Accuracy: 2mL/min	2467	1.9980	0.099%	Pass

Pressure Ripple Test			
	Pressure	Pressure Ripple	
Test Run	Measured	Measured	<= 0.30%
Flow Accuracy: 1mL/min	2132	0.080%	Pass
Flow Accuracy: 2mL/min	2467	0.121%	Pass

Angel Ruiz  
 Test Technician

22 Dec 2022  
 Date



# Aquion Detector Summary Test Report

Instrument Name	Model	Serial Number	Moduleware
Module	Aquion	221280114	3. 1. 0
Pump			
Detector		221260053	

Sequence Name: 2\_Aquion\_Detector\_FOQ  
 Sequence Run Date: 22 Dec 2022  
 Sequence Comment: AQUION Final Test Detector

Dummy Load				
	Cell Heater		Background Signal	
Test Run	Measured	34.8 - 35.2	Measured	18.9 - 23.1
Cell Dummy Load and Warm up	35.016	Pass	20.211	Pass

Detector Noise & Drift Test					
	Background Signal		Drift		Noise
Test Run	Measured	0.05 - 0.50 $\mu$ S	Measured	$\leq 10.0$ nS/hour	Measured $\leq 0.2$ nS
Cell DI Water Noise and Drift	0.090 $\mu$ S	Pass	-4.715 nS/hour	Pass	0.139 nS Pass

Detector Linearity Test					
	Correlation Coefficient		%RSD		Calibration Curve
Test Run	Measured	$\geq 0.999$	Measured	$\leq 5.0$ %	Offset Slope
Cell Linearity Test 5 ppm	0.99998	Pass	4.30	Pass	0.000 0.553

Injector Precision Test						
	Area			Retention Time		
Test Run	Average	%RSD	$\leq 1\%$	Average	Max-Min	1.000 min
Injector Precision: 50 ppm	2.576 $\mu$ S*min	0.106%	Pass	0.373 min	0.0100 min	FAIL

Angel Ruiz  
 Test Technician

22 Dec 2022

Date



# Thermo Scientific Aquion System Calibration Summary

Instrument Name	Model	Serial Number	Moduleware	Calibration	Value
Module	Aquion	221280114	3.1.0	Column Calibration	12/22/2022

<b>Column Heater</b>	Column Calibration	
	Electrical Offset	0.000
	Heater Offset	1.95
	Heater Slope	1.02

<b>Pump</b>	Pressure Calibration	12/22/2022	Flow Rate Calibration	12/22/2022
	Pressure Transducer Offset	1576.00	Flow Rate Parameter	5.4
	Pressure Transducer Slope	0.363	Flow Rate Nominal Speed	3845
			Flow Rate Slope	0.93

<b>Detector</b>	Detector Calibration	12/22/2022	Cell Heater Calibration	12/22/2022
	Fine Offset	251260.77	Electrical Offset	0.000
	Fine Slope	0.000000025	Calibration Temperature	35.00
	Mid-Range Offset	28004.72	Cell Serial Number	221260053
	Mid-Range Slope	0.000000409		
	Coarse Offset	17014.44		
	Coarse Slope	0.000002016		
	Cell Constant	153.13		

## China RoHS

### Electrical and Electronic Products Restriction of Hazardous Substances Management Measures

For applicable products, the Hazardous Substance Information Table is located at:  
<http://www.thermofisher.com/us/en/home/technical-resources/rohs-certificates.html>



CERT.No.: HS-T059I

Certificate of Calibration

Calibration Date : 1 Sep 22

Model : YSI 5000

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

S/N : 18L109487

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

Probe : YSI 5010

Samutsakorn 74130

S/N : 22G100123

ID NO. :

Avg Room Temp : 20 °C

Air Temp ref : S/N. E00522

Avg Water Temp : 20 °C

Barometric ref : S/N. E00522

Air Pressure : 760.00 mmHg

Water Temp ref : S/N. 11431

Salinity : 0 ppt

Technician : Kittipong M.

**Calibration Details**

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

Mean Measurement	9.09	mg/l	-	-
Inaccuracy	0.00	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



Laboratory Manager



# CERTIFICATE OF System Validation

*This certificate was provided by Amani Corporation limited. To certifies that the instruments referenced below have passed system Validation tests and complies with the requirements of the specified set of test*

*Validation Package Number : TR2022001*

*Instruments : GC*

*Model : KONIK GC 4000B*

*Serial No : 4B1774*

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



**Amani Corporation Limited**

*Service Engineer :* \_\_\_\_\_

*(Teerapon Tawonwong)*



**December 21, 2022**





## Calibration Result

Instruments Information			
Calibration Package Number		TR2022001	
Instruments Type		Gas Chromatograph	
Serial Number	4B1774	Model	KONIK GC 4000B
Installation Date		End of Warranty	
S.O. Number		P.O. Number	
Firmware Version		DPFC Rom Ver.	
Left Injection	-	Right Injector	S/SL
Left DPFC	-	Right DPFC	-
Left Detector	-	Right Detector	FID
Left DGFC	-	Right DGFC	-
Auxiliary Detector	-	Valve/Valve Oven	-
Last Validation	December 21,2022	Next Validation	December 21,2023
Last Preventive Maintenance	December 21,2022	Next Preventive Maintenance	December 21,2023
Data System Type	N2000	Data System Version	3.1.1

Gases Information			
Injector			
Left Carrier	-	Right Carrier	Helium,3.0mL/min
Detector			
Left Detector	-	Right Detector	FID
Gas 1	-	Gas 1(Hydrogen)	Hydrogen,40mL/min
Gas 2	-	Gas 2 (Make-up)	Nitrogen,30mL/min
Gas 3	-	Gas 3 (Air)	Air Zero, 350mL/min

Service Engineer Signature:

(Teerapon Tawonwong)

Date:

21.12.2022





## Gases Flow Rate Validation Result

### Carrier Gases

Set point (mL/min)	Measured (mL/min)	Criteria (mL/min)	Status
25	25.0	24.0-26.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail

### Detector Gases

#### Reference Gas

Set point (mL/min)	Measured (mL/min)	Criteria (mL/min)	Status
Low 9	9.3	8.0-12.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail
High 50	46.7	45.0-55.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail

#### Make-up Gas

Set point (mL/min)	Measured (mL/min)	Criteria (mL/min)	Status
Low 9	9.7	8.0-12.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail
High 30	31.3	28.0-32.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail

Service Engineer Signature:

(Teerapon Tawonwong)

Date:

21.12.2022



## Temperature Validation Result

### Injector Temperature

Set point ( ° C)	Measured ( ° C)	Status	Note
60 +/- 1.0	60.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail	

### Detector Temperature

Block Temp			
Set point ( ° C)	Measured ( ° C)	Status	Note
60 +/- 1.0	60.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail	
Transfer Temp			
Set point ( ° C)	Measured ( ° C)	Status	Note
60 +/- 1.0	60.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail	

### Column Oven

Set point ( ° C)	Measured ( ° C)	Status	Note
40 +/- 1	40.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail	RTD OFFSET = 6.2
120 +/- 1	120.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail	

Service Engineer Signature:

*Teerapon Tawonwong*

(Teerapon Tawonwong)



Date:

21.12.2022

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Amani Corporation Limited

## Parts Referenced

Part	Description	Note
Analytical Column	Capillary Column RTX-5 Film : 0.25 um Length : 7 Meter Diameter : 0.32 mmID	Reference With : Restek
Standard Sample	FID Performance Evaluation Sample Kit	Manufactured By Agilent Technologies. 5080-8842 Lot: 0006604151
Sample Injection	Syringe 10 ul	Manufactured By SGE




Service Engineer Signature:

(Teerapon Tawonwong)

Date:

21.12.2022

  
 บริษัท อามานี คอร์ปอเรชั่น จำกัด  
 Amani Corporation Limited



## Operating Condition

Parameter	Condition
<b>Environmental</b>	Temperature 25.0 °C Relative Humidity 45.7 °C
<b>Instrument Condition</b>	<b>Gases</b> <ul style="list-style-type: none"><li>- Carrier Gas : Helium = 1ml/min</li><li>- Hydrogen = 35 ml/min</li><li>- Air = 350 ml/min</li><li>- Make-up Gas: Nitrogen = 30ml/min</li></ul> <b>Oven</b> <ul style="list-style-type: none"><li>- Initial Temperature = 50°C</li><li>- Initial Time = 1 minute</li><li>- Ramp 1 = 20 °C/minute</li><li>- Final Temperature = 200°C</li><li>- Final Time = 1 minute</li></ul> <b>Injector</b> <ul style="list-style-type: none"><li>- Operating Mode = Spilt</li><li>- Temperature = 230 °C</li><li>- Split Flow 40 ml/min</li><li>- Purge Flow rate = 5 ml/min</li></ul> <b>Detector</b> <ul style="list-style-type: none"><li>- Base Temperature = 250 °C</li><li>- Detector Signal Range = 10°</li></ul> <b>Injected Volume</b> <ul style="list-style-type: none"><li>- 1 µl + needle of Test Mixture</li></ul>

Service Engineer Signature:



(Teerapon Tawonwong)



Date:

21.12.2022

บริษัท อามานี จำกัด  
Amani Corporation Limited



## Certificate of Calibration

<b>Equipment:</b>	Cooled Incubator	<b>Certificate No.:</b>	C31230380
<b>Model:</b>	KB 240	<b>Issued Date:</b>	21 February 2023
<b>Serial No.(or ID):</b>	20180000012164 ( WW-16-001 )	<b>Job No.:</b>	KSPR2302594
<b>Manufacturer:</b>	Binder	<b>Page:</b>	1 of 3
<b>Condition:</b>	In Condition	<b>Ventilation Valve:</b>	None
<b>Shelves(pc.):</b>	3		

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

**Environment Condition:**

Temperature:	22 °C	±	1.9 °C
Humidity:	72 %RH	±	6.2 %RH
Voltage:	229 VAC	±	3.1 VAC

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

**Calibration By:** Mr. Suphanimit Khamnonphoem

**Calibration Date:** 15 February 2023

**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 SPC RT Co., Ltd. Certificate No. C10220016



(Mr. Suphanimit Khamnonphoem)

Person in charge



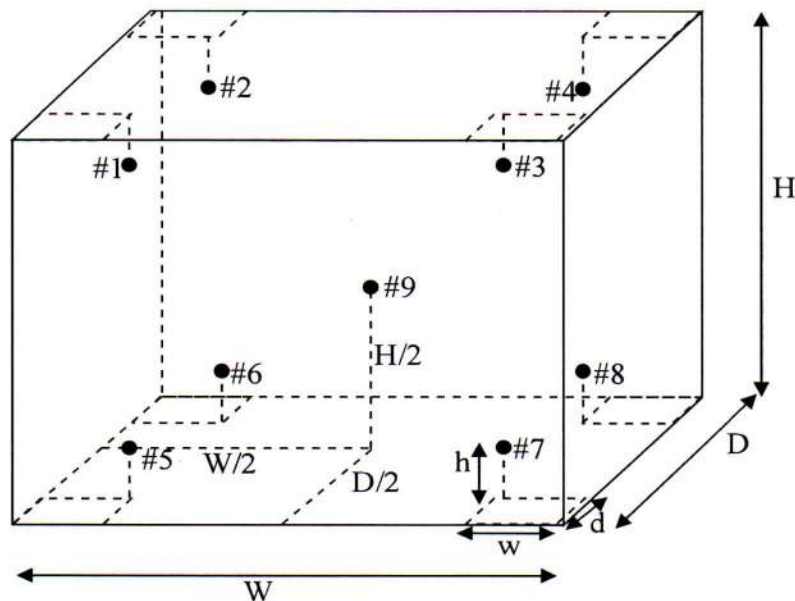
(Mr. Udon Srichana)

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.



### Standard Installation Locations

Volume (Calibration Zone)= 125 (Liters)

Inside chamber:  $W = 65 \text{ (cm)}$   $D = 49 \text{ (cm)}$   $H = 79 \text{ (cm)}$

Standard Locations (#1, #2, #3, #4):  $w = 7 \text{ (cm)}$   $d = 5 \text{ (cm)}$   $h = 8 \text{ (cm)}$

Standard Locations (#5, #6, #7, #8):  $w = 7 \text{ (cm)}$   $d = 5 \text{ (cm)}$   $h = 8 \text{ (cm)}$

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	1	2	3	4	5	6	7	8	9

### 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: 20.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	20.20	0.20	0.34
#2	20.07	0.07	0.37
#3	20.02	0.02	0.36
#4	19.96	-0.04	0.41
#5	20.07	0.07	0.35
#6	20.10	0.10	0.33
#7	19.84	-0.16	0.37
#8	20.08	0.08	0.36
#9	20.09	0.09	0.34

### Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
20.0	20.0	20.0	20.20	20.07	20.02	19.96	20.07	20.10	19.84	20.08	20.09	0.41

### Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
20.0	0.30	0.27	0.80

Note: \* Maximum uncertainty of the each position

**The End of Certificate**

## Statements of conformity:

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

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

### Tolerance and Decision rules:

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

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



(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 of UUC. (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	20.20	0.20	0.34	1.0	Pass
#2	20.07	0.07	0.37	1.0	Pass
#3	20.02	0.02	0.36	1.0	Pass
#4	19.96	-0.04	0.41	1.0	Pass
#5	20.07	0.07	0.35	1.0	Pass
#6	20.10	0.10	0.33	1.0	Pass
#7	19.84	-0.16	0.37	1.0	Pass
#8	20.08	0.08	0.36	1.0	Pass
#9	20.09	0.09	0.34	1.0	Pass

Correction of UUC.\* = Measured Temperature - Desired Temperature

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

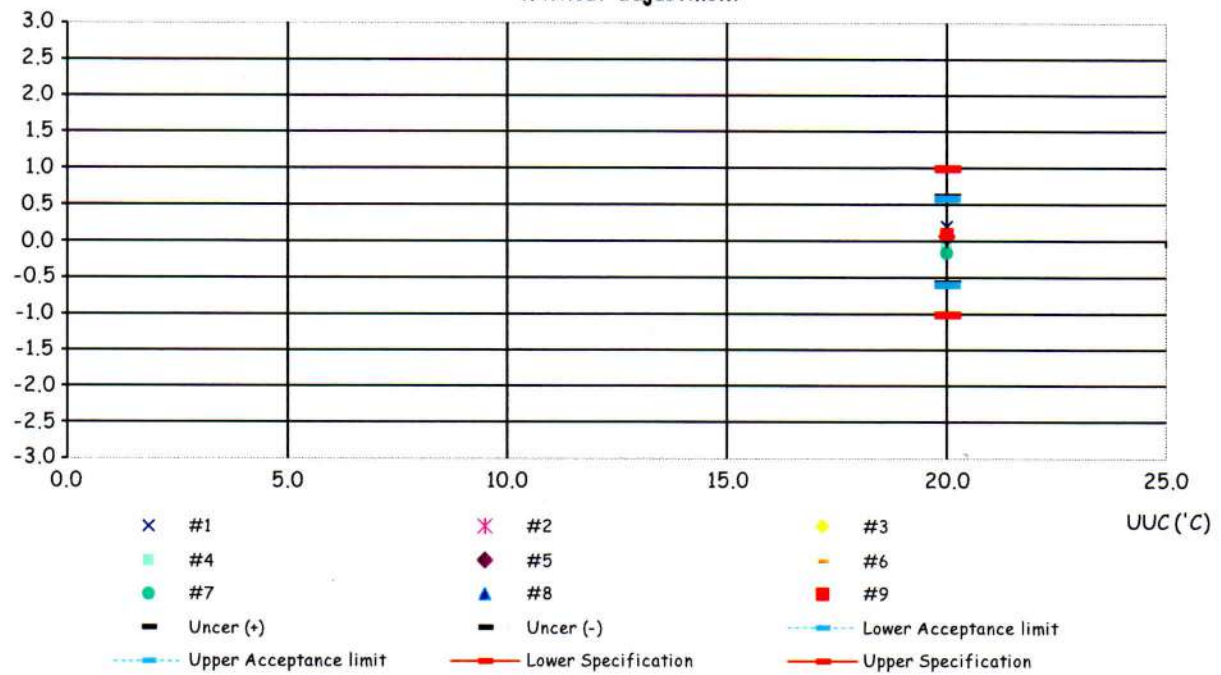
## The End of Statements of Conformity

# Corr\_Distribution & Max\_Measurement Uncertainty

Job\_No. KSPR2302594

Without adjustment

Correction ('C)

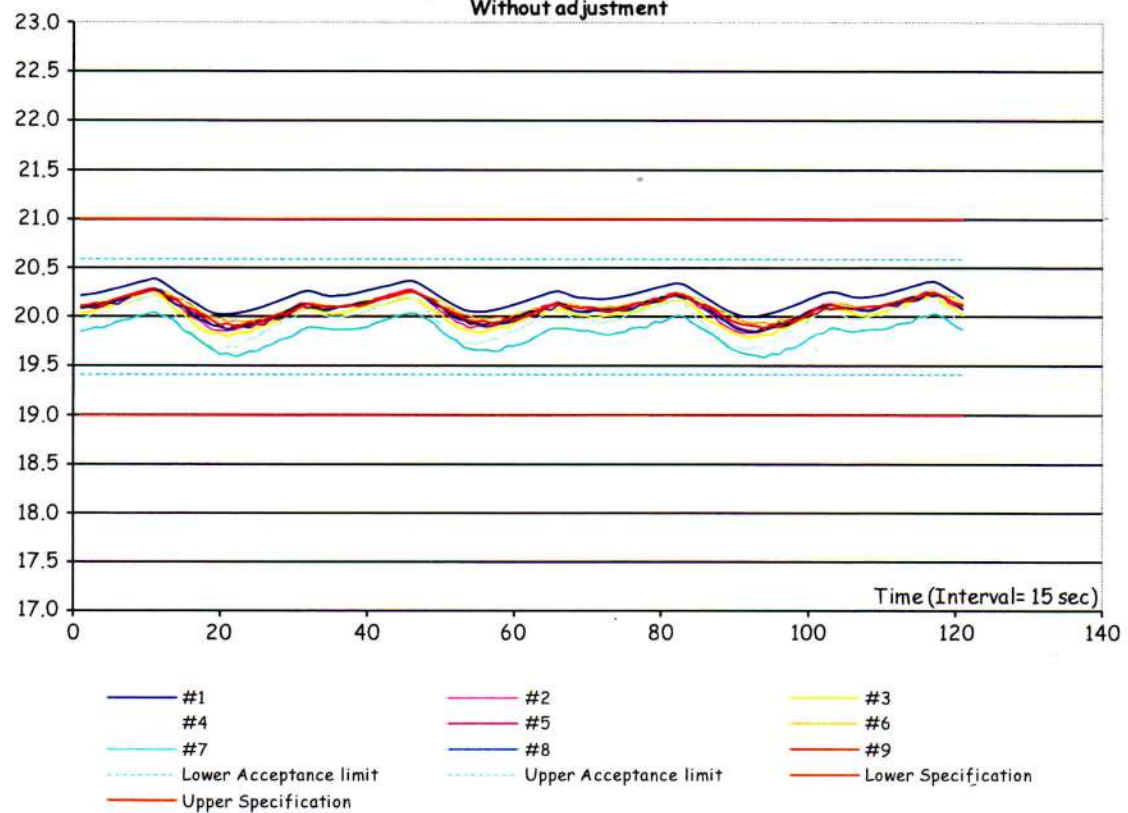


## Temperature Distribution @ 20.0°C

Job\_No. KSPR2302594

Without adjustment

Std('C)





## ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: KSPR2302594

ชนิดเครื่องมือ: Cooled Incubator

รุ่น: KB 240

หมายเลขเครื่อง: 20180000012164 ( WW-16-001 )

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
15 Feb 2023			15 Feb 2023		
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. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ :

Mr. Suphanimit Khamnonphoem

Service Engineer



## Certificate of Calibration

<b>Equipment:</b>	Hot Air Oven	<b>Certificate No.:</b>	C31230315
<b>Model:</b>	UF 55	<b>Issued Date:</b>	16 February 2023
<b>Serial No.(or ID):</b>	B219.0142 ( WW-05-002 )	<b>Job No.:</b>	KSPR2302593
<b>Manufacturer:</b>	Memmert	<b>Page:</b>	1 of 4
<b>Condition:</b>	In Condition	<b>Ventilation Valve:</b>	Closed
<b>Shelves(pc.):</b>	2		

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

**Environment Condition:**

Temperature:	26 °C	±	1.2 °C
Humidity:	55 %RH	±	5.4 %RH
Voltage:	226 VAC	±	2.6 VAC

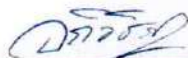
**Calibration Place:** C.E.M Technology (Thailand) Co., Ltd. ( Laboratory Room )  
219/43 Moo 12 Petchkasam Road,  
Omnoi Krathum Baen, Samut Sakhon 74130 Thailand

**Calibration By:** Mr. Apiwit Chaosap

**Calibration Date:** 15 February 2023

**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 SPC RT Co., Ltd. Certificate No. C10220016



(Mr. Apiwit Chaosap)

Person in charge



(Mr. Udon Srichana)

Authorized signatory

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

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

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

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

DKSH Technology Limited

2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260

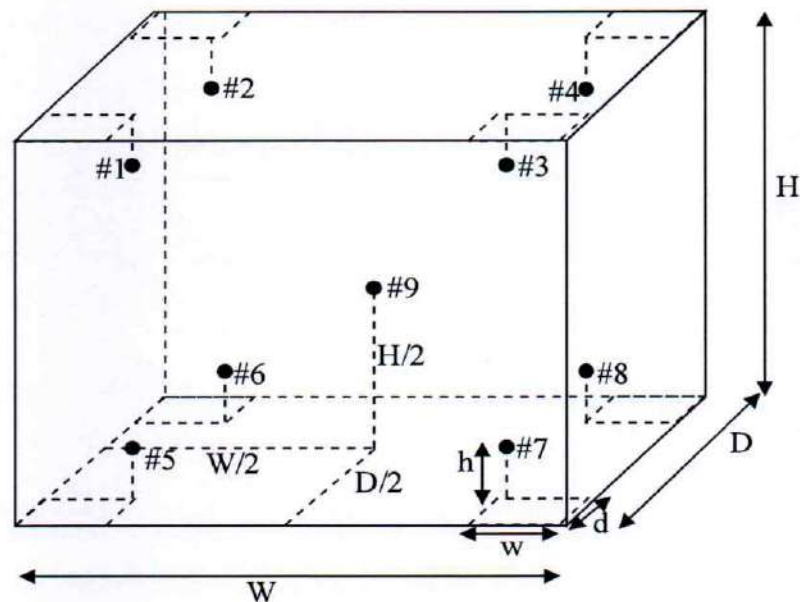
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

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

Delivering Growth - in Asia and Beyond.

CAL-FM-C31-10: 12 Sep 2022





### 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	1	2	3	4	5	6	7	8	9

### 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	104.08	0.08	0.39
#2	103.99	-0.01	0.39
#3	104.30	0.30	0.39
#4	104.24	0.24	0.39
#5	104.33	0.33	0.39
#6	104.22	0.22	0.39
#7	103.71	-0.29	0.39
#8	104.24	0.24	0.39
#9	104.36	0.36	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	104.08	103.99	104.30	104.24	104.33	104.22	103.71	104.24	104.36	0.39

### Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	0.70	0.07	0.76

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	179.63	-0.37	0.46
#2	179.69	-0.31	0.45
#3	180.34	0.34	0.45
#4	180.23	0.23	0.45
#5	180.59	0.59	0.45
#6	180.23	0.23	0.45
#7	179.42	-0.58	0.48
#8	180.28	0.28	0.45
#9	180.67	0.67	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	
180.0	180.0	180.0	179.63	179.69	180.34	180.23	180.59	180.23	179.42	180.28	180.67	0.48

**Chamber Characterization**

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180.0	1.41	0.15	1.54

Note: \* Maximum uncertainty of the each position

**The End of Certificate**



## Statements of conformity:

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

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

### Tolerance and Decision rules:

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

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



(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 of UUC. (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	104.08	0.08	0.39	1.0	Pass
#2	103.99	-0.01	0.39	1.0	Pass
#3	104.30	0.30	0.39	1.0	Pass
#4	104.24	0.24	0.39	1.0	Pass
#5	104.33	0.33	0.39	1.0	Pass
#6	104.22	0.22	0.39	1.0	Pass
#7	103.71	-0.29	0.39	1.0	Pass
#8	104.24	0.24	0.39	1.0	Pass
#9	104.36	0.36	0.39	1.0	Pass

Correction of UUC.\* = Measured Temperature - Desired Temperature

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



**Statements of conformity:(Cont.)****Without adjustment (Cont.)****Desired Temperature : 180.0°C Tolerances : 2.0 °C****Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C**

Locations	Measured (°C)	Correction of UUC.* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	179.63	-0.37	0.46	2.0	Pass
#2	179.69	-0.31	0.45	2.0	Pass
#3	180.34	0.34	0.45	2.0	Pass
#4	180.23	0.23	0.45	2.0	Pass
#5	180.59	0.59	0.45	2.0	Pass
#6	180.23	0.23	0.45	2.0	Pass
#7	179.42	-0.58	0.48	2.0	Pass
#8	180.28	0.28	0.45	2.0	Pass
#9	180.67	0.67	0.46	2.0	Pass

Correction of UUC.\* = Measured Temperature - Desired Temperature

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

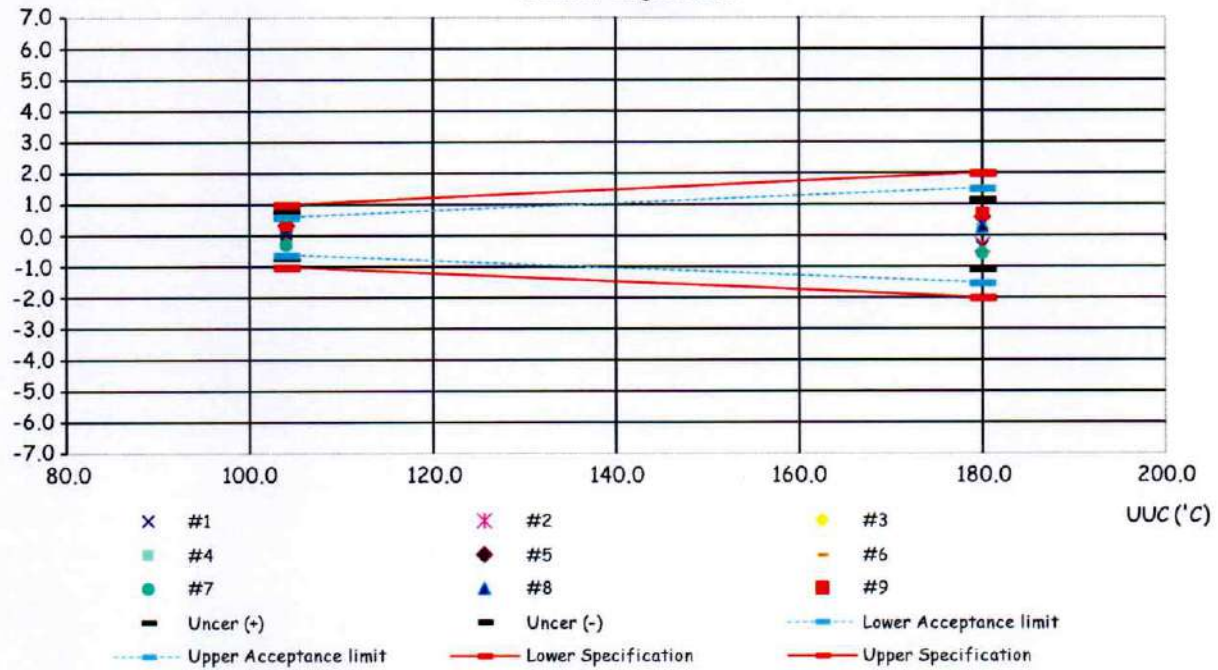
**The End of Statements of Conformity**

# Corr\_Distribution & Max\_Measurement Uncertainty

Job\_No. KSPR2302593

Without adjustment

Correction ('C)

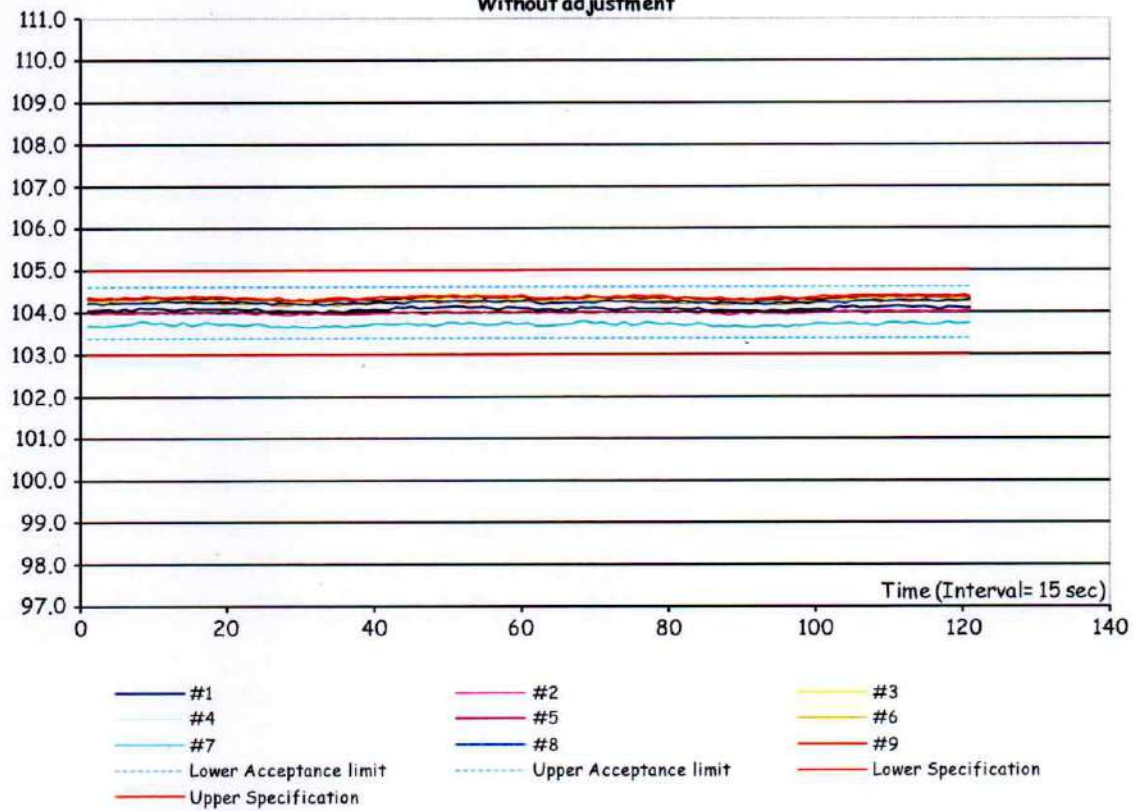


## Temperature Distribution @ 104.0°C

Job\_No. KSPR2302593

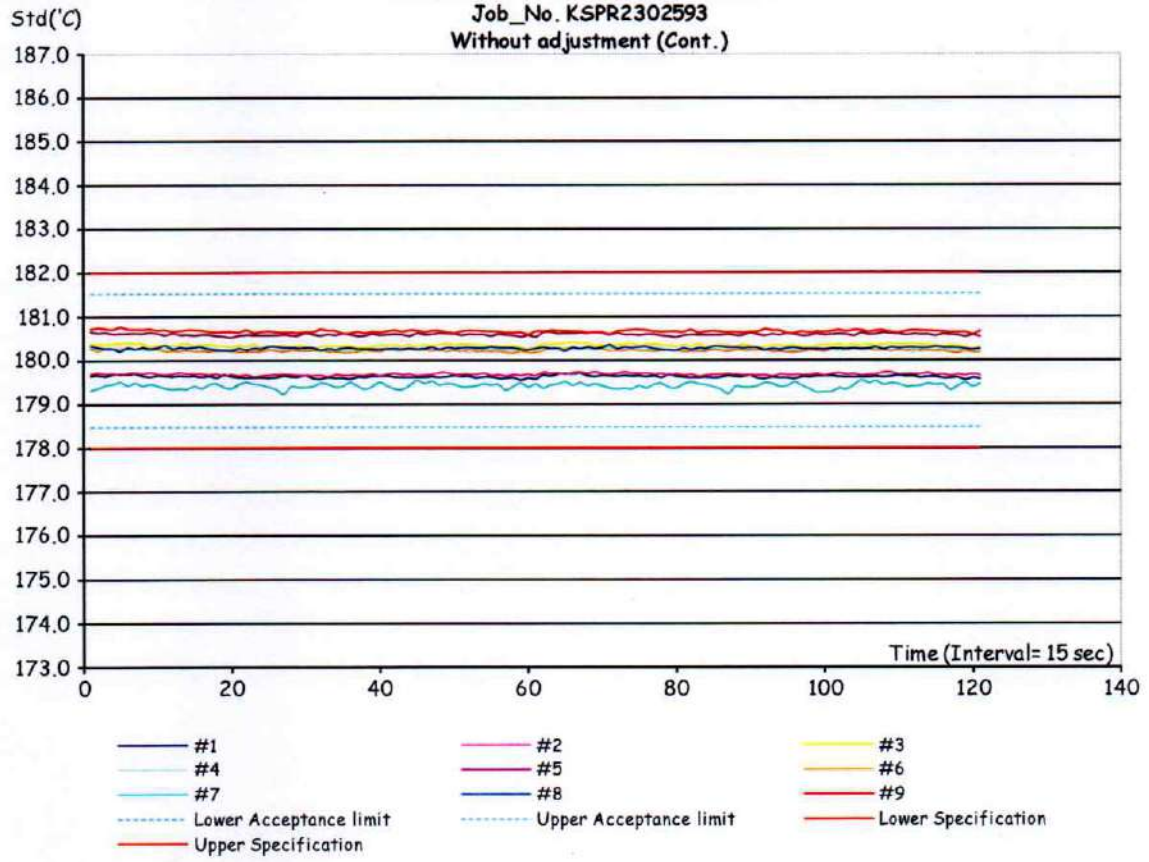
Without adjustment

Std('C)



# Temperature Distribution @ 180.0°C

Job\_No. KSPR2302593  
Without adjustment (Cont.)





## ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: KSPR2302593

ชนิดเครื่องมือ: Hot Air Oven

รุ่น: UF 55

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

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
15 Feb 2023			15 Feb 2023		
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. 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"/>	

ข้อแนะนำ :

Mr. Apiwit Chaosap

Service Engineer

## Certificate of Calibration

**Certificate No. :** 66-420017-1

**Page : 1 of 2**

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

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

**Equipment :** pH Meter with electrode

pH meter

Manufacturer : Thermo Scientific Model : VERSA STAR PRO

Range : N/A pH Resolution : 0.01 pH

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

Electrode

Model : 9156BNWP Serial No. : VV1-15843

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

Ambient Temperature : (22.0 to 22.6)° C

Relative Humidity : (55 to 58) %

**Date of Received :** 13 February 2023

**Date of Calibration :** 13 February 2023

**Date of Issue :** 18 February 2023

**Calibrated by :** Bunjerd Masri

**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-00473/64	27 Aug 2023	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61235182	857394	11 Dec 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.986	61267169	857395	11 Dec 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
10.010	61260481	857396	11 Dec 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :   
( Bunjerd Masri )  
Supervisor





## Certificate of Calibration

**Certificate No. : 66-420017-1**

**Page : 2 of 2**

**Result of Calibration :**

**UUC Condition As-Received :** Good

**Function :** Electrical measurement

pH meter

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

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

**Function :** pH meter with electrode

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

Adjustment Curve at nominal pH	Standard Buffer ( pH )	UUC Reading ( pH )	Correction ( pH )	Uncertainty ( ± pH )
4, 7, 10	4.008	4.01	0.00	0.0097
	6.986	7.00	-0.01	0.011
	10.010	10.01	0.00	0.014

Remark

UUC : Unit Under Calibration

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

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

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## Certificate of Calibration

**Certificate No. :** 66-400084-1

**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 : (22.0 to 22.6) °C  
Relative Humidity : (55 to 58) %  
Line Voltage : (224.5 to 226.0) VAC

**Date of Received :** 13 February 2023

**Date of Calibration :** 13 February 2023

**Date of Issue :** 18 February 2023

**Calibrated by :** Bunjerd Masri

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

The temperature scale used was based on ITS-90


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

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400002	TT-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 :   
( Bunjerd Masri )  
Supervisor



## Certificate of Calibration

**Certificate No. :** 66-400084-1

**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	25.004	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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*B.*



www.calibratech.co.th



Bangkok High Lab Co.,Ltd.

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Tel: (662) 971-5800

Website: [www.bangkokhighlab.com](http://www.bangkokhighlab.com)

Fax: (662) 971-5300

E-mail: [info@bangkokhighlab.com](mailto:info@bangkokhighlab.com)



NSC-TISI-TIS 17025  
CALIBRATION 0366

# CERTIFICATE OF CALIBRATION

Certificate No : S2022/168

Page : 1/5

Order No : 316/2022

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

Address : 219/43 Moo 12 Phet Kasem Rd., Omnoi, Krathum Baen, Chachoengsao 24000

Instrument : UV/VIS spectrophotometer

Manufacture : MERCK

Model : Prove100

Serial Number : 1714112078

Environment : Temperature (26.6 - 26.4) °C  
: Humidity (58 - 60) %RH

Received Date : September 29, 2022

Calibration Date : September 29, 2022

Issued Date : October 3, 2022

Calibrate Status : No Adjustment

Calibration Area : Customer area

Roomname : Laboratory Room of C.E.M Technology (Thailand) Co., Ltd

Calibrated By : JEERAPAT  
( Mr.Jeerapat Thaepphaisun )  
Calibration Engineer

Approved By : [Signature]  
( Mr.Wanchai Meesiri )  
Manager





Bangkok High Lab Co.,Ltd.

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E-mail: info@bangkokhighlab.com



Certificate No : S2022/168

Page : 2/5

## 1. Photometric Accuracy

CRMs: Neutral Density Glass Filters

CRMs Serial Number: A404

Traceability: Traceable to NIST, U.S.A. through Neutral density filters NIST SRM 930e & 1930, Double Aperture method through Starna certificate report no. 108644

Spectral slit width : 4.00 nm

### 1.1 Reading scale at 420.0 nm

Filter STDs (Abs) Certificate	Average Measured Value (A)	Correction (A)	Uncertainty ± (A)
0.0000	0.000	0.0000	0.0028
0.4965	0.495	0.0015	0.0044
0.9630	0.960	0.0030	0.0038
2.0356	2.030	0.0056	0.0064

### 1.2 Reading scale at 440.0 nm

Filter STDs (Abs) Certificate	Average Measured Value (A)	Correction (A)	Uncertainty ± (A)
0.0000	0.000	0.0000	0.0028
0.4870	0.485	0.0020	0.0040
0.9433	0.942	0.0013	0.0040
1.9665	1.970	-0.0035	0.0064

### 1.3 Reading scale at 465.0 nm

Filter STDs (Abs) Certificate	Average Measured Value (A)	Correction (A)	Uncertainty ± (A)
0.0000	0.000	0.0000	0.0028
0.4535	0.454	-0.0005	0.0034
0.8780	0.879	-0.0010	0.0040
1.8424	1.840	0.0024	0.0060

### 1.4 Reading scale at 546.1 nm

Filter STDs (Abs) Certificate	Average Measured Value (A)	Correction (A)	Uncertainty ± (A)
0.0000	0.000	0.0000	0.0028
0.4706	0.469	0.0016	0.0028
0.9094	0.909	0.0004	0.0028
1.8755	1.875	0.0005	0.0064



**Bangkok High Lab Co.,Ltd.**

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NSC-TISI-TIS 17025  
CALIBRATION 0366

**Certificate No : S2022/168**

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**1.5 Reading scale at 590.0 nm**

Filter STDs (Abs) Certificate	Average Measured Value (A)	Correction (A)	Uncertainty ± (A)
0.0000	0.000	0.0000	0.0028
0.4887	0.489	-0.0003	0.0029
0.9464	0.945	0.0014	0.0029
1.9021	1.899	0.0031	0.0061

**1.6 Reading scale at 635.0 nm**

Filter STDs (Abs) Certificate	Average Measured Value (A)	Correction (A)	Uncertainty ± (A)
0.0000	0.000	0.0000	0.0028
0.4634	0.463	0.0004	0.0030
0.8992	0.896	0.0032	0.0031
1.7824	1.776	0.0064	0.0062

**2. Photometric Accuracy**

**CRMs:** Potassium Dichromate in Perchloric acid

**CRMs Serial Number: 15086**

**Blank Serial Number: 15178**

**Traceability:** Traceable to NIST, U.S.A. through crystalline potassium dichromate NIST SRM 935a through Starna certificate report no. 88921

**Spectral slit width : 4.00 nm**

Wavelength (nm)	Certificate (Abs)	Average Measured Value (A)	Correction (A)	Uncertainty ± (A)
235	0.0000	#N/A	#N/A	#N/A
	0.7340	#N/A	#N/A	#N/A
257	0.0000	#N/A	#N/A	#N/A
	0.8528	#N/A	#N/A	#N/A
313	0.0000	#N/A	#N/A	#N/A
	0.2873	#N/A	#N/A	#N/A
350	0.0000	#N/A	#N/A	#N/A
	0.6336	#N/A	#N/A	#N/A





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NSC-TISI-TIS 17025  
CALIBRATION 0366

Certificate No : S2022/168

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### 3. Wavelength Accuracy

Spectral slit width : 4.00 nm

#### 3.1 CRMs: Holmium Glass Filter

CRMs Serial Number: W184/H

Traceability: Traceable to NIST Holmium oxide filter NIST SRM 2034, through Starna certificate report no. 108651

Filter STDs (nm) Certificate	Average Measured Value (nm)	Correction (nm)	Uncertainty ± (nm)
241.74	#N/A	#N/A	#N/A
279.44	#N/A	#N/A	#N/A
287.98	#N/A	#N/A	#N/A
334.10	333.3	0.80	0.12
361.00	360.2	0.80	0.12
418.61	418.2	0.41	0.12
453.63	452.6	1.03	0.12
460.05	459.4	0.65	0.12
536.66	536.0	0.66	0.12
637.98	637.4	0.58	0.12

#### 3.2 CRMs: Didymium Glass Filter

CRMs Serial Number: W184/D

Traceability: Traceable to NIST Holmium oxide filter NIST SRM 2034, through Starna certificate report no. 108652

Filter STDs (nm) Certificate	Average Measured Value (nm)	Correction (nm)	Uncertainty ± (nm)
585.29	584.8	0.49	0.12
684.49	683.6	0.89	0.12
740.18	739.2	0.98	0.12
748.48	747.4	1.08	0.12
807.03	806.1	0.93	0.12
879.27	878.5	0.77	0.12





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NSC-TISI-TIS 17025  
CALIBRATION 0366

Certificate No : S2022/168

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#### 4. \*Stray Light

CRMs: Potassium Chloride aqueous solution

CRMs Serial Number: 5469

Blank Serial Number: 8745

Traceability: Traceable to NIST, U.S.A. potassium chloride NIST SRM2032, through Starna certificate report no. 88922

Spectral slit width : 4.00 nm

Wavelength (nm)	Certificate	Average Measured
201.28	>2A	#N/A
201.28	<1%T	#N/A

#### 5. \*Spectral Resolution

CRMs: Toluene in Hexane

CRMs Serial Number: 8697

Blank Serial Number: 8716

Traceability: Traceable to toluene in hexane NIST SRM2034, through Starna certificate report no. 88923

Spectral slit width (nm)	Abs Ratio
0.5	#N/A
1.0	#N/A
1.5	#N/A
2.0	#N/A
3.0	#N/A

Note : \* "Not TISI Accredited" in this certificate have been included for completeness

**Remark:** Calibrate Method

- 1.1 Photometric and Wavelength accuracy: In-house method W-SER-001 based on ASTM E925-02 and ASTM E275-01
- 1.2 Stray light: Measuring the CRMs in both absorbance and transmittance unit at wavelength 201.23 nm. Base on European Pharmacopoeia V.6.19.3 1984
- 1.3 Spectral resolution: Measuring the CRMs. The maximum absorbance values were read at closest to 268.7nm and the minimum absorbance values were read at closest 267.0 nm. Refer to European Pharmacopoeia V.6.19.3 1984
2. N/A = not available.
3. Uncertainty of Measurement: The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%.
4. This result of calibration was found accurate as shown on date and place of calibration only.
5. This report will certify of calibrated equipment only.

- End of Report -



# Certificate of Calibration

<b>Equipment:</b>	Digital Thermometer with Sensor	<b>Certificate No.:</b>	C15230305
<b>Model:</b>	TK 61	<b>Issued Date:</b>	16 February 2023
<b>Serial No.:</b>	1P181269184	<b>Job No.:</b>	KSPR2302595
<b>Manufacturer:</b>	KIMO	<b>ID No.:</b>	WW-06-002
<b>Condition:</b>	In Condition	<b>Page:</b>	1 of 2

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

**Environment Condition:** Temperature: 22 °C ± 3 °C  
Humidity: 50 %RH ± 20 %RH  
Voltage: 220 VAC ± 10 %

**Calibration Place:** Thermo-Hygro Laboratory, DKSH Technology Limited.  
2533 Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260 Thailand

**Calibration By:** Mr. Anat Karapitak  
**Calibration Date:** 16 February 2023  
**The Method used:** In house method, CAL-WI-19, by comparison with standard thermometer  
**Traceability:** This certificate is traceable to the International System of Unit maintained by National Institute of Metrology Thailand Certificate No. TT-0111-21



(Mr. Anat Karapitak)  
Person in charge



(Mr. Pramote Ramrong)  
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.

**Calibration Results:****Without Adjustment**

Sensor Type: TC Type K

Channel: T1

Diameter (mm): 2

Length (mm): -

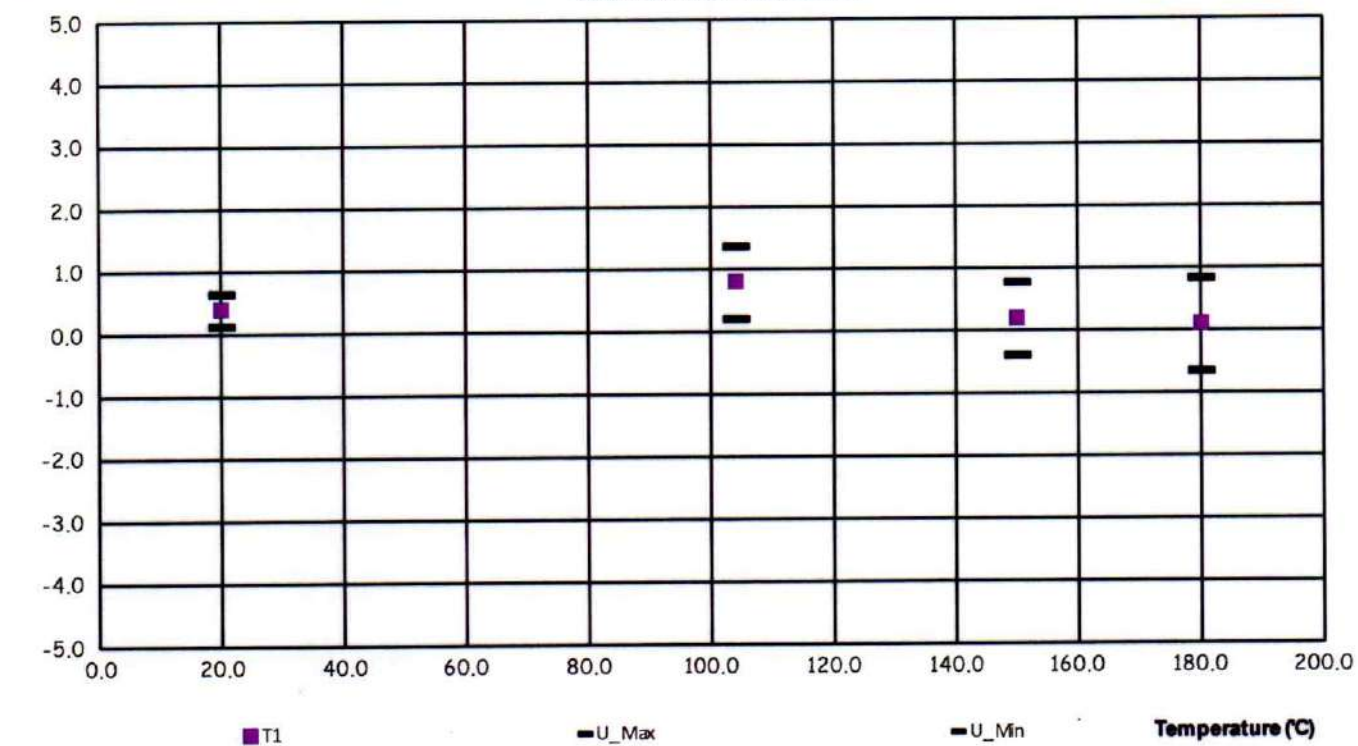
Immersion (mm): 110

Calibrate Point.(°C)	STD. Reading (°C)	UUC. Reading (°C)	Correction of UUC (°C)	Uncertainty (± °C)
20.0	20.0021	19.6	0.4021	0.26
104.0	104.0036	103.2	0.8036	0.58
150.0	150.0018	149.8	0.2018	0.58
180.0	180.0039	179.9	0.1039	0.74

**The End of Certificate**



**Without Adjustment**  
**Job No.: KSPR2302595**



## ใบตรวจสอบสภาพเครื่องมือวัดอุณหภูมิ

เลขที่ใบงาน: KSPR2302595

ชนิดเครื่องมือ: Digital Thermometer with Sensor

รุ่น: TK 61

หมายเลขเครื่อง: 1P181269184

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
16-Feb-2023			16-Feb-2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input type="checkbox"/>	<input type="checkbox"/>	2. Adapter / Power supply 220 / 110 VAC	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. Battery	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพ Sensor ( In / Ex )	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ :

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Mr. Anat Karapitak

Service Engineer

## CERTIFICATE OF CALIBRATION

**Certificate No.:** T1-2103001/23

**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** Merck

**Model** TR420

**Serial No.** 19490640

**ID No.** WW-07-002

**Description** Resolution of UUC : 1 °C

**Environmental Conditions** Ambient Temperature: 24.5 °C  
Relative Humidity: 41 %  
Atmospheric Pressure: -

**Calibration Location** Laboratory

**Received Date** 21 March 2023

**Calibration Date** 21 March 2023

**Date of Issue** 22 March 2023

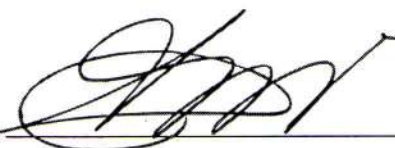
**Condition of Artifacts** Used conditions but can be calibrated

**Checked by**



Act as Technical Manager

**Approved by**



Representative of Managing Director

- |  |  |
|--|--|
| <input type="checkbox"/> ( Krisyosl K. )           | <input type="checkbox"/> ( Sakda Y. )      |
| <input type="checkbox"/> ( Patiphan K. )           | <input type="checkbox"/> ( Onnapa P. )     |
| <input checked="" type="checkbox"/> ( Pongsak H. ) | <input type="checkbox"/> ( Nitiphong K. )  |
| <input type="checkbox"/> ( Kanung C. )             | <input type="checkbox"/> ( Nonthachai K. ) |
| <input type="checkbox"/> ( Pramong P. )            | <input type="checkbox"/> ( Noppol P. )     |

( Dr. Ekachai Puttitwong )

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**Certificate No.:** T1-2103001/23

**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	MY57010717/ MY59004982	I0-1308001/22	Aug. 12, 2023	THC

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

- THC, Thai Heart Calibration Co., Ltd.

**Certificate No.:** T1-2103001/23

**Page 3 of total 4 pages**
**Measurement Results:**
**( L )**

Hole No.	UUC Setting (°C)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Stability of UUC (± °C)	Uncertainty (± °C)
# 1	150	148.1	150	-1.9	0.16	0.61
# 2	150	148.1	150	-1.9	0.15	
# 3	150	147.8	150	-2.2	0.11	
# 4	150	147.8	150	-2.2	0.18	
# 5	150	148.7	150	-1.3	0.13	
# 6	150	148.5	150	-1.5	0.21	
# 7	150	148.6	150	-1.4	0.14	
# 8	150	149.5	150	-0.5	0.18	
# 9	150	148.5	150	-1.5	0.13	
# 10	150	149.0	150	-1.0	0.15	
# 11	150	149.5	150	-0.5	0.24	
# 12	150	148.7	150	-1.3	0.15	

**( R )**

Hole No.	UUC Setting (°C)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Stability of UUC (± °C)	Uncertainty (± °C)
# 1	150	148.2	150	-1.8	0.12	0.61
# 2	150	148.0	150	-2.0	0.13	
# 3	150	148.5	150	-1.5	0.21	
# 4	150	149.0	150	-1.0	0.18	
# 5	150	149.6	150	-0.4	0.16	
# 6	150	149.3	150	-0.7	0.15	
# 7	150	148.4	150	-1.6	0.18	
# 8	150	148.6	150	-1.4	0.15	
# 9	150	148.4	150	-1.6	0.16	
# 10	150	148.6	150	-1.4	0.12	
# 11	150	149.2	150	-0.8	0.12	
# 12	150	148.5	150	-1.5	0.12	

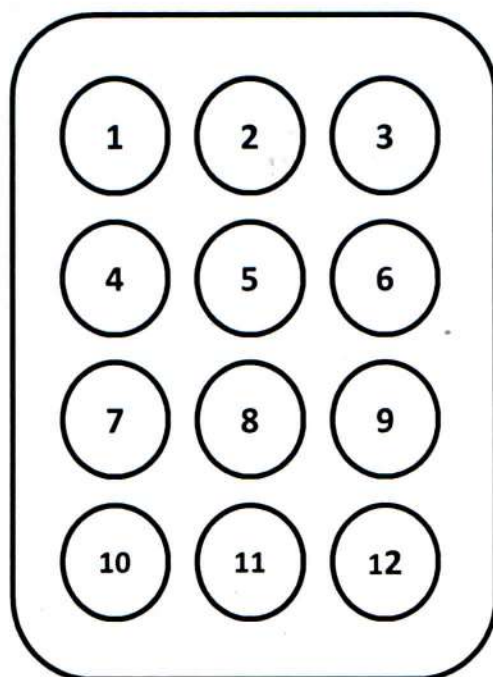
**UUC : Unit Under Calibration**
**Calibrated by**
**Apisit**



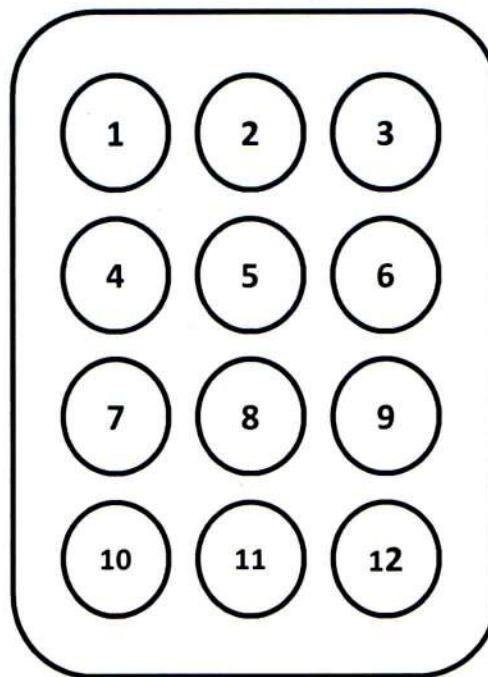
Certificate No.: T1-2103001/23

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 -



## Certificate of Calibration

**Certificate No. :** 66-430007-1 **Page : 1 of 2**

**Submitted by :** C.E.M Technology (Thailand) Co.,Ltd.  
219/43 Moo.12 Petchkasem Rd, Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

**Equipment :** Digital Conductivity meter (Pocket)  
Manufacturer : XS Instruments Model : PC 5  
Serial No. : GB 0706/024 ID No. : WW-23-001

**Environment :** On site calibration was carried out at the Laboratory C.E.M Technology (Thailand) Co.,Ltd.  
Ambient Temperature (22.0 to 22.6) °C  
Relative Humidity (55 to 58) %

**Date of Received :** 13 February 2023  
**Date of Calibration :** 13 February 2023  
**Date of Issue :** 18 February 2023  
**Calibrated by :** Bunjerd Masri

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

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

**Standard Buffer Solution**

Material	Lot No.	Exp. Date	Traceability
84 µS/cm	7824	16 June 2025	National Institute of Standards and Technology (NIST), U.S.A., S.R.M.
1413 µS/cm	795891	17 February 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
12.88 mS/cm	795893	14 February 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :

( Bunjerd Masri )

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. : 66-430007-1**

**Page : 2 of 2**

**Result of Calibration :**

**UUC Condition As-Received :** Good

**Function :** Conductivity measurement

Before Adjustment

Standard Conductivity Solution	UUC Reading	Correction	Uncertainty ( ± )	Unit
84*	116.4	-32.4	1.1	μS/cm
1413	1576	-163	9.0	μS/cm
12.88	15.27	-2.39	0.082	mS/cm

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

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

Remark

UUC : Unit Under Calibration

\* This parameter are out of accreditation's scope.

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

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

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# THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonthon 5 Rd., Sampran, Nakhonpathom 73210

Tel. 0-3439-7682-5 Fax: 0-3439-7687

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



## CALIBRATION CERTIFICATE

Certificate No.S2303153S

page 1 of 2

**Customer :** C.E.M. TECHNOLOGY (THAILAND) CO., LTD.  
31/8 Moo 13 Raikhing,  
Samphran, Nakhornpathom 73210

**Equipment :** Non-automatic weighing instrument (Electronic instrument)

**Manufacturer :** Sartorius **Order No. :** 66S0828-1

**Model :** BSA224S-CW **Ambient temperature :**  $(24.1 \pm 5.0) ^\circ\text{C}$

**Accuracy class :** - **Relative humidity :**  $(47.5 \pm 10.0) \%$

**Capacity :** 220000 mg **Received date :** 03-Mar-2023

**Resolution :** 0.1 mg **Date of calibration :** 03-Mar-2023

**Serial No. :** 3139614148 **Date of issue :** 04-Mar-2023

**ID No. :** CI-01-003 **Condition of the balance :** Good working conditions

**Place of calibration :** ห้องเครื่องชั่ง

### Calibration method

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

### Condition of reference standard weight

Instrument	Nominal value	Serial No.	Certificate No.	Due-date	Density (kg/m <sup>3</sup> )
1 Standard weight set	1 mg to 2 kg	15885+15849	M2210001S	8-Oct-2023	7950

### Traceability of the reference standard weight

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

Calibrated By :

Teerawat Intanom  
Technician

Approved By :

Chonlatee Pongwatvisanon  
Approved Signatory

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





# THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonthon 5 Rd., Sampran, Nakornpatom 73210

Tel. 0-3439-7682-5 Fax: 0-3439-7687

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



## CALIBRATION CERTIFICATE

Certificate No.S2303153S

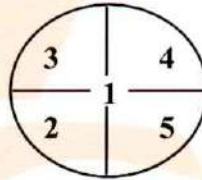
page 2 of 2

### The repeatability of indication

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

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

Position	Balance Reading ( mg )
Point 1	100000.0
Point 2	99999.9
Point 3	100000.0
Point 4	100000.0
Point 5	100000.0
Eccentric Value	0.1



### The error of indication

Nominal Value ( mg )	Value of Reference Standard Weight ( mg )	Balance Reading ( mg )	Correction ( mg )	Uncertainty (±) ( mg )	k
Unload	0.0	0.0	0.0	0.14	2.21
1000	1000.0	1000.0	0.0	0.14	2.20
2000	2000.0	2000.1	-0.1	0.14	2.20
5000	5000.0	5000.1	-0.1	0.14	2.18
10000	10000.0	10000.0	0.0	0.14	2.17
20000	20000.0	20000.0	0.0	0.15	2.14
50000	50000.0	50000.1	-0.1	0.15	2.11
100000	100000.0	99999.8	+0.2	0.18	2.04
120000	120000.0	119999.8	+0.2	0.22	2.00
150000	150000.0	149999.8	+0.2	0.24	2.00
200000	200000.0	199999.7	+0.3	0.27	2.00

Remark : Adjustment, Internal weight

### Uncertainty of measurement

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

**This report will certify of the calibrated equipment only.**

--End--