

ภาคผนวกที่ 4

สรุปเอกสารสอบเทียบอุปกรณ์เครื่องมือ

เอกสารการสอบเทียบเครื่องมือตรวจวัดระดับเสียงในบรรยากาศ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0012

MTC No. EEL BP. 20/1065

CALIBRATION CERTIFICATE

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

Address : 31/8 Moo 13, Raikhing, Sampran, Nakhonpathom 73210.

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

Instrument Calibrated :

Description : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 222185 (NS-03-015)

Microphone : Type 7052NR No.84149

Preamplifier : +

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 00464402.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042688.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rinn NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 5 Oct. 2022

Date of Calibration : 1 Nov. 2022

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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 Tansigawa TPA-305A 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 : 1 Nov. 2022

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Accepted limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.97	114.1	114.0	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 114.5 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20.9	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	16.4	0.10	N/A
C-Weight	21.5	0.10	N/A
Flat	26.3	0.10	N/A

Date of Calibration : 1 Nov. 2022

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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	-0.2	-0.1	-0.1	1.5	0.45	0.6
1 000	0.0	0.0	0.0	1.0	0.45	0.6
8 000	-1.3	-1.4	-1.2	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	-0.3	-0.1	0.0	2.0	0.20	0.6
125	-0.4	0.1	0.0	1.5	0.20	0.6
250	-0.2	0.0	0.0	1.5	0.20	0.6
500	-0.2	0.1	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	-0.2	-0.3	-0.1	3.0	0.20	0.6
8 000	-0.4	-0.4	-0.2	5.0	0.20	0.7

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5. Long-term stability

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

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7. Level linearity on the reference level range

Anticipated value	Measured value	Deviated value	Acceptance limit	Uncertainty	Maximum-permitted uncertainty of measurement
(dB)	(dB)	(dB)	class 2	(±dB)	(±dB)
			(±dB)	(±dB)	(±dB)
122	122.1	0.1	1.1	0.30	0.3
121	121.1	0.1	1.1	0.30	0.3
120	120.1	0.1	1.1	0.30	0.3
119	119.1	0.1	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	74.1	0.1	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	63.8	-0.2	1.1	0.30	0.3
59	58.9	-0.1	1.1	0.30	0.3
54	53.8	-0.2	1.1	0.30	0.3
49	48.8	-0.2	1.1	0.30	0.3

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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)
44	43.8	-0.2	1.1	0.30	0.3
39	38.8	-0.2	1.1	0.30	0.3
34	34.1	0.1	1.1	0.30	0.3
33	33.2	0.2	1.1	0.30	0.3
32	32.2	0.2	1.1	0.30	0.3
31	31.4	0.4	1.1	0.30	0.3
30	30.5	0.5	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)
40-130	94.0	94.0	0.0	1.1	0.30	0.3
30-120	94.0	94.0	0.0	1.1	0.30	0.3
20-110	94.0	94.0	0.0	1.1	0.30	0.3
20-100	94.0	94.0	0.0	1.1	0.30	0.3

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8. Level linearity including the level range control

At reference level at 5 dB greater than the 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)
40-130	45.0	44.9	-0.1	1.1	0.30	0.3
30-120	35.0	35.0	0.0	1.1	0.30	0.3
20-110	25.0	25.5	0.5	1.1	0.30	0.3
20-100	25.0	25.4	0.4	1.1	0.30	0.3
20-90	25.0	25.5	0.5	1.1	0.30	0.3
20-80	25.0	25.5	0.5	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	116.0	0.0	±1.0	0.20	0.3
	2	98.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	89.8	-0.2	+1.5; -5.0	0.20	0.3
Slow	200	109.5	-0.1	±1.0	0.20	0.3
	2	89.8	-0.2	+1.0; -5.0	0.20	0.3
SEL	200	109.9	-0.1	±1.0	0.20	0.3
	2	90.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	80.9	-0.1	+1.5; -5.0	0.20	0.3

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Request No. 21-660012

MTC No. EEL-BP. 20/0665

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	125.4	125.2	-0.2	3.0	0.20	0.35
Positive half cycle	124.4	124.3	-0.1	2.0	0.20	0.35
Negative half cycle	124.4	124.2	-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				
131.0	131.1	-0.1	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	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by :

Approved by :

(Mr. Tawakiat Jansumran)

(Mr. Praveen Klayapong)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 1 Nov. 2022

Date of Issue : 2 Nov. 2022

Ref : 2011265100504293063

End of Certificate

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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. : 222180

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 :

Reviewed By : Mr. Sompang Seisat

Mr. Nanthapaksarn Thammaphan

Ms. Bhatharin Phansangkaew MD

Mr. Boonyarit Auejirakarn

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

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/- dB)
A	94	94.3	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

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

Address : 31/9 Moo 13, Rakkhang, Samphran,
Nakhonpathom 73210

Location : Laboratory

Equipment : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 222187

Identity No. : NS-GG-017

Range : See to Data

Ambient temperature : (20 ± 2) °C

Relative humidity : (50 ± 15) %

Atmospheric pressure : -

Date of received : 03-Feb-2023

Date of calibration : 07-Feb-2023

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	KELBP.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 Auejirakorn

Approved By :

Reviewed By : [] Mr. Sompong Srisert

[] Mr. Nattaphakorn Thammaphan

[] Ms. Bhacharin Phanangkaew (MD)

[] Mr. Boonyarit Auejirakorn

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 (\pm 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. : 66S0420-22

Job No. : 66S0420

Page : 1 of 2

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

Address : 31/8 Moo 13, Baikong, Samphan,
Nakhonpathom 73210

Location : Laboratory

Equipment : Sound Level Meter

Manufacturer : ACO

Model : 8236

Serial No. : 222188

Identity No. : NS-03-018

Range : See to Data

Ambient temperature : (20 \pm 2) °C

Relative humidity : (50 \pm 15) %

Atmospheric pressure : -

Date of received : 30-Mar-2023

Date of calibration : 03-Apr-2023

Date of issued : 05-Apr-2023

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

Reference Standard Instruments :

Equipment	Model	Serial No.	Certification No.	Due Date
Sound Level Calibrator	8930B	2000210	KELBP/31/0064	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. Boonyuot Angsriakorn

Approved By :

Reviewed By : [] Mr. Sompote Srisert

[] Mr. Natthaprasern Thammaphan

[] Ms. Bhacharin Phanangkarn (MD)

[] Mr. Boonyuot Angsriakorn

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	113.9	-0.1	0.20
B	94	94.0	0.0	0.20
	104	103.9	-0.1	0.20
	114	113.8	-0.2	0.20
Z	94	94.0	0.0	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. : 66S0420-23

Job No. : 66S0420

Page : 1 of 2

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

Address : 31/8 Moo 13, Raikhang, Samphan,
Nakhornpathom 73210

Location : Laboratory

Equipment : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 222192

Identity No. : NS-03-021

Range : See to Data

Ambient temperature : (20 ± 2) °C

Relative humidity : (50 ± 15) %

Atmospheric pressure : -

Date of received : 30-Mar-2023

Date of calibration : 03-Apr-2023

Date of issued : 05-Apr-2023

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

Reference Standard Instruments :

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

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

Calibrated By : Mr. Boonyarit Ausjirakorn

Approved By :

Reviewed By : Mr. Sompang Sriert

Mr. Naithaparakorn Thammaphan

Mr. Shacharin Phanangkaew (MD)

Mr. Boonyarit Ausjirakorn

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

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

UUC* = Unit Under Calibration

• The End •

CERTIFICATE OF CALIBRATION

Certificate No. : 66S0420-24

Job No. : 66S0420

Page : 1 of 2

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

Address : 31/8 Moo 13, Raikhang, Samphan,
Nakhonpathom 73210

Location : Laboratory

Equipment : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 222190

Identity No. : NS-03-023

Range : See to Data

Ambient temperature : (20 ± 2) °C

Relative humidity : (50 ± 15) %

Atmospheric pressure : -

Date of received : 30-Mar-2023

Date of calibration : 03-Apr-2023

Date of issued : 05-Apr-2023

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

Reference Standard Instruments :

Equipment	Model	Serial No.	Certification No.	Due Date
Sound Level Calibrator	8930B	2000210	EELBP.31/0064	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 Anojrakarn

Approved By :

Reviewed By : Mr. Sampang Sriart

Mr. Natthaporn Thammaphan

Mr. Bhacharin Phansongkarn (MD)

Mr. Boonyarit Anojrakarn

Continuation of Calibration Report

Certificate No. : 66S0420-24

Job No. : 66S0420

Page : 2 of 2

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	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 -

FORTH CALIBRATION & SERVICE CO., LTD.

395/47 Soi Ratchadapisek 123, Ratchadapisek Rd., Mueang, Bangkok 10110
Tel: 0-2040-6648, 0-2317-6688-1 Fax: 0-2317-6674
Email: forthcal@orthcal.com



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, Raikhang, Samphran,
Nakhonpathom 73210

Location : Laboratory

Equipment : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 222195

Identity No. : NS-03-025

Range : See to Data

Ambient temperature : (20 ± 2) °C

Relative humidity : (50 ± 10) %

Atmospheric pressure : -

Date of received : 05-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	REL.BP.31/0464	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. Boonyarat Ausirakarn

Approved By :

Reviewed By : Mr. Sompong Seisorn

Ms. Natthagrakarn Thummaaphan

Ms. Bhaskarin Phamangkarn (MD)

Mr. Boonyarat Ausirakarn

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. : 66S0929-1

Job No. : 66S0929

Page : 1 of 2

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

Address : 31/8 Moo 13, Raikhang, Samphan,
Nakhonphanom 73210

Location : Laboratory

Equipment : Sound Level Meter

Manufacturer : BSWA Tech

Model : BSWA 300

Serial No. : 590102

Identity No. : NS-04-003

Range : See to Data

Ambient temperature : (20 ± 2) °C

Relative humidity : (50 ± 15) %

Atmospheric pressure : 1 -

Date of received : 11-Sep-2023

Date of calibration : 14-Sep-2023

Date of issued : 18-Sep-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	8900B	2000210	KEL.BP.40/0645	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. Boonparit Auejirakarn

Approved By :

Reviewed By : 1 Mr. Sompeng Srisert

1 Ms. Natthaporn Thammaphan

1 Ms. Bhacharin Phannongkaew (MD)

1 Mr. Boonparit Auejirakarn

Continuation of Calibration Report

Certificate No. : 66S0929-1

Job No. : 66S0929

Page : 2 of 2

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.0	0.0	0.20
	104	103.9	-0.1	0.20
	114	113.9	-0.1	0.20
B	94	94.0	0.0	0.20
	104	103.9	-0.1	0.20
	114	113.9	-0.1	0.20
Z	94	94.1	0.1	0.20
	104	104.1	0.1	0.20
	114	114.0	0.0	0.20

UUC* = Unit Under Calibration

- The End -

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, Raikhang, Samphran,
Nakhonpathom 73210

Location : Laboratory

Equipment : Sound Level Meter

Manufacturer : Tenmars

Model : ST-109R

Serial No. : 221201934

Identity No. : NS-11-001

Range : See to Data

Ambient temperature : (20 ± 2) °C

Relative humidity : (50 ± 10) %

Atmospheric pressure : -

Date of received : 05-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	EELBP.31/0064	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. Boonyarat Auejirakarn

Approved By :

Reviewed By : Mr. Sompang Seiwon

Mr. Nanthagrakarn Thammaphan

Mr. Bhakarn Phiangkaew OMD

Mr. Boonyarat 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	94.5	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

Ambient temperature : (20 ± 2) °C

Manufacturer : Scarlet Tech

Relative humidity : (50 ± 15) %

Model : ST-11D

Atmospheric pressure : -

Serial No. : 820388

Date of received : 08-Mar-2023

Identity No. : NS-12-001

Date of calibration : 10-Mar-2023

Range : See to Data

Date of issued : 19-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	8900B	2000210	KELBP.31/0064	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. Boonyarat Auejirakarn

Approved By :

Reviewed By : 1 Mr. Sompang Sriest

1 Mr. Bhacharin Phatungkarn (MD)

1 Mr. Nuthaprakara Thamataphan

1 Mr. Boonyarat 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. : 66S0330-8

Job No. : 66S0330

Page : 1 of 2

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

Address : 31/9 Moo 13, Raikhing, Samphran,
Nakhonpathom 73210

Location : Laboratory

Equipment : Sound Level Meter

Manufacturer : Scarlet Tech

Model : ST-11D

Serial No. : 820892

Identity No. : NS-12-003

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	EKL-BP-31-0064	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. Boonyarat Ausjirakarn

Approved By :

Reviewed By : [] Mr. Sompang Seisarn

[x] Mr. Natthaporn Thammaphan

[] Mr. Bhacharin Phansongkarn (MD)

[x] Mr. Boonyarat Ausjirakarn

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 ·

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในบรรยากาศ



Trade & Engineering

TSP High Volume Sampler TE-5000 TSP Sampler Verification

Site Information

Location: - Site ID: - Date: 0 Jan 23
Sampler: TE-5000 TSP Serial No: 3242 Tech: Tony F

Site Conditions

Barometric Pressure (in Hg): 29.00 Corrected Pressure (mm Hg): 734.6
Temperature (deg F): 16.0 Temperature (deg K): 287.6
Average Press. (in Hg): 27.00 Corrected Average (mm Hg): 665.8
Average Temp (Deg F): 75.6 Average Temp (Deg K): 297.5

Calibration Orifice

Maker: Tiaohi Qstd Slope: 1.58304
Model: TE-5020A Qstd Intercept: -0.01320
Serial#: 1179 Calibration Due Date 12 December 2023

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	6.20	1.792	42.0	61.08	Slope: 37.2576
2	6.40	1.884	55.0	54.18	Intercept: -5.2773
3	6.00	1.401	48.0	47.29	Corr. Coeff: 0.9987
4	4.70	1.330	45.0	44.33	
5	3.90	1.239	41.0	40.39	

of Observations: 5

Calculations

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

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

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:

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

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

nter Average I (chart): 44.0
Average Flow Calculation m3/min
1.264452021
Average Flow Calculation in cfm
44.64872898
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min
1820.810911
Total flow in 24 hours cfm
64294.16973

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



Trade & Engineering

TSP High Volume Sampler TE-5000 TSP Sampler Verification

Site Information

Location: - Site ID: - Date: 0 Jan 23
Sampler: TE-5000 TSP Serial No: 3243 Tech: Tony F

Site Conditions

Barometric Pressure (in Hg): 29.00 Corrected Pressure (mm Hg): 711.2
Temperature (deg F): 16.0 Temperature (deg K): 287.6
Average Press. (in Hg): 26.00 Corrected Average (mm Hg): 663.4
Average Temp (Deg F): 75.6 Average Temp (Deg K): 297.5

Calibration Orifice

Maker: Tiaohi Qstd Slope: 1.58304
Model: TE-5020A Qstd Intercept: -0.01320
Serial#: 1179 Calibration Due Date 12 December 2023

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	5.70	1.482	60.0	59.08	Slope: 29.6275
2	4.00	1.223	53.0	51.21	Intercept: 15.8440
3	3.40	0.990	46.0	44.53	Corr. Coeff: 0.9998
4	2.10	0.898	43.0	43.62	
5	1.50	0.158	38.5	37.27	

of Observations: 5

Calculations

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

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

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:

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

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

nter Average I (chart): 44.0
Average Flow Calculation m3/min
0.881394911
Average Flow Calculation in cfm
31.12270125
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min
1269.208672
Total flow in 24 hours cfm
44816.6896

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

TSP

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

Site Information

Location: - Site ID: - Date: 9 Jan 23
Sampler: TE-5000 TSP Serial No: 3208 Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 29.00 Corrected Pressure (mm Hg): 711.2
Temperature (deg F): 76.0 Temperature (deg K): 297.6
Average Press. (in Hg): 27.00 Corrected Average (mm Hg): 685.5
Average Temp (Deg F): 75.3 Average Temp: (Deg K): 297.2

Calibration Orifice

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

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	4.20	1.761	61.6	61.57	Slope: 39.0390
2	4.40	1.597	54.9	55.08	Intercept: -1.2149
3	3.00	1.327	49.7	48.31	Corr. Coeff: 0.9826
4	4.50	1.307	44.5	45.01	
5	3.80	1.217	42.0	40.66	

of Observations: 5

Calculations

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

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

Qstd = standard flow rate
IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

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

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure

Enter Average I (chart): 51.5
Average Flow Calculation m3/min
1.22794512
Average Flow Calculation in cfm
43.35964351
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min
1768.240973
Total flow in 24 hours cfm
62437.88665

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

TSP

Trade & Engineering

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

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

Site Conditions

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

Calibration Orifice

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

Calibration Information

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

of Observations: 5

Calculations

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

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

Qstd = standard flow rate
IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

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

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

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

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

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



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

Location: -	Site ID: -	Date: 18 Oct 23
Sampler: TE-5000 TSP	Serial No: 3279	Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 28.50	Corrected Pressure (mm Hg): 723.9
Temperature (deg F): 76.0	Temperature (deg K): 297.6
Average Press. (in Hg): 26.00	Corrected Average (mm Hg): 660.4
Average Temp (Deg F): 76.5	Average Temp: (Deg K): 297.9

Calibration Orifice

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

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	7.30	1.676	60.3	58.89	Slope: 33.4101
2	6.10	1.533	55.8	54.50	Intercept: 2.9989
3	5.10	1.403	50.7	49.51	Corr. Coeff: 0.9982
4	4.00	1.243	46.2	45.12	
5	3.50	1.164	42.5	41.51	
# of Observations: 5					

Calculations

Qstd = 1/m[Sqrt(H2O(Pa/Pstd)(Tstd/Ta))-b]
IC = I[Sqrt(Pa/Pstd)(Tstd/Ta)]

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

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

Enter Average I (chart): 51.1
Average Flow Calculation m3/min 1.336282554
Average Flow Calculation in cfm 47.1851178
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min 1924.246877
Total flow in 24 hours cfm 67946.56964

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



Trade & Engineering

TSP High Volume Sampler TE-5000 TSP Sampler Verification

Site Information

Location: -	Site ID: -	Date: 9 Jan 23
Sampler: TE-5000 TSP	Serial No: 3264	Tech: Tong, P

Site Conditions

Barometric Pressure (in Hg): 27.00	Corrected Pressure (mm Hg): 685.8
Temperature (deg F): 75.0	Temperature (deg K): 297.0
Average Press. (in Hg): 26.00	Corrected Average (mm Hg): 660.4
Average Temp (Deg F): 74.2	Average Temp (Deg K): 296.6

Calibration Orifice

Make: Tisch	Qstd Slope: 1.50304
Model: TE-5020A	Qstd Intercept: -0.01520
Serial#: 1179	Calibration Due Date: 12 December 2023

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	6.80	1.577	62.1	59.09	Slope: 33.1580
2	5.00	1.354	55.4	52.71	Intercept: 7.2943
3	3.60	1.150	48.2	45.86	Corr. Coeff: 0.9980
4	3.10	1.068	45.0	42.82	
5	2.50	0.960	40.5	38.53	

of Observations: 5

Calculations

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

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

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

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure

enter Average I (chart):	44.0
Average Flow Calculation m3/min	1.019916094
Average Flow Calculation in cfm	36.01398589
Sample Time (Hrs):	24.0
Total flow in 24 hours m3/min	1468.679175
Total flow in 24 hours cfm	51860.13967

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



Trade & Engineering

PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 10 January 2023
 Sampler: TE-6070 PM10 Serial No: 1313 Tech: Tony F.

Site Conditions

Barometric Pressure (in Hg): 29.58 Corrected Pressure (mm Hg): 713.7
 Temperature (deg F): 76.2 Temperature (deg K): 297.6
 Average Press. (in Hg): 29.60 Corrected Average (mm Hg): 685.8
 Average Temp. (deg F): 75.4 Average Temp. (deg K): 297.1

Calibration Orifice

Make: Tisch Environmental, Inc. Qstd Slope: 1.58304
 Model: TE-50268 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	8.80	1.220	59.9	38.68	Slope 33.6928
2	9.00	1.089	54.9	35.45	Intercept -1.8198
3	9.80	0.992	49.9	32.22	Corr. Coeff 0.9995
4	9.00	0.922	44.8	28.91	SFR 1.007
5	9.00	0.805	38.7	24.99	SSP 33.92

of Observations: 5

Calculations

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

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

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

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

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

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

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

Average I(chart): 34.5
 Average Flow over Sample (m3/min)
 0.72790338
 Enter Total Time (Hrs): 24.0
 Total flow over sample (m3/min)
 1048.298913
 Total flow over sample (CFM)
 37015.63468

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



Trade & Engineering

PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 10 January 2023
 Sampler: TE-6070 PM10 Serial No: 1409 Tech: Tony F.

Site Conditions

Barometric Pressure (in Hg): 29.00 Corrected Pressure (mm Hg): 736.8
 Temperature (deg F): 76.0 Temperature (deg K): 297.4
 Average Press. (in Hg): 29.50 Corrected Average (mm Hg): 723.9
 Average Temp. (deg F): 75.6 Average Temp. (deg K): 297.2

Calibration Orifice

Make: Tisch Environmental, Inc. Qstd Slope: 1.58304
 Model: TE-50268 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	1.152	55.2	37.42	Slope 31.5154
2	8.30	1.017	54.2	34.94	Intercept 1.7368
3	9.10	0.916	49.2	31.26	Corr. Coeff 0.9950
4	4.30	0.842	44.2	28.02	SFR 1.117
5	9.10	0.716	38.0	24.13	SSP 34.03

of Observations: 5

Calculations

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

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

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

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

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

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

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

Average I(chart): 34.9
 Average Flow over Sample (m3/min)
 1.098298194
 Enter Total Time (Hrs): 24.0
 Total flow over sample (m3/min)
 1561.336874
 Total flow over sample (CFM)
 55844.06701

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



Trade & Engineering

PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 4 October 2022
Sampler: TE-6070 PM10 Serial No: 3113 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 29.00 Corrected Pressure (mm Hg): 760.1
Temperature (deg F): 77.0 Temperature (deg K): 298.0
Average Press. (in Hg): 29.00 Corrected Average (mm Hg): 760.0
Average Temp. (deg F): 77.6 Average Temp. (deg K): 298.3

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)	
1	6.90	1.049	58.0	36.30	Linear Regression Slope 27.3102 Intercept 8.0454 Corr. Coeff 0.9947 SFR 1.130 SSP 62.14
2	8.10	0.903	53.0	32.19	
3	7.90	0.791	48.0	30.05	
4	7.10	0.706	43.0	26.82	
5	6.90	0.555	37.0	23.17	

of Observations: 5

Calculations

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

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

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

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

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

Average I(chart): 51.3
Average Flow over Sample (m3/min): 1.069302853
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min): 1453.488152
Total flow over sample (CFM): 51323.96044

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



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

of Observations: 5

Calculations

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

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

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

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

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

Average I(chart): 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

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



PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 4 October 2022
Sampler: TE-8070 2910 Serial No: 3245 Tech: Tony F.

Site Conditions

Barometric Pressure (in Hg): 29.47 Corrected Pressure (mm Hg): 755.0
Temperature (deg F): 74.9 Temperature (deg K): 297.9
Average Press. (in Hg): 28.76 Corrected Average (mm Hg): 760.2
Average Temp. (deg F): 77.0 Average Temp. (deg K): 299.0

Calibration Orifice

Make: Tisch Environmental, Inc. Qstd Slope: 1.36104
Model: TE-5010A Qstd Intercept: +0.01500
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	7.40	1.086	58.0	25.09	Slope 32.3113
2	6.40	0.946	50.0	31.33	Intercept 0.4538
3	6.40	0.940	45.0	26.19	Corr. Coeff 0.9961
4	3.60	0.781	40.0	25.04	SFR 1.132
5	2.70	0.660	34.0	21.30	SSP 59.04

of Observations: 5

Calculations

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

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

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

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

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

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

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

Average I(chart): 55.0
Average Flow over Sample (m3/min): 1.043330321
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min): 1533.198943
Total flow over sample (CFM): 540.64, 62058

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



PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 18 January 2023
Sampler: TE-8070 2910 Serial No: 3260 Tech: Tony F.

Site Conditions

Barometric Pressure (in Hg): 27.00 Corrected Pressure (mm Hg): 605.8
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: 1.36104
Model: TE-5010A Qstd Intercept: +0.01500
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	8.20	1.281	58.0	36.97	Slope 31.6154
2	6.30	1.051	54.0	35.68	Intercept 1.8101
3	5.10	0.949	49.0	32.39	Corr. Coeff 0.9992
4	4.90	0.872	44.0	29.03	SFR 1.104
5	3.20	0.742	38.0	25.01	SSP 55.87

of Observations: 5

Calculations

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

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

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

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

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

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

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

Average I(chart): 51.1
Average Flow over Sample (m3/min): 1.040313912
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min): 1526.852034
Total flow over sample (CFM): 53913.14732

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



PM10 High Volume Sampler Verification

Site Information

Location: – Site ID: – Date: 2 October 2023
Sampler: TE-6070 PM10 Serial No: 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

$Qa = 1/m(\sqrt{(H_2O)(Ta/Pa)}) - b$
 $IC = I(\sqrt{Ta/Pa})$

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

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

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

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



PM10 High Volume Sampler Verification

Site Information

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

Site Conditions

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

Calibration Orifice

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

Calibration Data

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

Calculations

$Qa = 1/m(\sqrt{(H_2O)(Ta/Pa)}) - b$
 $IC = I(\sqrt{Ta/Pa})$

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

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

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

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

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

Certificate of Analyzer Performance Testing

Calibrated Date: 1. 30-Jun-23 Certificate No.: 0123-001
Page: 1/1

Analyzer Instruments

Analyzer Type: 1. TIC Analyzer Manufacturer: 1. Thermo Environmental
Model: 1. 81 Serial No.: 1. 33107-72094-373

Environmental

Temperature: 1. 24.7 °C
Humidity: 1. 54.8 %RH

Calibration System

Calibrator Units

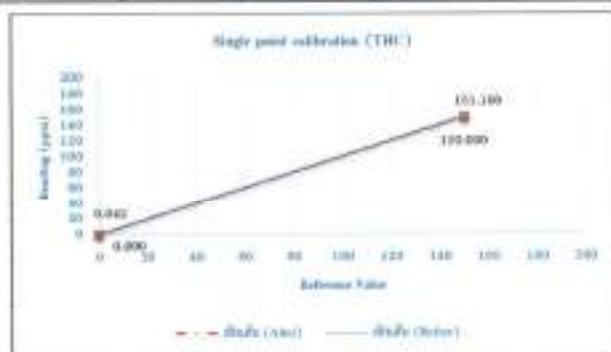
Gas Calibration: 1. Thermo Environmental Zero Air Generator: 1. AF1
Model: 1. 1400 Model: 1. 301
Serial No.: 1. 214011408 Serial No.: 1. 179

Standard Gas

Propane Conc.: 1. 1.00 ppm Cylinder No.: 1. 21W201046
Expiry Date: 1. 30-Sep-25

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
TIC	0.042	0.000	0.042	151	150	0.722
After						
TIC	0.000	0.000	0.000	150	150	0.000



Calibrated by:

Tong
(Mr. Tong Pium)

Certificate of Analyzer Performance Testing

Calibrated Date: 1. 30-Jun-23 Certificate No.: 0123-001
Page: 1/1

Analyzer Instruments

Analyzer Type: 1. TIC Analyzer Manufacturer: 1. Bosch
Model: 1. Series 8000 Serial No.: 1. 101

Environmental

Temperature: 1. 20.5 °C
Humidity: 1. 66.2 %RH

Calibration System

Calibrator Units

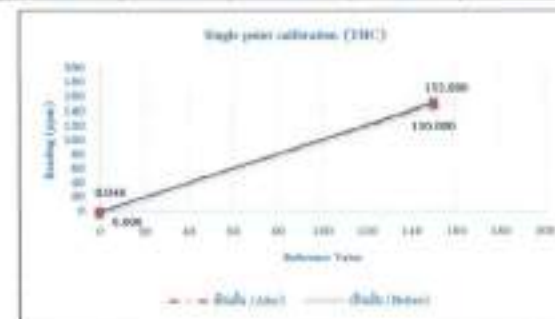
Gas Calibration: 1. Thermo Environmental Zero Air Generator: 1. AF1
Model: 1. 1400 Model: 1. 301
Serial No.: 1. 214011408 Serial No.: 1. 179

Standard Gas

Propane Conc.: 1. 1.00 ppm Cylinder No.: 1. 21W201046
Expiry Date: 1. 30-Sep-25

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
TIC	0.040	0.000	0.040	152	150	1.333
After						
TIC	0.000	0.000	0.000	152	150	0.000



Calibrated by:

Tong
(Mr. Tong Pium)

Certificate of Analyzer Performance Testing

Calibrated Date: 11-Mar-22 Certificate No.: 0002-001
Page: 1/1

Analyzer Instruments
 Analyzer Type: 1 CO Analyser Manufacturer: 1 Thermo Environmental
 Model: 1 48C Serial No.: 1 004011041

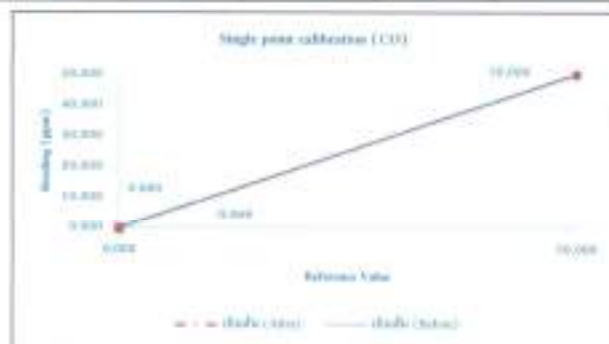
Environmental
 Temperature: 1 24.2 °C
 Humidity: 1 53.0 %RH

Calibration System
Calibrator Units
 Gas Calibration: 1 Thermo Environmental Zero Air Generator: 1 AP1
 Model: 1 148C Model: 1 001
 Serial No.: 1 014011010 Serial No.: 1 178

Standard Gas
 NO Conc.: 1 0 ppm Cylinder No.: 1 CCT100007
 SO2 Conc.: 1 0 ppm Expiry Date: 1 31-Dec-22
 CO Conc.: 1 0.01 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Diff (W)	Reading Value (ppm)	Expected Value (ppm)	Diff (W)
Before						
CO	0.000	0.000	0.00	20.2	20.000	0.20
After						
CO	0.000	0.000	0.00	20.0	20.000	0.00



Calibrated by:

Top
(Ms. Ting Puan)

Certificate of Analyzer Performance Testing

Calibrated Date: 11-Mar-22 Certificate No.: 0002-001
Page: 1/1

Analyzer Instruments
 Analyzer Type: 1 CO Analyser Manufacturer: 1 Thermo Environmental
 Model: 1 48C Serial No.: 1 004011041

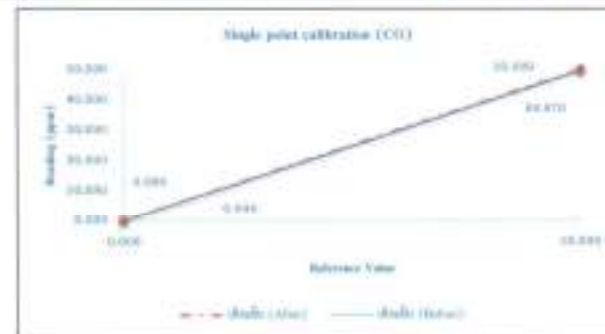
Environmental
 Temperature: 1 24.2 °C
 Humidity: 1 53.4 %RH

Calibration System
Calibrator Units
 Gas Calibration: 1 Thermo Environmental Zero Air Generator: 1 AP1
 Model: 1 148C Model: 1 001
 Serial No.: 1 014011010 Serial No.: 1 178

Standard Gas
 NO Conc.: 1 0 ppm Cylinder No.: 1 CCT100007
 SO2 Conc.: 1 0 ppm Expiry Date: 1 31-Dec-22
 CO Conc.: 1 0.01 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Diff (W)	Reading Value (ppm)	Expected Value (ppm)	Diff (W)
Before						
CO	0.004	0.000	0.04	40.870	40.000	-0.86
After						
CO	0.000	0.000	0.00	40.800	40.000	0.80



Calibrated by:

Top
(Ms. Ting Puan)

Certificate of Analyzer Performance Testing

Calibrated Date: 1-Aug-22 Certificate No.: 0025-004
Page: 1/1

Analyzer Instruments
 Analyzer Type: 1: E10 Analyser Manufacturer: 1: Thermo Environmental
 Model: 1: 49C Serial No.: 1: 000011009

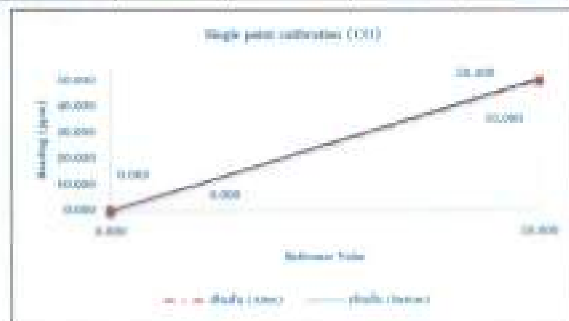
Environmental
 Temperature: 1: 25.2 °C
 Humidity: 1: 31.2 %RH

Calibration System
Calibrator Units
 Gas Calibration: 1: Thermo Environmental Zero Air Generator 1: 301
 Model: 1: 1497 Model: 1: 701
 Serial No.: 1: 0149714106 Serial No.: 1: 179

Standard Gas
 NO Conc.: 1: 5 ppm Cylinder No.: 1: C17402207
 SO2 Conc.: 1: 5 ppm Expiry Date: 1: 31-Nov-23
 CO Conc.: 1: 50 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Diff (m)	Reading Value (ppm)	Expected Value (ppm)	Diff (m)
Before						
CO	0.000	0.000	-0.07	50.4	50.000	-0.40
After						
CO	0.000	0.000	0.00	50.0	50.000	0.00



Calibrated by:

Tong
(Mr. Tong Ping)

Certificate of Analyzer Performance Testing

Calibrated Date: 1-Aug-22 Certificate No.: 0025-004
Page: 1/1

Analyzer Instruments
 Analyzer Type: 1: E10 Analyser Manufacturer: 1: Thermo Environmental
 Model: 1: 49C Serial No.: 1: 000011009

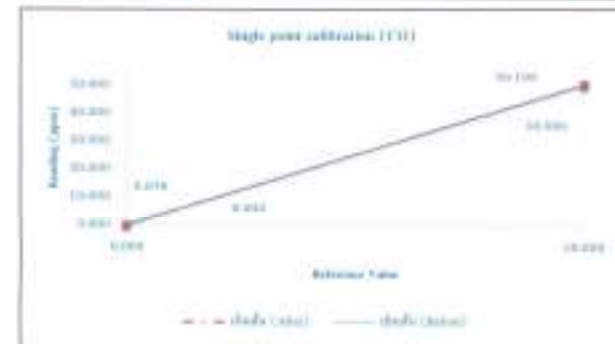
Environmental
 Temperature: 1: 25.2 °C
 Humidity: 1: 31.2 %RH

Calibration System
Calibrator Units
 Gas Calibration: 1: Thermo Environmental Zero Air Generator 1: 301
 Model: 1: 1497 Model: 1: 701
 Serial No.: 1: 0149714106 Serial No.: 1: 179

Standard Gas
 NO Conc.: 1: 5 ppm Cylinder No.: 1: C17402207
 SO2 Conc.: 1: 5 ppm Expiry Date: 1: 31-Nov-23
 CO Conc.: 1: 50 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Diff (m)	Reading Value (ppm)	Expected Value (ppm)	Diff (m)
Before						
CO	0.075	0.000	-0.08	50.7	50.000	-0.20
After						
CO	0.000	0.000	0.00	50.0	50.000	0.00



Calibrated by:

Tong
(Mr. Tong Ping)

Certificate of Analyzer Performance Testing

Calibrated Date: 10-Aug-21 Certificate No.: 0023-001
Page: 1/1

Analyzer Instruments
 Analyzer Type: 1 CO Analyzer Manufacturer: 1 Thermo Environmental
 Model: 1 49C Serial No.: 1 508011348

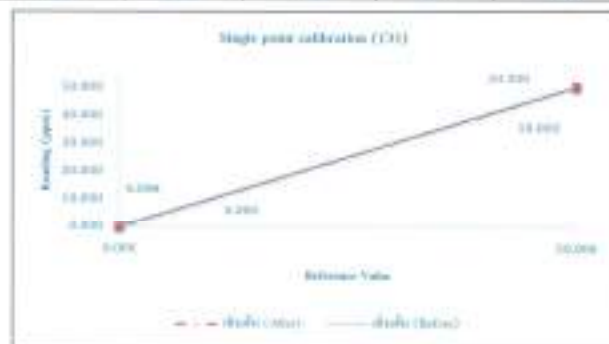
Environmental
 Temperature: 1 28.3 °C
 Humidity: 1 61.3 %RH

Calibration System
Calibrator Units
 Gas Calibration: 1 Thermo Environmental Zero Air Generator: 1 API
 Model: 1 4407 Model: 1 793
 Serial No.: 1 0148114128 Serial No.: 1 178

Standard Gas
 NO Conc.: 1 0 ppm Cylinder No.: 1 CCT02227
 SO2 Conc.: 1 0 ppm Expiry Date: 1 31-Dec-21
 CO Conc.: 1 0 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Difference (W)	Reading Value (ppm)	Expected Value (ppm)	Difference (W)
Before						
CO	0.000	0.000	0.10	28.3	30.000	0.00
After						
CO	0.000	0.000	0.00	28.0	30.000	0.00



Calibrated by:

Taylor
(Mr. Tony Pines)

Certificate of Analyzer Performance Testing

Calibrated Date: 10-Jun-21 Certificate No.: 0023-001
Page: 1/1

Analyzer Instruments
 Analyzer Type: 1 CO Analyzer Manufacturer: 1 Thermo Environmental
 Model: 1 49C Serial No.: 1 508011348

Environmental
 Temperature: 1 25.3 °C
 Humidity: 1 51.3 %RH

Calibration System
Calibrator Units
 Gas Calibration: 1 Thermo Environmental Zero Air Generator: 1 API
 Model: 1 4407 Model: 1 793
 Serial No.: 1 0148114128 Serial No.: 1 178

Standard Gas
 NO Conc.: 1 0 ppm Cylinder No.: 1 CCT02227
 SO2 Conc.: 1 0 ppm Expiry Date: 1 31-Dec-21
 CO Conc.: 1 0 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Difference (W)	Reading Value (ppm)	Expected Value (ppm)	Difference (W)
Before						
CO	0.000	0.000	0.08	28.1	30.000	0.10
After						
CO	0.000	0.000	0.00	28.0	30.000	0.00



Calibrated by:

Taylor
(Mr. Tony Pines)

Certificate of Analyzer Performance Testing

Calibrated Date: 21-Nov-20
Certificate No.: 0122-003
Page: 1/1

Analyzer Instruments

Analyzer Type: 1 CO Analyzer
Model: 2 48C
Manufacturer: 1 Thermo Environmental
Serial No.: 2 T1021-003

Environmental

Temperature: 2 26.4 °C
Humidity: 1 65.7 %RH

Calibration System

Calibrator Units

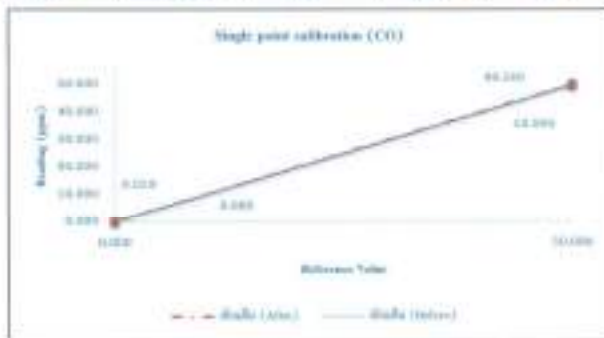
Gas Calibration: 1 Thermo Environmental
Model: 1 1402
Serial No.: 2 014011412
Zero Air Generator: 1 AFI
Model: 2 101
Serial No.: 1 179

Standard Gas

NO Conc.: 1 0 ppm
NO2 Conc.: 1 0 ppm
CO Conc.: 1 0.1 ppm
Cylinder No.: 1 15150227
Expiry Date: 1 21-Nov-20

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	DR% (w)	Reading Value (ppm)	Expected Value (ppm)	DR% (w)
Below						
CO	0.025	0.000	0.00	95.240	95.000	-0.24
Above						
CO	0.000	0.000	0.00	95.000	95.000	0.00



Calibrated by:

Tanfer
(Mr. Wang Wang)

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 : 481

Serial No. : 1172750082

Environmental

Temperature : 24.7 °C

Humidity : 52.8 %RH

Calibration System

Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 140C

Model : 701

Serial No. : 514811456

Serial No. : 179

Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC750227

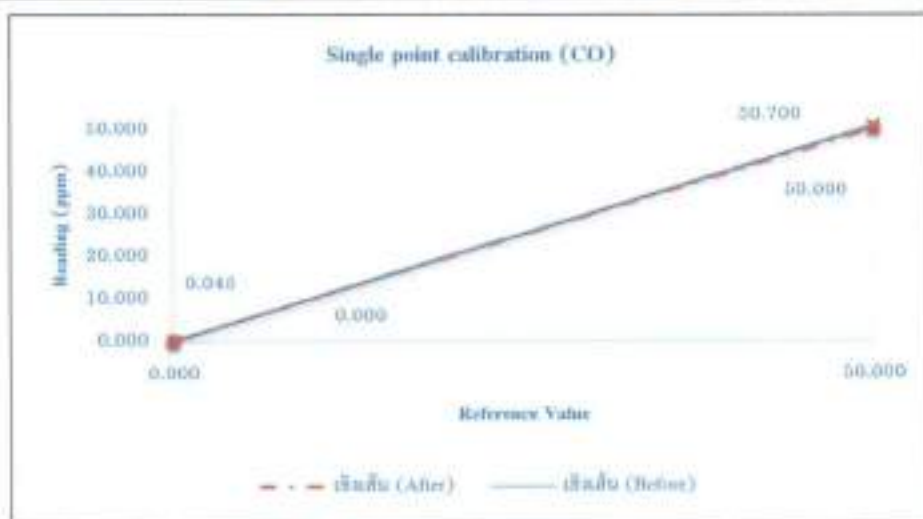
SO2 Conc. : 2 ppm

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	0.045	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 :

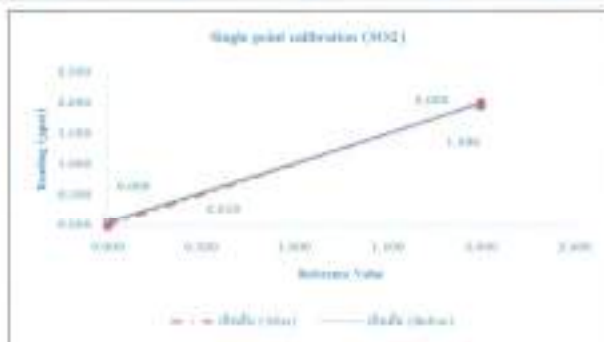
Tong Pima
(Mr. Tong Pima)

Certificate of Analyzer Performance Testing

Calibrated Date	2	20-Aug-22	Certificate No.	2	0022-002	
			Page	2	1/1	
Analyzer Instruments						
Analyzer Type	2	NO2 Analyzer	Manufacturer	2	Thermo Environmental	
Model	2	93C	Serial No.	2	430-10855-347	
Environmental						
Temperature	2	33.1	°C			
Humidity	2	47.8	%RH			
Calibration System						
Calibrator Units						
Gas Calibration	1	Thermo Environmental	Zero Air Generator	2	API	
Model	2	146C	Model	2	101	
Serial No.	2	014611438	Serial No.	2	179	
Standard Gas						
NO Conc.	1	0	ppm	Cylinder No.	2	077100227
SO2 Conc.	1	0	ppm	Expiry Date	2	31-Dec-22
CO Conc.	1	0	ppm			

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Diff (ppm)	Reading Value (ppm)	Expected Value (ppm)	Diff (ppm)
Before						
NO2	0.000	0.000	0.00	1.99	2.000	-0.01
After						
NO2	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by:

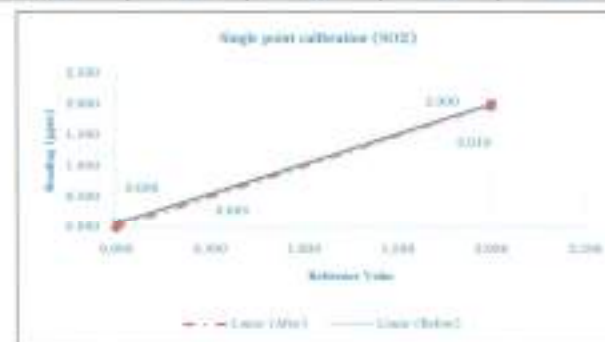
Tong
(Mr. Tong Phee)

Certificate of Analyzer Performance Testing

Calibrated Date		20-Sep-22	Certificate No.		0022-004	
			Page		1/1	
Analyzer Instruments						
Analyzer Type		NO2 Analyzer	Manufacturer		Thermo Environmental	
Model		93C	Serial No.		430-10855-347	
Environmental						
Temperature		36.2	°C			
Humidity		44.8	%RH			
Calibration System						
Calibrator Units						
Gas Calibration		Thermo Environmental	Zero Air Generator		API	
Model		146C	Model		101	
Serial No.		014611438	Serial No.		179	
Standard Gas						
NO Conc.		0	ppm		Cylinder No.	171700227
SO2 Conc.		0	ppm		Expiry Date	31-Dec-23
CO Conc.		0	ppm			

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Diff (ppm)	Reading Value (ppm)	Expected Value (ppm)	Diff (ppm)
Before						
NO2	0.000	0.000	0.00	2.01	2.000	0.01
After						
NO2	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by:

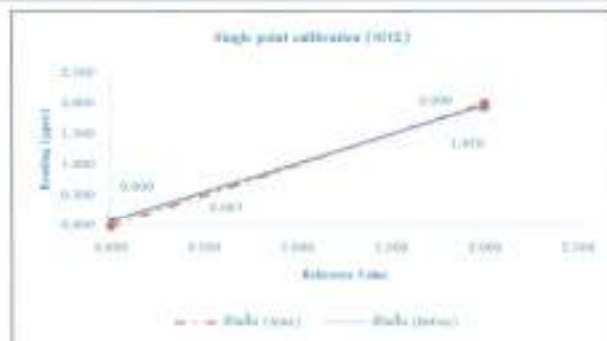
Tong
(Mr. Tong Phee)

Certificate of Analyzer Performance Testing

Calibrated Date	2	26-Aug-22	Certificate No.	1	0023-001	
			Page	2	1/1	
Analyzer Instruments						
Analyzer Type	1	NO ₂ Analyzer	Manufacturer	1	Thermo Environmental	
Model	1	43C	Serial No.	2	43C-77000-007	
Environmental						
Temperature	1	24.3	°C			
Humidity	1	46.3	%RH			
Calibration System						
Calibrator Units						
Gas Calibration	1	Thermo Environmental	Zero Air Generator	1	AP5	
Model	2	149C	Model	1	700	
Serial No.	1	014011129	Serial No.	1	179	
Standard Gas						
NO Conc.	1	5	ppm	Cylinder No.	1	CC750003
NO ₂ Conc.	1	5	ppm	Expiry Date	1	31-Nov-22
CO Conc.	1	50	ppm			

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Diff (ppm)	Reading Value (ppm)	Expected Value (ppm)	Diff (ppm)
Before						
NO ₂	0.007	0.000	-0.007	1.97	1.995	-0.025
After						
NO ₂	0.000	0.000	0.000	2.00	2.000	0.000



Calibrated by:

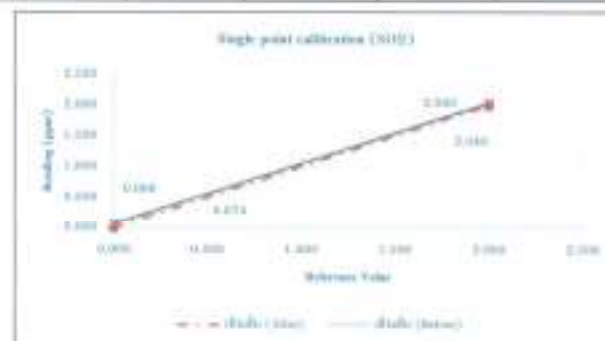
Tong
(Mr. Tong Ruan)

Certificate of Analyzer Performance Testing

Calibrated Date	2	26-Aug-22	Certificate No.	1	0023-001	
			Page	2	1/1	
Analyzer Instruments						
Analyzer Type	1	NO ₂ Analyzer	Manufacturer	1	Thermo Environmental	
Model	1	43C	Serial No.	1	43C-77000-007	
Environmental						
Temperature	1	24.3	°C			
Humidity	1	46.3	%RH			
Calibration System						
Calibrator Units						
Gas Calibration	1	Thermo Environmental	Zero Air Generator	1	AP5	
Model	1	149C	Model	1	700	
Serial No.	1	014011129	Serial No.	1	179	
Standard Gas						
NO Conc.	1	5	ppm	Cylinder No.	1	CC750003
NO ₂ Conc.	1	5	ppm	Expiry Date	1	31-Nov-22
CO Conc.	1	50	ppm			

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Diff (ppm)	Reading Value (ppm)	Expected Value (ppm)	Diff (ppm)
Before						
NO ₂	0.074	0.000	0.074	2.04	2.000	0.040
After						
NO ₂	0.000	0.000	0.000	2.00	2.000	0.000



Calibrated by:

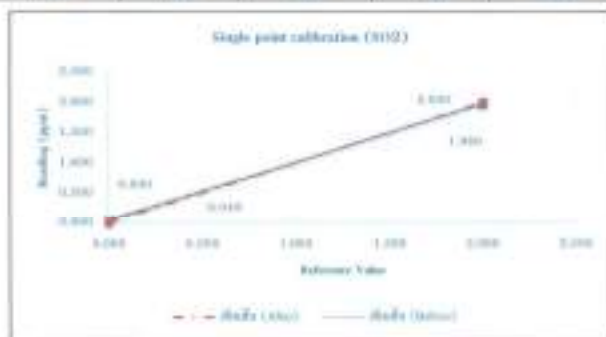
Tong
(Mr. Tong Ruan)

Certificate of Analyzer Performance Testing

Calibrated Date	1	1-Apr-22	Certificate No.	1	0001-000	
			Page	1	1/1	
Analyzer Instruments						
Analyzer Type	1	910 Analyzer	Manufacturer	1	Thermo Environmental	
Model	1	430	Serial No.	1	00010-304	
Environmental						
Temperature	1	22.2	°C			
Humidity	1	52.2	%RH			
Calibration System						
Calibrator Units						
Gas Calibration	1	Thermo Environmental	Zero Air Generator	1	AP5	
Model	1	140C	Model	1	791	
Serial No.	1	0110111450	Serial No.	1	078	
Standard Gas						
NO Conc.	1	0	ppm	Cylinder No.	1	CTY34227
NO2 Conc.	1	0	ppm	Expiry Date	1	31-Nov-23
CO Conc.	1	0	ppm			

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Diff (ppm)	Reading Value (ppm)	Expected Value (ppm)	Diff (ppm)
Before						
NO2	0.040	0.000	0.04	1.990	2.000	-0.010
After						
NO2	0.000	0.000	0.00	0.000	2.000	-0.00



Calibrated by:

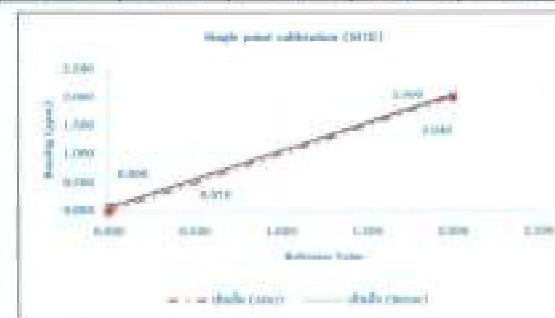
Top
(Mr. Tony Poon)

Certificate of Analyzer Performance Testing

Calibrated Date	1	9-10-22	Certificate No.	1	1002-000	
			Page	1	1/1	
Analyzer Instruments						
Analyzer Type	1	910 Analyzer	Manufacturer	1	Thermo Environmental	
Model	1	430	Serial No.	1	07143000-000	
Environmental						
Temperature	1	24.3	°C			
Humidity	1	33.3	%RH			
Calibration System						
Calibrator Units						
Gas Calibration	1	Thermo Environmental	Zero Air Generator	1	AP1	
Model	1	040C	Model	1	791	
Serial No.	1	0100111450	Serial No.	1	110	
Standard Gas						
NO Conc.	1	0	ppm	Cylinder No.	1	CTY34227
NO2 Conc.	1	0	ppm	Expiry Date	1	31-Nov-23
CO Conc.	1	0	ppm			

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Diff (ppm)	Reading Value (ppm)	Expected Value (ppm)	Diff (ppm)
Before						
NO2	0.039	0.000	0.04	1.990	2.000	-0.010
After						
NO2	0.000	0.000	0.00	1.990	2.000	-0.010



Calibrated by:

Top
(Mr. Tony Poon)

Certificate of Analyzer Performance Testing

Calibrated Date : 3-Aug-23

Certificate No. : 0623-001

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. : 014811658

Serial No. : 179

Standard Gas

NO Conc. : 2 ppm

Cylinder No. : CC760227

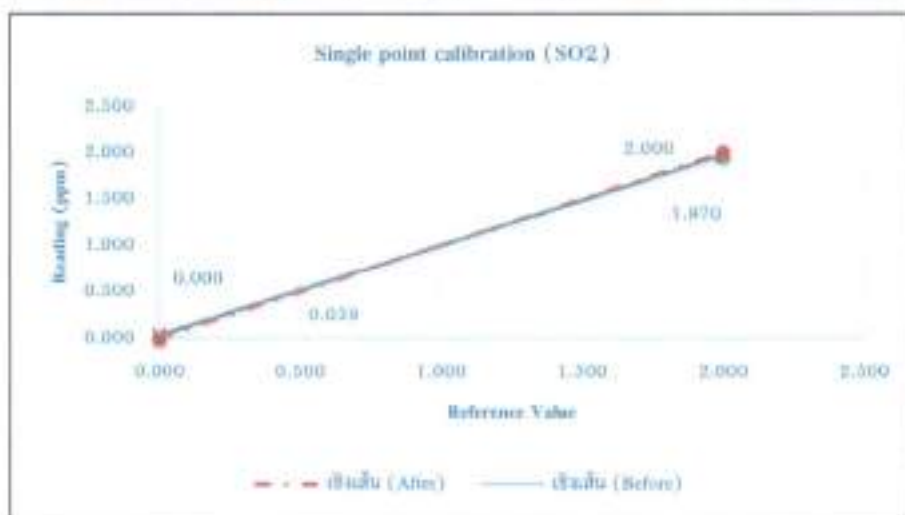
SO2 Conc. : 2 ppm

Expire Date : 31-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 Pima)

Certificate of Analyzer Performance Testing

Calibrated Date: 10-Aug-23 Certificate No.: 0001-001
Page: 1/1

Analyzer Instruments
 Analyzer Type: NO/NO2/NOx Analyzer Manufacturer: Thermo Environmental
 Model: 42C Serial No.: 60180-001

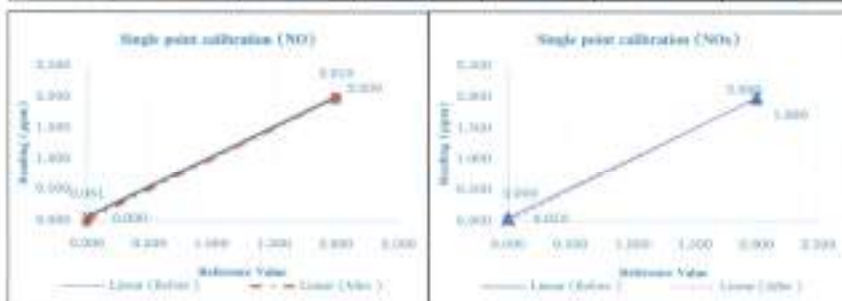
Environmental
 Temperature: 25.3 °C
 Humidity: 40.2 %RH

Calibration System
Calibrator Units
 Gas Calibrator: Thermo Environmental Zero Air Generator: AP1
 Model: 149C Model: 701
 Serial No.: 01481143X Serial No.: 179

Standard Gas
 NO Conc.: 0 ppm Cylinder No.: CCT00001
 NO2 Conc.: 0 ppm Expiry Date: 21-Nov-23
 CO Conc.: 0 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Diff. (w)	Reading Value (ppm)	Expected Value (ppm)	Diff. (w)
Before						
NO	0.001	0.000	0.00	0.01	0.00	-0.01
NO2	0.000	0.000	0.00	1.00	0.00	-0.99
After						
NO	0.000	0.000	0.00	0.01	0.00	-0.01
NO2	0.000	0.000	0.00	0.00	0.00	0.00



Calibrated by:

Tong
(Ms. Tong Piao)

Certificate of Analyzer Performance Testing

Calibrated Date: 11-May-23 Certificate No.: 0001-002
Page: 1/1

Analyzer Instruments
 Analyzer Type: NO/NO2/NOx Analyzer Manufacturer: Thermo Environmental
 Model: 42C Serial No.: 60180-001

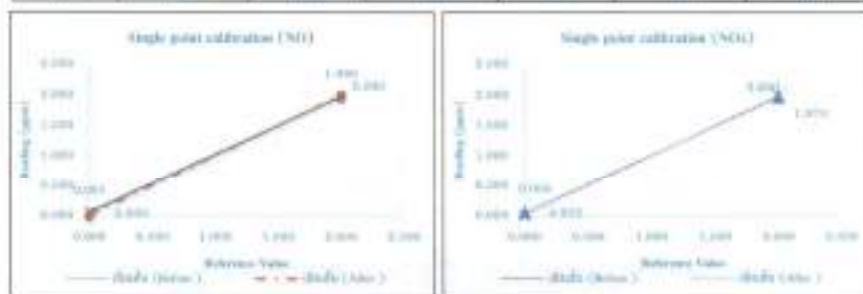
Environmental
 Temperature: 24.1 °C
 Humidity: 55.4 %RH

Calibration System
Calibrator Units
 Gas Calibrator: Thermo Environmental Zero Air Generator: AP1
 Model: 149C Model: 701
 Serial No.: 01481143X Serial No.: 179

Standard Gas
 NO Conc.: 0 ppm Cylinder No.: CCT00001
 NO2 Conc.: 0 ppm Expiry Date: 21-Nov-23
 CO Conc.: 0 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Diff. (w)	Reading Value (ppm)	Expected Value (ppm)	Diff. (w)
Before						
NO	0.000	0.000	0.00	1.00	0.00	-0.99
NO2	0.000	0.000	0.00	1.00	0.00	-0.99
After						
NO	0.000	0.000	0.00	0.00	0.00	0.00
NO2	0.000	0.000	0.00	0.00	0.00	0.00



Calibrated by:

Tong
(Ms. Tong Piao)

Certificate of Analyzer Performance Testing

Calibrated On: 1-Apr-22 Certificate No.: 0403-004
Page: 1/1

Analyzer Instruments
 Analyzer Type: NO/NO₂/NO_x Analyzer Manufacturer: Thermo Environmental
 Model: 42C Serial No.: 73424-023

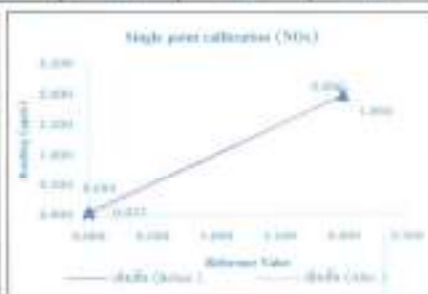
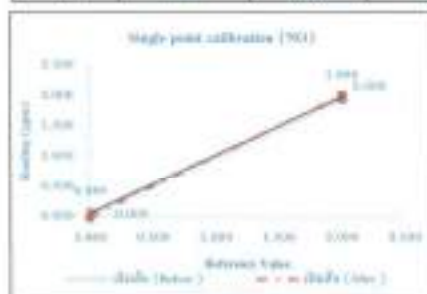
Environmental
 Temperature: 23.2 °C
 Humidity: 59.2 %RH

Calibration System
Calibrator Units
 Gas Calibration: Thermo Environmental Zero Air Generator: Z95
 Model: 146C Model: 701
 Serial No.: 5149114108 Serial No.: 179

Standard Gas
 NO Conc.: 0 ppm Cylinder No.: YY730422
 NO₂ Conc.: 0 ppm Expiry Date: 21-Nov-22
 CO Conc.: 0 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.000	0.000	0.00	0.00	0.00	-1.00
NO ₂	0.007	0.000	0.00	0.00	0.00	-0.00
After						
NO	0.000	0.000	0.00	0.00	0.00	0.00
NO ₂	0.000	0.000	0.00	0.00	0.00	0.00



Calibrated by:

Tong
(Mr. Tong Pina)

Certificate of Analyzer Performance Testing

Calibrated On: 4-May-22 Certificate No.: 0710-002
Page: 1/1

Analyzer Instruments
 Analyzer Type: NO/NO₂/NO_x Analyzer Manufacturer: Thermo Environmental
 Model: 42C Serial No.: 63470-109

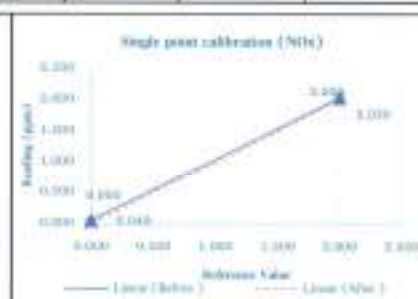
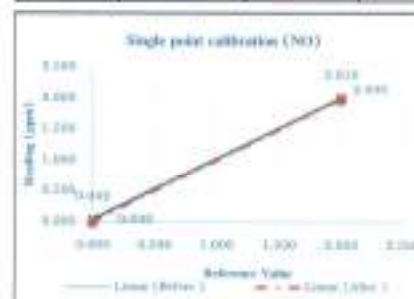
Environmental
 Temperature: 23.1 °C
 Humidity: 45.4 %RH

Calibration System
Calibrator Units
 Gas Calibration: Thermo Environmental Zero Air Generator: Z95
 Model: 146C Model: 701
 Serial No.: 5149114108 Serial No.: 179

Standard Gas
 NO Conc.: 0 ppm Cylinder No.: CT760227
 NO₂ Conc.: 0 ppm Expiry Date: 21-Nov-22
 CO Conc.: 0 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.002	0.000	0.00	0.01	0.00	0.00
NO ₂	0.003	0.000	0.00	0.00	0.00	1.00
After						
NO	0.000	0.000	0.00	0.00	0.00	0.00
NO ₂	0.000	0.000	0.00	0.00	0.00	0.00



Calibrated by:

Tong
(Mr. Tong Pina)

Certificate of Analyzer Performance Testing

Calibrated Date : 9-Aug-20 Certificate No. : 0023-000
Page : 1/1

Analyzer Instruments
Analyzer Type : NO/NO_x/NH₃ Analyzer Manufacturer : Thermo Environmental
Model : 43C Serial No. : 008811077

Environmental
Temperature : 24.9 °C
Humidity : 41.2 %RH

Calibration System
Calibrator Units
Gas Calibration : Thermo Environmental Zero Air Generator : AP1
Model : 148C Model : 701
Serial No. : 014811459 Serial No. : 178

Standard Gas
NO Conc. : 0 ppm Cylinder No. : CCT00007
NO₂ : 2 ppm Expiry Date : 31-Nov-21
CO Conc. : 10 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)
Before						
NO	0.061	0.000	0.06	1.99	2.00	-0.01
NO ₂	0.000	0.000	0.00	0.01	0.00	0.01
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NO ₂	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by :

TOP
(Mr. Yang Pina)

Certificate of Analyzer Performance Testing

Calibrated Date : 11-Aug-20 Certificate No. : 0720-000
Page : 1/1

Analyzer Instruments
Analyzer Type : NO/NO_x/NH₃ Analyzer Manufacturer : Thermo Environmental
Model : 43C Serial No. : 01270-000

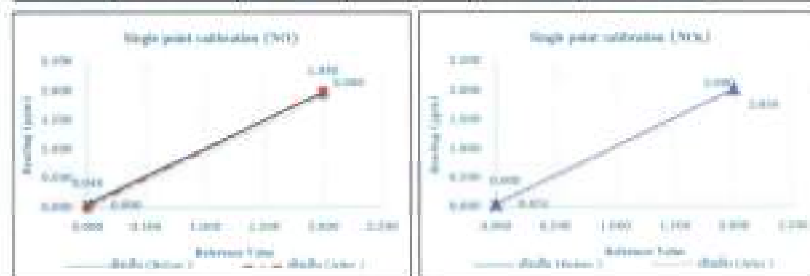
Environmental
Temperature : 25.0 °C
Humidity : 60.0 %RH

Calibration System
Calibrator Units
Gas Calibration : Thermo Environmental Zero Air Generator : AP1
Model : 148C Model : 701
Serial No. : 014811459 Serial No. : 178

Standard Gas
NO Conc. : 0 ppm Cylinder No. : CCT00007
NO₂ : 2 ppm Expiry Date : 31-Nov-21
CO Conc. : 10 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)
Before						
NO	0.048	0.000	0.05	1.99	2.00	-0.01
NO ₂	0.002	0.000	0.00	2.00	2.00	0.00
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NO ₂	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by :

TOP
(Mr. Yang Pina)

เอกสารการสอบเทียบเครื่องมือตรวจวัดความชื้นสะท้อน

Calibration Certificate

Part Number: 721A2601
 Description: Micromate with DIN Geophone
 Serial Number: UM20454
 Calibration Date: April 21, 2023
 Calibration Reference Equipment: SRV-AFR 714J7401

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.

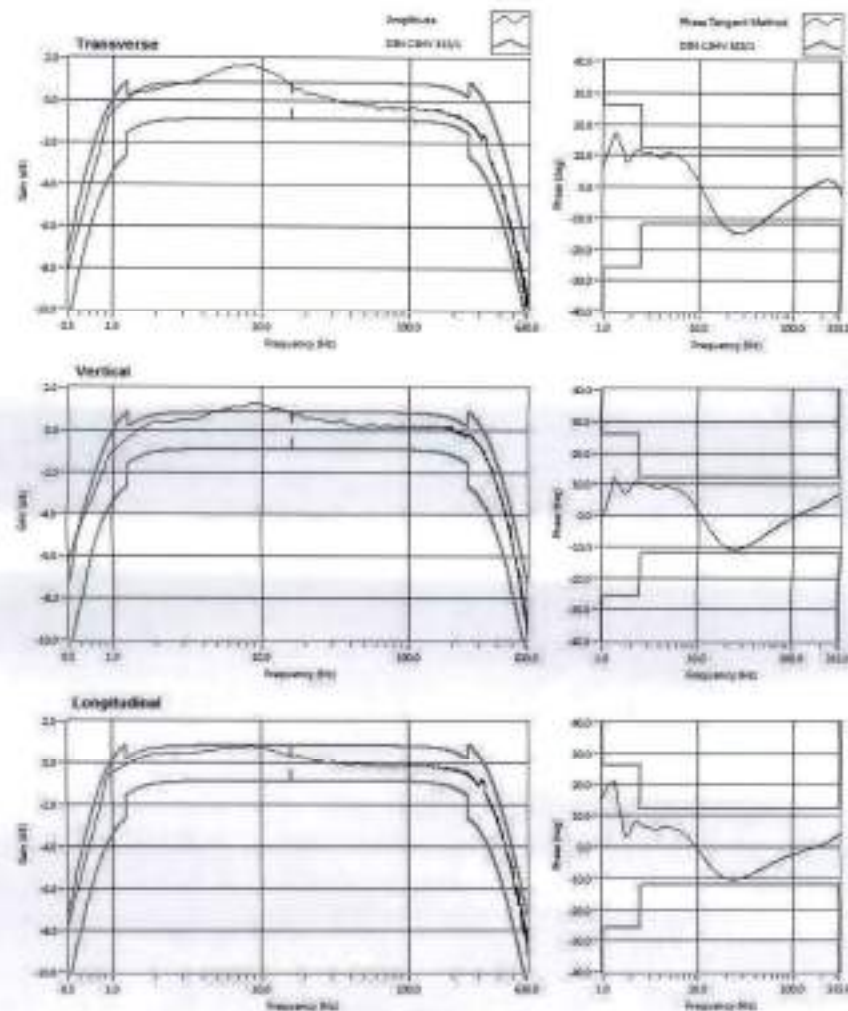
Calibrated By:

Martin Hogue



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

Frequency Response of UM20454 (As Found)



Thursday, April 20, 2023



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.: CP20220909EA

Operation No.: CP2022090011

Certificate of Calibration

Equipment: Vibration Meter

Manufacturer: Instanteil

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.Bai Khung, A.Sam Phan,
Nakhon Phanom 73210

Received Date: 15 September 2022

Calibrated Date: 4 - 6 October 2022

Issued Date: 12 October 2022

Calibrated by: Mr. Juntaporn Kunhakorn

Approved by:

(Mr. Sittichai Swaksunyswong)
Group Manager

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ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20220909EA

Calibration Report

Equipment: Vibration Meter

Manufacturer: Instanteil

Model: Micromate

Serial No.: UM14163

ID No.: VB-01-001

Ambient Temperature: $(23 \pm 5) ^\circ\text{C}$

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

Method of Calibration :-

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

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard Accelerometer	8305	2708237	AV-0010-21	30-Nov-2022
2) Measuring Amplifier	2525	3016651	AV-0007-22	9-Jun-2023
3) FULSE Multi-analyzer system	3050-A-060	2705645	CO20210013EA	1-Dec-2022
4) Pressure humidity and Temperature Transmitter	HMT331	K3810009	CO20220120EA	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.: CP202203095A

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	10.013	9.947	-0.066	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	9.857	-0.158	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.: CP202203095A

Calibration Report

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

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty \pm (%)	Direction
4.0	10	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	



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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 --



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

975 Moo 6, Bangsao Industrial Estate, Soi 8, Sukhumvit Road km 37

Phraek So, Mutang Samut Prakan, Samut Prakan 10280

Tel: +66 2709 4991 Fax: +66 2304 0917

Certificate No.: CP20230148EA

Operation No.: CP2023020050

Certificate of Calibration

Equipment: Vibration Meter

Manufacturer: InstanteL

Model/Type: Micromate

Serial No.: UM16048

ID No.: VB-03-003

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

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

Received Date: 28 February 2023

Calibrated Date: 7 - 9 March 2023

Issued Date: 14 March 2023

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: _____

[Mr. Sittichai Swakunyawong]

Group Manager

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ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20230148EA

Calibration Report

Equipment: Vibration Meter
Manufacturer: Instabel
Model: Micromate
Serial No.: UM16048
ID No.: V9-01-003
Ambient Temperature: $(23 \pm 5) ^\circ\text{C}$
Relative Humidity: $(50 \pm 15) \%$

Method of Calibration :-

In-house method : CC-SVC04 by comparison with standard accelerometer.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard Accelerometer	8305-001	30120	AV-0013-21	30-May-2023
2) Measuring Amplifier	2525	3016651	AV-0057-32	9-Jun-2023
3) PULSE Multi-analyzer system	3560-C	2705645	CQ00230003EA	25-Dec-2023
4) Humidity and Temperature Transmitter	HMT331	K3810009	CD20220120EA	23-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)



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20230148EA

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	10.554	0.546	1.50	Linearity (1)
5.0	10.000	10.004	10.514	0.510	1.50	
6.3	10.000	10.007	10.633	0.626	1.50	
8.0	10.000	10.008	10.565	0.557	1.50	
10.0	10.000	10.006	10.341	0.335	1.50	
12.5	10.000	9.997	10.262	0.265	1.50	
16.0	10.000	9.998	10.262	0.264	1.50	
	20.000	19.997	20.548	0.551	1.50	
	30.000	29.995	30.786	0.791	1.50	
	50.000	49.992	51.153	1.161	1.50	
20.0	10.000	10.003	10.294	0.291	1.50	
25.0	10.000	10.000	10.341	0.341	1.50	
31.5	10.000	10.010	10.572	0.562	1.50	
40.0	10.000	9.998	10.420	0.422	1.50	
50.0	10.000	10.017	10.428	0.411	1.50	
55.0	10.000	10.001	10.522	0.521	1.50	
63.0	10.000	10.010	10.688	0.678	1.50	
80.0	10.000	10.004	10.680	0.676	1.50	



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20230148EA

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	9.970	10.853	0.883	1.50	Vertical (V)
5.0	10.000	9.938	10.869	0.871	1.50	
6.3	10.000	10.000	10.901	0.901	1.50	
8.0	10.000	10.003	10.536	0.535	1.50	
10.0	10.000	10.000	10.467	0.467	1.50	
12.5	10.000	10.004	10.412	0.408	1.50	
16.0	10.000	10.001	10.428	0.427	1.50	
	20.000	19.997	20.761	0.764	1.50	
	30.000	29.995	31.031	1.036	1.50	
	50.000	49.978	51.516	1.538	1.50	
20.0	10.000	10.008	10.491	0.493	1.50	
25.0	10.000	10.000	10.675	0.675	1.50	
31.5	10.000	10.006	10.530	0.522	1.50	
40.0	10.000	10.004	10.609	0.609	1.50	
50.0	10.000	9.994	10.593	0.599	1.50	
62.0	10.000	10.001	10.688	0.687	1.50	
63.0	10.000	10.008	10.845	0.837	1.50	
80.0	10.000	10.008	10.940	0.932	1.50	



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20230148EA

Calibration Report

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

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
4.0	10.000	10.006	10.711	0.705	1.50	Vertical (V)
5.0	10.000	10.003	10.554	0.551	1.50	
6.3	10.000	10.008	10.562	0.554	1.50	
8.0	10.000	9.991	10.128	0.137	1.50	
10.0	10.000	10.008	10.065	0.057	1.50	
12.5	10.000	10.001	10.057	0.056	1.50	
16.0	10.000	10.004	10.065	0.061	1.50	
	20.000	19.997	20.114	0.117	1.50	
	30.000	30.010	30.148	0.138	1.50	
	50.000	49.992	50.269	0.277	1.50	
20.0	10.000	9.993	10.175	0.182	1.50	
25.0	10.000	10.003	9.766	-0.237	1.50	
31.5	10.000	10.003	10.120	0.117	1.50	
40.0	10.000	10.006	10.262	0.256	1.50	
50.0	10.000	10.001	10.333	0.332	1.50	
62.0	10.000	10.000	10.574	0.574	1.50	
63.0	10.000	9.998	10.451	0.453	1.50	
80.0	10.000	10.001	10.751	0.750	1.50	

Remark

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

-- End of Report --

Calibration Certificate

Part Number: 721A2601
Description: Micromate with DIN Geophone
Serial Number: UM21467
Calibration Date: MAY 29 2023
Calibration Reference Equipment: 714/7403

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 Lisagett 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 THORS disponible en téléchargement gratuit sur le site Web d'Instantel: 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

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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: 221280063

Aquion Final Test

- (x) Pump Calibration, Range and Accuracy
- (x) Suppressor Control, Cal and Accuracy
- (x) Column Heater, Cal and Check
- (x) Detector Heater, Cal and Accuracy
- (x) Conductivity Detector Cal, Noise and Linearity
- (x) Degass Calibration

- (x) Injection Valve Precision
- (x) Retention and TLL pH Test
- (x) Injection Valve Functionality
- (x) Leak Sensors
- (x) 16-Port Test
- (x) Eluent Generator Calibration

Tester's Signature: Angel Ruiz

Date: 22 Dec 2022

60-00000 Rev B



Aquion Pump Summary Test Report

Instrument Name	Model	Serial Number	Moduleware
Module	Aquion	221280114	3.1.0
Pump			
Detector		221280063	

Sequence Name: 1_Aquion_Pump_FDG
Sequence Run Date: 22 Dec 2022
Sequence Comment: Aquion Pump Test Final

Flow Accuracy Test				
Test Run	Pressure	Flow Rate		
	Measured	Measured	Accuracy	<= 0.80%
Flow Accuracy: 1mL/min	2132	0.9988	0.115%	Pass
Flow Accuracy: 2mL/min	2467	1.9980	0.066%	Pass

Pressure Ripple Test			
Test Run	Pressure	Pressure Ripple	
	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	5.1.0
Pump			
Detector		221280053	

Sequence Name: 2_Aquion_Detector_F00
Sequence Run Date: 22 Dec 2022
Sequence Comment: AQUION Final Test Detector

Cummy Load			
Cell Heater		Background Signal	
Test Run	Measured	Measured	Pass
Cell Cummy Load and Warm up	20.016	20.201	Pass

Detector Noise & Drift Test			
Background Signal		Drift	
Test Run	Measured	Measured	Pass
Cell On Water Noise and Drift	0.006 µS	4.715 nS/hour	Pass

Detector Linearity Test			
Correlation Coefficient		%RSD	
Test Run	Measured	Measured	Pass
Cell Linearity Test 5 ppm	0.99999	4.30	Pass

Injector Precision Test			
Area		Retention Time	
Test Run	Average	Average	Pass
Injector Precision 10 ppm	2.676 µS/min	0.372 min	Pass

Analyst: [Signature]
Test Technician: [Signature]
Date: 22 Dec 2022

Thermo Aquion System Calibration Summary

Instrument Name	Model	Serial Number	Moduleware	Calibration	Value
Module	Aquion	221280114	5.1.0	Column Calibration	12/22/2022

Column Heater	Column Calibration	Value
	Electrical Offset	0.000
	Heater Offset	1.86
	Heater Slope	1.02

Pump	Pressure Calibration	Value
	Pressure Transducer Offset	1576.00
	Pressure Transducer Slope	0.363

Detector	Detector Calibration	Value
	Flow Rate Calibration	12/22/2022
	Flow Rate Parameter	5.4
	Flow Rate Nominal Speed	3845
	Flow Rate Slope	0.50

Detector	Detector Calibration	Value
	Cell Heater Calibration	12/22/2022
	Electrical Offset	0.000
	Calibration Temperature	35.00
	Cell Serial Number	221280053
	Cell Offset	17014.44
	Cell Slope	0.000002016
	Cell Constant	155.13

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.thermo.com.cn/user/home/technical-resources/rohs-certificates.html>



Harikul Science Co., Ltd.
694 Soi Ratchadriwit 24, Prachauttamphen,
Samsenok, Huai Khwang, Bangkok 10310
Tel: 0-2274-2456 Fax: 0-2274-2453
Email: info@harikul.com www.harikul.com

CERT No.: HS-T088

Certificate of Calibration

Calibration Date : 1 Sep 22	Model : YSI 5000
Submitted by : C.E.M TECHNOLOGY (THAILAND) Co., LTD.	S/N : 18L109487
21943 Moo 12, Pothasam Road, Ornoi, Krathumbien,	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 : Kitipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.08 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 certify 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 : 081774

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



Amani Corporation Limited

Service Engineer :

(Tavean Taveanong)

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

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

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:

Thi
(Teerapon Tawonwong)

Date:

21.12.2022



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:

Thi
(Teerapon Tawonwong)

Date:

21.12.2022



Operating Condition

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

Service Engineer Signature:

Teerapon Tawonwong



(Teerapon Tawonwong)

Date:

29.12.2022



Certificate of Calibration

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

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.

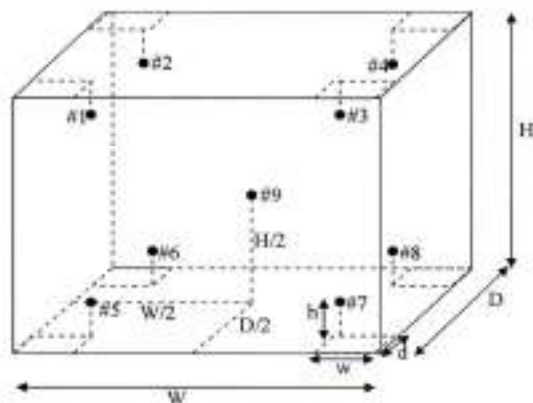
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

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.

DKSH Technology (Thailand) Co., Ltd.
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201/220 Moo 6, PRAVATE, PRAVATE, BANGKOK 10250
Phone +66 2322 4421-3 Email info.calibration@dksh.com Website www.dksh.com/thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-C31-10-12 Sep 2023



Standard Installation Locations

Volume (Calibration Zone)= 125 (Liters)

Inside chamber: W = 65 (cm) D = 49 (cm) H = 79 (cm)

Standard Locations (#1, #2, #3, #4): w = 7 (cm) d = 5 (cm) h = 8 (cm)

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

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	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	20.06	0.06	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	20.06	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 Single 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 ($w = r \cdot U$), PFA – Probability of False Accept



(Mr. Udoo Brichana)
Authorized signatory

Without adjustment

Desired Temperature : 20.0°C Tolerances : 1.0 °C

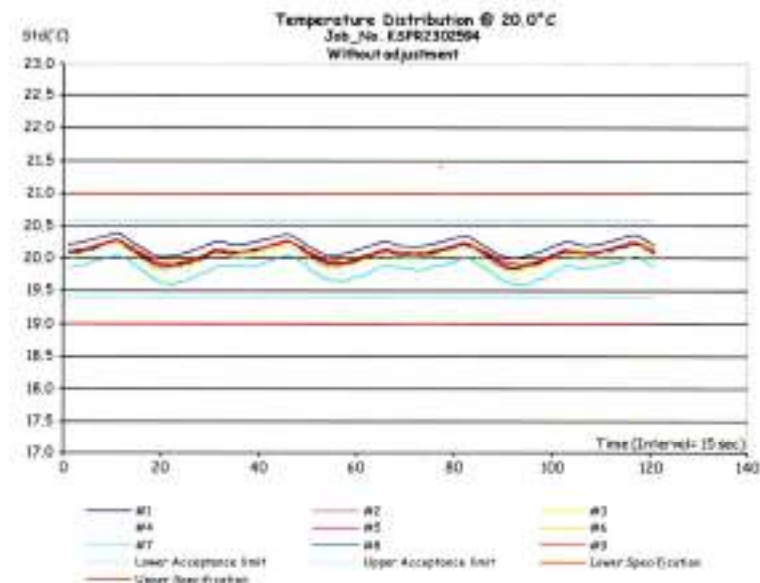
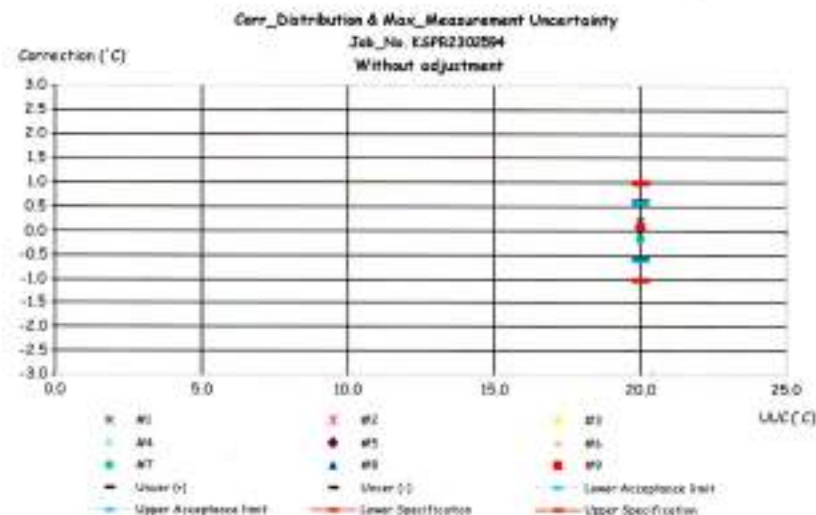
Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 20.0 °C

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	20.06	0.06	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





ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: KSPR2302594

ชนิดเครื่อง: Cooled incubator

รุ่น: KB 240

หมายเลขเครื่อง: 2018000012164 (WW-16-001)

ตรวจสอบ (วัน)		รายการตรวจสอบ	ตรวจสอบ (ผู้)		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. การทำงานระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. การทำงานระบบทำความเย็น	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. การทำงานระบบทำความร้อน	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. สภาพตู้เย็นเครื่อง	<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"/>	

ลงนามที่

Mr. Suphanimit Khamnonphoem
Service Engineer

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Thailand 10260
Phone: +66 (0)26 7000 Email: info@dksh.com Website: www.dksh.com

Delivering Growth - in Asia and Beyond.



Certificate of Calibration

Equipment:	Hot Air Oven	Certificate No.:	C31230315
Model:	UF 55	Issued Date:	16 February 2023
Serial No.(or ID):	B219.0142 (WW-05-002)	Job No.:	KSPR2302593
Manufacturer:	Mettler	Page:	1 of 4
Condition:	In Condition	Ventilation Valve:	Closed
Shelves(pc.):	2		
Customer:	C.E.M Technology (Thailand) Co., Ltd. 31/8 Moo 13, Tambon Rakking, 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. Apitit Chaoap		
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. Apitit Chaoap)

Person in charge

(Mr. Udon Srichana)

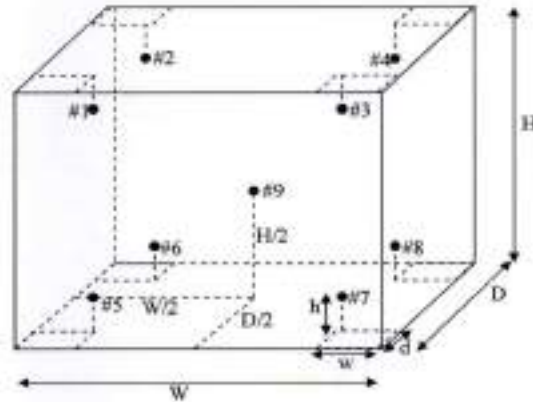
Authorized signatory

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

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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	0.46

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 condition 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 ($w = r \cdot U$); 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	104.68	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	104.38	0.38	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.



Refer to Certificate No.: C31230315 Page: 2 of 2

Statements of conformity:(Cont.)

Without adjustment (Cont.)

Desired Temperature : 180.0°C Tolerances : 2.0 °C

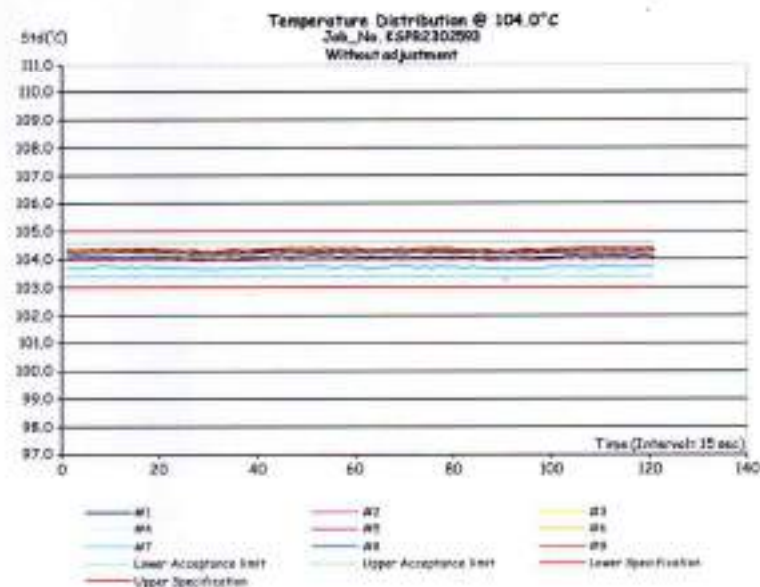
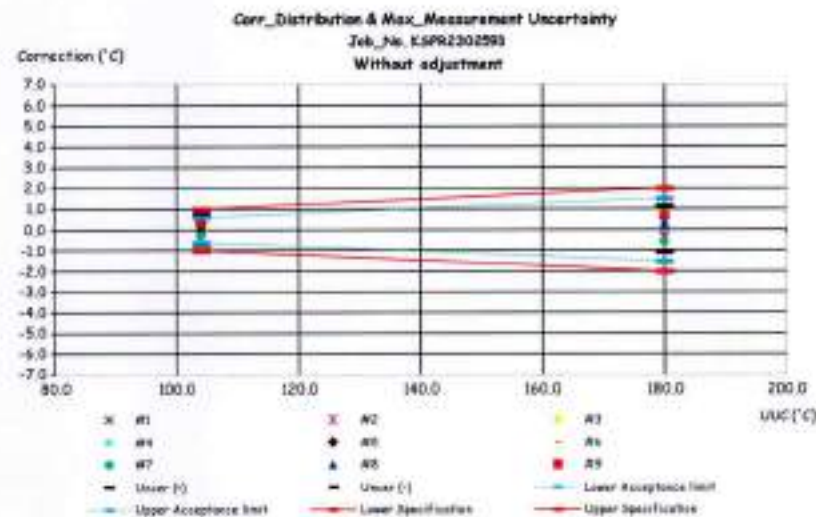
Measurement Temperature at Spread Locations, indicating of Unit Under Calibration: 180.0 °C

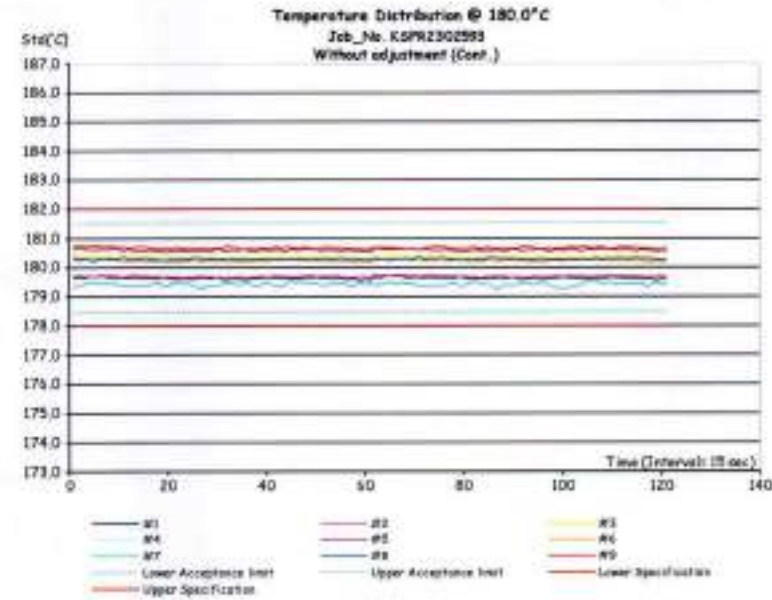
Locations	Measured (°C)	Correction of UUC.* (°C)	Guard band (W) (k °C)	Tolerance (k °C)	Conformity
#1	179.63	-0.37	0.46	2.0	Pass
#2	179.69	-0.31	0.45	2.0	Pass
#3	180.34	0.34	0.45	2.0	Pass
#4	180.23	0.23	0.45	2.0	Pass
#5	180.59	0.59	0.45	2.0	Pass
#6	180.23	0.23	0.45	2.0	Pass
#7	179.42	-0.58	0.48	2.0	Pass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





ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: KSPR2302593

ชนิดเครื่อง: Hot Air Oven

รุ่น: UF 55

หมายเลขเครื่อง: B219.0142 (WW-05-002)

ตรวจสอบ (วัน)		รายการตรวจสอบ	ตรวจสอบ (ครั้ง)		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. การแสดง Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน ฟิวส์	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. สลัก Lever of Ventilation valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สลัก Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สลัก 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. สลักตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. สลักแนวตั้ง ณ สถานะเปิดเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ลงนาม: _____

Mr. Apin Chaisap
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 Peichkasem Rd, Omnoi, Krathumban, Samutprakarn 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-564201 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

The Uncertainties are for a confidence probability of approximately 95%

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



Certificate of Calibration

Certificate No. : 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	177.4000	4	4.00	177.4	0.1	0.12
	0.0000	7	7.00	0.0	0.0	0.086
	-177.4000	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%

- u(Ls) -



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, Krathumburi, Samutprakorn 14130 (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 Maen

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

2. Standard Digital Thermometer

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

Approved by :

(Bunjerd Maen)

Supervisor

The Uncertainty are for a confidence probability of approximately 95%

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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	25.034	25.0	0.0	0.19

Remark

UUC : Unit Under Calibration

This result of calibration was found accurate as shown on data 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%

- (B) -





Bangkok High Lab Co., Ltd.
4/176 Soi Ladplakao 66, Ladplakao Rd., Anusawari, Bangkok, Bangkok 10220
Tel: (662) 971-5800 Fax: (662) 971-5300
Website: www.bangkokhighlab.com E-mail: info@bangkokhighlab.com



NIST-1917E-1102
CALIBRATION CODE

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 :
(Mr. Wanchai Meesin)
Manager



Bangkok High Lab Co., Ltd.
4/176 Soi Ladplakao 66, Ladplakao Rd., Anusawari, Bangkok, Bangkok 10220
Tel: (662) 971-5800 Fax: (662) 971-5300
Website: www.bangkokhighlab.com E-mail: info@bangkokhighlab.com



NIST-1917E-1102
CALIBRATION CODE

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 Sigma certificate report no. 106944

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	0.496	0.0015	0.0044
0.9630	0.960	0.0030	0.0038
2.0356	2.030	0.0066	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	0.486	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 485.0 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
0.8760	0.879	-0.0010	0.0040
1.8424	1.840	0.0024	0.0060

1.4 Reading scale at 545.1 nm

Filter STDs (Abs) Certificate	Average Measured Value (A)	Correction (A)	Uncertainty ± (A)
0.0000	0.000	0.0000	0.0028
0.4708	0.469	0.0016	0.0028
0.9094	0.909	0.0004	0.0028
1.8755	1.875	0.0006	0.0064



Certificate No : S2022/168
Page : 3/5

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
0.9404	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 Sigma 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



Certificate No : S2022/168
Page : 4/5

3. Wavelength Accuracy

Spectral slit width : 4.00 nm

3.1 CRMs: Holmium Glass Filter

CRMs Serial Number: W164H

Traceability: Traceable to NIST Holmium oxide filter NIST SRM 2034, through Sigma 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
287.88	#N/A	#N/A	#N/A
334.10	333.3	0.80	0.12
361.00	360.3	0.80	0.12
418.61	418.2	0.41	0.12
453.63	452.6	1.03	0.12
480.05	459.4	0.65	0.12
535.66	536.0	0.66	0.12
637.95	637.4	0.55	0.12

3.2 CRMs: Didymium Glass Filter

CRMs Serial Number: W184/D

Traceability: Traceable to NIST Holmium oxide filter NIST SRM 2034, through Sigma 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	0.96	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



Bangkok High Lab Co., Ltd.
4/176 Soi Ladplakao 66, Ladplakao Rd., Anusawari, Bangkok, Bangkok 10220
Tel: (662) 971-5800 Fax: (662) 971-5300
Website: www.bangkokhighlab.com E-mail: info@bangkokhighlab.com



NAC-MEA
ISO 17025:2017
CALIBRATION

Certificate No : S2022/168
Page : 5/5

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 Stama certificate report no. 58022

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: 889T

Blank Serial Number: 8716

Traceability: Traceable to toluene in hexane NIST SRM2034, through Stama certificate report no. 58923

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 TSI 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 201.28 nm. Base on European Pharmacopoeia V.S.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.G.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

Equipment: Digital Thermometer with Sensor
Model: TK 61
Serial No.: 1P181289184
Manufacturer: KIMO
Condition: In Condition

Certificate No.: C15230305
Issued Date: 16 February 2023
Job No.: KSPR2302595
ID No.: WW-06-002
Page: 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, Bangkok,
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 in the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

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

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Phone: +66 2636 7000 Email: info.calibration@dksh.com Website: www.dksh.com/en/thailand

Delivering Growth - In Asia and Beyond.

CAL-FW-C15-14: 06 Dec 2022



Certificate No.: C15230305

Page: 2 of 2

Calibration Results:**Without Adjustment**

Sensor Type: TC Type K

Channel: T1

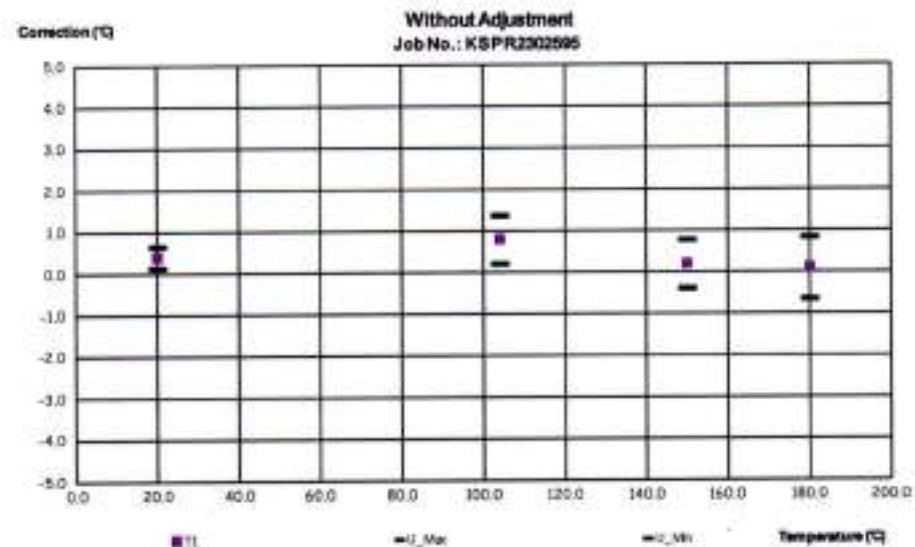
Diameter (mm): 2

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





ใบตรวจสอบสภาพเครื่องมือวัดอุณหภูมิ

เลขที่ใบงาน: KSPR2302596

ชนิดเครื่องมือ: Digital Thermometer with Sensor

รุ่น: TK 81

หมายเลขเครื่อง: 1P181269184

ตรวจสอบ (ใบ)		รายการตรวจสอบ	ตรวจสอบ (ครั้ง)		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"/>	

ชื่อคนส่ง:

Mr. Anat Karapitak
Service Engineer

2501 Technology (Thailand) Co., Ltd.
2501 Technology Limited
2501 หมู่ 10 ถนนสาย 101 แขวงคลองเตย เขตคลองเตย กรุงเทพฯ 10110
2501 Sukhumvit Road, Bangkok, Thailand, Bangkok 10110
Phone: +66 2029 7000 Email: info@2501technology.com Website: www.2501technology.com

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THAI HEART CALIBRATION CO., LTD.

112/1 Moo 3, Phrasak Sa, Muang, Samut Prakan 10280
Tel: 0-2194-2162, 0-2377-6435, 0-2377-8996 Fax: 0-2377-8997



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, Samutprakorn 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

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

(Dr. Ekachai Pattirong)

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FE-169

REV.02 02/24/21

**THAI HEART CALIBRATION CO., LTD.**112/1 Moo 3, Phrak Sa, Muang, Samut Prakan 10280
Tel. 0-2946-2162, 0-2357-6495, 0-2357-6496 Fax: 0-2357-9517

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/	MY57010717/	I0-1308001/22	Aug. 12, 2023	THC
	34901A	MY59004982			

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

- THC, Thai Heart Calibration Co., Ltd.

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Tel. 0-2946-2162, 0-2357-6495, 0-2357-6496 Fax: 0-2357-9517

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



THAI HEART CALIBRATION CO., LTD.

112/1 Moo 5, Phrak Sa, Maeng, Samut Prakan 10180
Tel. 0-2594-2162, 0-2557-8485, 0-2557-8896 Fax: 0-2557-8507



CAL

Calibratech Co., Ltd.

7108-7 Moo 2, Sukhprachone 1 Rd., Banggood, Pakkret, Nonthaburi 11120
Tel: 02-944-0211 Fax: 02-944-5155, e-mail: calibratech.co@calibtech.co, calibtech.co@thairail.com

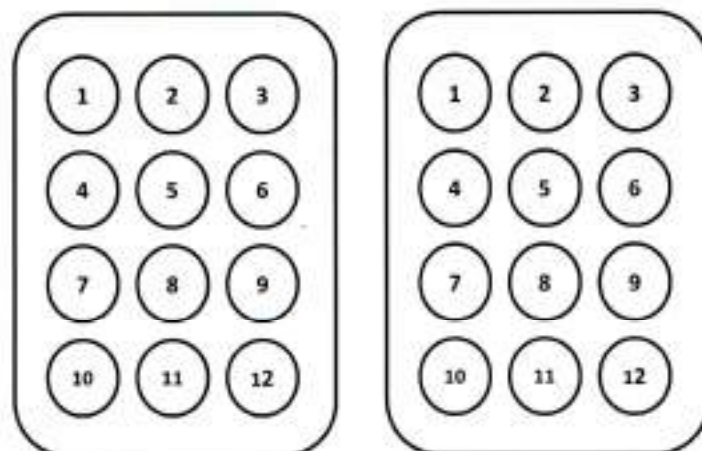


Certificate of Calibration

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 No. : 66-430007-1

Page : 1 of 2

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

219/43 Moo.12 Pochikassan Rd, Ormai, Kruthamban, 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 : Bunjeri Maari

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 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
12.88 mS/cm	795893	14 February 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :

(Bunjeri Maari)

Supervisor

The Uncertainty are for a confidence probability of approximately 95%

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CAL-P0031-03

CAL

Calibratech Co.,Ltd.

7106-7 Moo 2, Subhacharn 2 Rd., Bangsue, Bangkok, Thailand 11210

Tel: 021 944-6211 Fax: 021 944-5155 e-mail : cal@caltech.co.th, cal@caltech.co.th, cal@caltech.co.th

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 12.888, 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 : UUC 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 measurements was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

-:Do:-

B



THAI CALIBRATION SERVICES CO., LTD.

198 Moo 9 Soi Rakkhing 30 Pattanamontri 5 Rd., Sampran, Nakhonpathom 73210

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

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



NSC-TIS-118 17025
CALIBRATION 0-104

CALIBRATION CERTIFICATE

Certificate No.S23031535

page 1 of 2

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

31/8 Moo 13 Rakkhing,

Sampran, Nakhonpathom 73210

Equipment : Non-automatic weighing instrument (Electronic instrument)

Manufacturer : Sartorius

Order No. : 66S0828-1

Model : BSA224S-CW

Ambient temperature : (24.1 ± 5.0) °C

Accuracy class : -

Relative humidity : (47.5 ± 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 condition

Place of calibration : vnuuufuadu

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	Expiry (days)
1 Standard weight set	1 mg to 1 kg	15885-15849	M22109915	6-Oct-2025	7098

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 Intanon
Technician

Approved By

Chonlath Pongwarvisanon
Approved Signatory

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TCS-F-138 Issue 01/Rev.002 Jul 2018

NO. 05234

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188 Moo 9 Soi Rattikong 50 Pattanasontana 5 Rd., Sumprean, Nakornpathom 73210

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

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

**CALIBRATION CERTIFICATE**

Certificate No.S2391153S

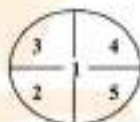
page 2 of 2

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 (\pm) (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--