

ภาคผนวกที่ 4

สรุปเอกสารสอบเทียบอุปกรณ์เครื่องมือ

เอกสารการสอบเทียบเครื่องมือตรวจวัดระดับเสียงในบรรยากาศ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0074

MTC No. EEL. BP. 17/1165

CALIBRATION CERTIFICATE

Submitted by : C.E.M. TECHNOLOGY (THAILAND) CO., LTD.
Address : 31/8 Moo 13, Raikhing, Samphran, Nakhornpathom 73210.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
 Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Level Meter
 Manufacturer : ACO
 Model : 6236
 Serial No. : 222128 (NS-03-013)
 Microphone : Type 7052NR No.84161
 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 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 2 Nov. 2022

Date of Calibration : 3 Nov. 2022

1 / 9
Ph.

The results relate only to the items tested/calibrated or value assigned.
 Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office
 35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
 Changwat Pathumthani 12120, Thailand
 Tel. (66) 0 2577 9000
 Fax. (66) 0 2577 9009
 E-mail : rumpa@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
 Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
 Amphoe Muang, Changwat Samutprakan 10280, Thailand
 Tel. (66) 0 2323 1672-80 ext. 115, 116
 Fax. (66) 0 2323 9165
 E-mail : mtc@tistr.or.th

Office
 196 Phahonyothin Road, Chatuchak, Bangkok 10900,
 Thailand
 Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
 Fax. (66) 0 2579 8592
 E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0074

MTC No. EEL. BP. 17/1165

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

Calibration Procedure :

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

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

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

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

Date of Calibration : 3 Nov. 2022

2 / 9
Ph.

The results relate only to the items tested/calibrated or value assigned.
 Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office
 35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
 Changwat Pathumthani 12120, Thailand
 Tel. (66) 0 2577 9000
 Fax. (66) 0 2577 9009
 E-mail : rumpa@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
 Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
 Amphoe Muang, Changwat Samutprakan 10280, Thailand
 Tel. (66) 0 2323 1672-80 ext. 115, 116
 Fax. (66) 0 2323 9165
 E-mail : mtc@tistr.or.th

Office
 196 Phahonyothin Road, Chatuchak, Bangkok 10900,
 Thailand
 Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
 Fax. (66) 0 2579 8592
 E-mail : sumalee@tistr.or.th

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.97	113.3	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 114.2 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20.6	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	16.9	0.10	N/A
C-Weight	21.7	0.10	N/A
Flat	26.0	0.10	N/A

Date of Calibration : 3 Nov. 2022

3 / 9


The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.0	0.0	0.1	1.5	0.45	0.6
1 000	-0.4	-0.4	-0.5	1.0	0.45	0.6
8 000	-4.3	-4.4	-4.1	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	-0.4	0.0	0.0	2.0	0.20	0.6
125	-0.4	0.1	0.0	1.5	0.20	0.6
250	-0.3	0.1	0.1	1.5	0.20	0.6
500	-0.2	-0.1	-0.1	1.5	0.20	0.6
1 000	0.0	-0.1	-0.1	1.0	0.20	0.6
2 000	0.0	0.0	0.0	2.0	0.20	0.6
4 000	-0.2	-0.2	0.0	3.0	0.20	0.6
8 000	-0.2	-0.5	0.0	5.0	0.20	0.7

Date of Calibration : 3 Nov. 2022

4 / 9


The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0074

MTC No. EEL. BP. 17/1165

5. Long-term stability

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

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

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

6.2 Time weightings at 1 kHz

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

Date of Calibration : 3 Nov. 2022

5/9
Pn.

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpaigtistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0074

MTC No. EEL. BP. 17/1165

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)
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	88.9	-0.1	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.1	0.1	1.1	0.30	0.3
74	74.3	0.3	1.1	0.30	0.3
69	68.9	-0.1	1.1	0.30	0.3
64	63.8	-0.2	1.1	0.30	0.3
59	58.8	-0.2	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

Date of Calibration : 3 Nov. 2022

6/9
Pn.

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpaigtistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0074

MTC No. EEL. BP. 17/1165

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	43.9	-0.1	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	31.3	0.3	1.1	0.30	0.3
30	30.4	0.4	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	93.9	-0.1	1.1	0.30	0.3

Date of Calibration : 3 Nov. 2022

7/9

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0074

MTC No. EEL. BP. 17/1165

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	45.0	0.0	1.1	0.30	0.3
30-120	35.0	35.0	0.0	1.1	0.30	0.3
20-110	25.0	25.6	0.6	1.1	0.30	0.3
20-100	25.0	25.6	0.6	1.1	0.30	0.3
20-90	25.0	25.5	0.5	1.1	0.30	0.3
20-80	25.0	25.7	0.7	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	89.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	109.5	-0.1	±1.0	0.20	0.3
	2	89.9	-0.1	+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

Date of Calibration : 3 Nov. 2022

8/9

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0074

MTC No. EEL. BP. 17/1165

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	125.7	0.3	3.0	0.20	0.35
Positive half cycle	124.4	124.2	-0.2	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				
130.0	130.0	0.0	1.5	0.20	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by :

(Mr. Pannasit Phasingsri)

Approved by :

(Mr. Prawate Kluyapa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 3 Nov. 2022

Date of Issue : 3 Nov. 2022

Ref : 2011265110204749001

End of Certificate

9 / 9

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

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

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

FM.BL.MTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0012

MTC No. EEL. BP. 19/1065

CALIBRATION CERTIFICATE

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

Address : 31/8 Moo 13, Raikhing, Samphran, Nakhornpathom 73210.

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

Instrument Calibrated :

Description : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 222129 (NS-03-014)

Microphone : Type 7052NR No.82954

Preamplifier : -

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) kPa

Standards used :

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

Date of Receipt : 5 Oct. 2022

Date of Calibration : 1 Nov. 2022

1 / 9

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

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

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

FM.BL.MTC.002 Rev.4

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0012

MTC No. EEL. BP. 19/1065

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

Calibration Procedure :

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

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

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

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

Date of Calibration : 1 Nov. 2022

2 / 9

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0012

MTC No. EEL. BP. 19/1065

1. Absolute Sensitivity

Reference	Measured value (dB)		Deviation	Acceptance	Uncertainty	Maximum-permitted
Acoustic Signal			value	limit Class 2		uncertainty of measurement
(dB)	Before adjust	After adjust	(dB)	(±dB)	(±dB)	(±dB)
113.97	113.6	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	Uncertainty	Maximum-permitted
(dB)	(±dB)	uncertainty of measurement (±dB)
20.1	0.10	N/A

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

Frequency	Measured value	Uncertainty	Maximum-permitted
Weighting	(dB)	(±dB)	uncertainty of measurement (±dB)
A-Weight	15.9	0.10	N/A
C-Weight	20.5	0.10	N/A
Flat	26.0	0.10	N/A

Date of Calibration : 1 Nov. 2022

3 / 9

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0012

MTC No. EEL. BP. 19/1065

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	0.1	0.1	0.1	1.5	0.45	0.6
1 000	-0.6	-0.6	-0.6	1.0	0.45	0.6
8 000	-4.4	-4.6	-4.4	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	-0.1	0.0	0.1	2.0	0.20	0.6
125	-0.3	0.1	0.1	1.5	0.20	0.6
250	-0.1	0.1	0.1	1.5	0.20	0.6
500	-0.1	0.0	0.1	1.5	0.20	0.6
1 000	0.0	0.0	0.1	1.0	0.20	0.6
2 000	-0.1	0.0	0.1	2.0	0.20	0.6
4 000	-0.3	-0.3	0.0	3.0	0.20	0.6
8 000	-0.5	-0.5	-0.1	5.0	0.20	0.7

Date of Calibration : 1 Nov. 2022

4 / 9

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0012

MTC No. EEL. BP. 19/1065

5. Long-term stability

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

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

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

Date of Calibration : 1 Nov. 2022

5 / 9

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0012

MTC No. EEL. BP. 19/1065

7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
122	122.0	0.0	1.1	0.30	0.3
121	121.0	0.0	1.1	0.30	0.3
120	120.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	113.9	-0.1	1.1	0.30	0.3
109	108.9	-0.1	1.1	0.30	0.3
104	103.9	-0.1	1.1	0.30	0.3
99	98.9	-0.1	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	88.8	-0.2	1.1	0.30	0.3
84	83.9	-0.1	1.1	0.30	0.3
79	78.9	-0.1	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	68.9	-0.1	1.1	0.30	0.3
64	63.8	-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

Date of Calibration : 1 Nov. 2022

6 / 9

Ph

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0012

MTC No. EEL. BP. 19/1065

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	39.1	0.1	1.1	0.30	0.3
34	34.0	0.0	1.1	0.30	0.3
33	33.3	0.3	1.1	0.30	0.3
32	32.3	0.3	1.1	0.30	0.3
31	31.6	0.6	1.1	0.30	0.3
30	30.9	0.9	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

Date of Calibration : 1 Nov. 2022

7 / 9

Ph

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0012

MTC No. EEL. BP. 19/1065

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	44.8	-0.2	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	25.6	0.6	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	89.9	-0.1	+1.0; -5.0	0.20	0.3
SEL	200	110.0	0.0	±1.0	0.20	0.3
	2	89.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	80.8	-0.2	+1.5; -5.0	0.20	0.3

Date of Calibration : 1 Nov. 2022

8 / 9

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0012

MTC No. EEL. BP. 19/1065

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	125.7	0.3	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	124.3	-0.1	2.0	0.20	0.35

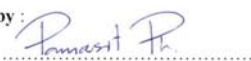
11. Overload indication

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				
132.0	132.1	-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 :



(Mr. Pannasit Phasingsri)

Approved by :



(Mr. Prawat Kluaypa)

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 : 2011265100504293002

End of Certificate

9 / 9

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

CERTIFICATE OF CALIBRATION

Certificate No. : 66S0205-3 Job No. : 66S0205 Page : 1 of 2

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

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

Location : Laboratory

Equipment : Sound Level Meter

Ambient temperature : (20 ± 2) °C

Manufacturer : ACO

Relative humidity : (50 ± 15) %

Model : 6236

Atmospheric pressure : -

Serial No. : 222186

Date of received : 03-Feb-2023

Identity No. : NS-03-016

Date of calibration : 07-Feb-2023

Range : See to Data

Date of issued : 09-Feb-2023

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

Reference Standard Instruments :

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

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

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

[] Ms. Bhacharin Phanangkaew (MD)

Reviewed By : [] Mr. Somporn Srisert

[] Mr. Boonyarit Auejirakarn

[] Ms. Natthaparakarn Thammaphan

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

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.3	0.3	0.20
	104	104.2	0.2	0.20
	114	114.1	0.1	0.20
B	94	94.4	0.4	0.20
	104	104.2	0.2	0.20
	114	113.9	-0.1	0.20
Z	94	94.4	0.4	0.20
	104	104.1	0.1	0.20
	114	113.9	-0.1	0.20

UUC* = Unit Under Calibration

- The End -

CERTIFICATE OF CALIBRATION

Certificate No. : 66S0205-5 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. : 222189

Date of received : 03-Feb-2023

Identity No. : NS-03-019

Date of calibration : 07-Feb-2023

Range : See to Data

Date of issued : 09-Feb-2023

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

Reference Standard Instruments :

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

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

- National Institute of Metrology Thailand, (NIMT).

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

[] Ms. Bhacharin Phanangkaew (MD)

Reviewed By : [] Mr. Sompong Srisert

[] Mr. Boonyarit Auejirakarn

[x] Ms. Natthaparakarn Thammaphan

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

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.4	0.4	0.20
	104	104.1	0.1	0.20
	114	114.0	0.0	0.20
B	94	94.4	0.4	0.20
	104	104.1	0.1	0.20
	114	113.9	-0.1	0.20
Z	94	94.4	0.4	0.20
	104	104.1	0.1	0.20
	114	113.9	-0.1	0.20

UUC* = Unit Under Calibration

- The End -

CERTIFICATE OF CALIBRATION

Certificate No. : 66S0330-4 Job No. : 66S0330 Page : 1 of 2

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

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

Location : Laboratory

Equipment : Sound Level Meter

Ambient temperature : (20 ± 2) °C

Manufacturer : ACO

Relative humidity : (50 ± 15) %

Model : 6236

Atmospheric pressure : -

Serial No. : 222190

Date of received : 08-Mar-2023

Identity No. : NS-03-020

Date of calibration : 10-Mar-2023

Range : See to Data

Date of issued : 13-Mar-2023

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

Reference Standard Instruments :

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

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

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

[] Ms. Bhacharin Phanangkaew (MD)

Reviewed By : [] Mr. Sompong Srisert

[] Mr. Boonyarit Auejirakarn

[] Ms. Natthaparakarn Thammaphan

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

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.0	0.0	0.20
	104	104.1	0.1	0.20
	114	114.1	0.1	0.20
C	94	94.2	0.2	0.20
	104	104.1	0.1	0.20
	114	113.8	-0.2	0.20
Z	94	94.0	0.0	0.20
	104	104.0	0.0	0.20
	114	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, Raikhing, Samphran,
Nakhornpathom 73210

Location : Laboratory

Equipment : Sound Level Meter

Ambient temperature : (20 ± 2) °C

Manufacturer : ACO

Relative humidity : (50 ± 15) %

Model : 6236

Atmospheric pressure : -

Serial No. : 222193

Date of received : 30-Mar-2023

Identity No. : NS-03-023

Date of calibration : 03-Apr-2023

Range : See to Data

Date of issued : 05-Apr-2023

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

Reference Standard Instruments :

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

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

- National Institute of Metrology Thailand, (NIMT).

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

[] Ms. Bhacharin Phanangkaew (MD)

Reviewed By : [] Mr. Somporn Srisert

[] Mr. Boonyarit Auejirakarn

✓ [] Ms. Natthaparakarn Thammaphan

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

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 -

CERTIFICATE OF CALIBRATION

Certificate No. : 66S0330-1 Job No. : 66S0330 Page : 1 of 2

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

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

Location : Laboratory

Equipment : Sound Level Meter

Ambient temperature : (20 ± 2) °C

Manufacturer : ACO

Relative humidity : (50 ± 15) %

Model : 6236

Atmospheric pressure : -

Serial No. : 222196

Date of received : 08-Mar-2023

Identity No. : NS-03-026

Date of calibration : 10-Mar-2023

Range : See to Data

Date of issued : 13-Mar-2023

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

Reference Standard Instruments :

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

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

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

[] Ms. Bhacharin Phanangkaew (MD)

Reviewed By : [] Mr. Sompong Srisert

[x] Mr. Boonyarit Auejirakarn

[x] Ms. Natthaparakarn Thammaphan

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

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.1	0.1	0.20
	104	103.8	-0.2	0.20
	114	113.6	-0.4	0.20
C	94	94.0	0.0	0.20
	104	103.8	-0.2	0.20
	114	113.7	-0.3	0.20
Z	94	94.0	0.0	0.20
	104	103.8	-0.2	0.20
	114	113.6	-0.4	0.20

UUC* = Unit Under Calibration

- The End -

CERTIFICATE OF CALIBRATION

Certificate No. : 66S0330-2 Job No. : 66S0330 Page : 1 of 2

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

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

Location : Laboratory

Equipment : Sound Level Meter

Ambient temperature : (20 ± 2) °C

Manufacturer : ACO

Relative humidity : (50 ± 15) %

Model : 6236

Atmospheric pressure : -

Serial No. : 222199

Date of received : 08-Mar-2023

Identity No. : NS-03-029

Date of calibration : 10-Mar-2023

Range : See to Data

Date of issued : 13-Mar-2023

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

Reference Standard Instruments :

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

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

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

[] Ms. Bhacharin Phanangkaew (MD)

Reviewed By : [] Mr. Sompong Srisert

[x] Mr. Boonyarit Auejirakarn

[x] Ms. Natthaparakarn Thammaphan

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

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.2	0.2	0.20
	104	104.2	0.2	0.20
	114	114.2	0.2	0.20
C	94	94.1	0.1	0.20
	104	104.2	0.2	0.20
	114	114.2	0.2	0.20
Z	94	94.2	0.2	0.20
	104	104.2	0.2	0.20
	114	114.1	0.1	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, Raikhing, Samphran,
Nakhornpathom 73210
Location : Laboratory

Equipment : Sound Level Meter Ambient temperature : (20 ± 2) °C
Manufacturer : Tenmars Relative humidity : (50 ± 15) %
Model : ST-109R Atmospheric pressure : -
Serial No. : 221201934 Date of received : 08-Mar-2023
Identity No. : NS-11-001 Date of calibration : 10-Mar-2023
Range : See to Data Date of issued : 13-Mar-2023

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

Reference Standard Instruments :

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

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

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By : 
[] Ms. Bhacharin Phanangkaew (MD)

Reviewed By : [] Mr. Sompong Srisert

[x] Ms. Natthaparakarn Thammaphan

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

Continuation of Calibration Report

Certificate No. : 66S0330-5

Job No. : 66S0330

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	94.5	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 : 13-Mar-2023

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

Reference Standard Instruments :

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

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

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

[] Ms. Bhacharin Phanangkaew (MD)

Reviewed By : [] Mr. Sompong Srisert

[] Mr. Boonyarit Auejirakarn

[] Ms. Natthaparakarn Thammaphan

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

Continuation of Calibration Report

Certificate No. : 66S0330-7

Job No. : 66S0330

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

UUC* = Unit Under Calibration

- The End -

CERTIFICATE OF CALIBRATION

Certificate No. : 66S0330-6 Job No. : 66S0330 Page : 1 of 2

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

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

Location : Laboratory

Equipment : Sound Level Meter

Ambient temperature : (20 ± 2) °C

Manufacturer : Scarlet Tech

Relative humidity : (50 ± 15) %

Model : ST-11D

Atmospheric pressure : -

Serial No. : 820891

Date of received : 08-Mar-2023

Identity No. : NS-12-002

Date of calibration : 10-Mar-2023

Range : See to Data

Date of issued : 13-Mar-2023

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

Reference Standard Instruments :

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

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

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

[] Ms. Bhacharin Phanangkaew (MD)

Reviewed By : [] Mr. Sompong Srisert

[] Mr. Boonyarit Auejirakarn

[x] Ms. Natthaparakarn Thammaphan

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

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.0	0.0	0.20
	104	104.0	0.0	0.20
	114	114.0	0.0	0.20
B	94	94.4	0.4	0.20
	104	104.0	0.0	0.20
	114	113.8	-0.2	0.20
Z	94	94.0	0.0	0.20
	104	104.0	0.0	0.20
	114	113.8	-0.2	0.20

UUC* = Unit Under Calibration

- The End -

CERTIFICATE OF CALIBRATION

Certificate No. : 66S0330-8 Job No. : 66S0330 Page : 1 of 2

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

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

Location : Laboratory

Equipment : Sound Level Meter

Ambient temperature : (20 ± 2) °C

Manufacturer : Scarlet Tech

Relative humidity : (50 ± 15) %

Model : ST-11D

Atmospheric pressure : -

Serial No. : 820892

Date of received : 08-Mar-2023

Identity No. : NS-12-003

Date of calibration : 10-Mar-2023

Range : See to Data

Date of issued : 13-Mar-2023

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

Reference Standard Instruments :

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

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

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

[] Ms. Bhacharin Phanangkaew (MD)

Reviewed By : [] Mr. Sompong Srisert

[] Mr. Boonyarit Auejirakarn

[] Ms. Natthaparakarn Thammaphan

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

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.1	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



PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 10 January 2023
Sampler: TE-6070 PM10 Serial No: 1239 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 27.00 Corrected Pressure (mm Hg): 685.8
Temperature (deg F): 75.6 Temperature (deg K): 297.2
Average Press. (in Hg): 26.50 Corrected Average (mm Hg): 673.1
Average Temp. (deg F): 75.2 Average Temp. (deg K): 297.0

Calibration Orifice

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

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.60	1.229	59.7	39.30	Slope 33.1155
2	6.80	1.094	54.7	36.01	Intercept -0.8080
3	5.60	0.994	49.7	32.72	Corr. Coeff 0.9947
4	4.80	0.921	44.6	29.36	SFR 1.110
5	3.60	0.799	38.5	25.35	SSP 54.60
# of Observations:					5

Calculations

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

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

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): 50.1
Average Flow over Sample (m3/min)
1.029348739
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min)
1482.262184
Total flow over sample (CFM)
52338.6777

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



PM10 High Volume Sampler Verification

Site Information

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

Site Conditions

Barometric Pressure (in Hg): 28.10 Corrected Pressure (mm Hg): 713.7
Temperature (deg F): 76.2 Temperature (deg K): 297.6
Average Press. (in Hg): 27.00 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-5028A Qstd Intercept: -0.01520
Serial#: 1179 Calibration Due Date: 12 Dec 23

Calibration Data

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

Calculations

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

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

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)
0.727985358
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min)
1048.298915
Total flow over sample (CFM)
37015.43469

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



PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 10 January 2023
Sampler: TE-6070 PM10 Serial No: 1629 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 29.00 Corrected Pressure (mm Hg): 736.6
Temperature (deg F): 76.0 Temperature (deg K): 297.4
Average Press. (in Hg): 28.50 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-5028A Qstd Intercept: -0.01520
Serial#: 1179 Calibration Due Date: 12 Dec 23

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.10	1.152	59.2	37.62	Slope 31.6154
2	6.30	1.017	54.2	34.44	Intercept 1.7368
3	5.10	0.916	49.2	31.26	Corr. Coeff 0.9952
4	4.30	0.842	44.1	28.02	SFR 1.111
5	3.10	0.716	38.0	24.15	SSP 58.03

of Observations: 5

Calculations

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

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

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)

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

Average I(chart): 56.9
Average Flow over Sample (m3/min)
1.098289496
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min)
1581.536874
Total flow over sample (CFM)
55844.06701

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: 3183 Tech: Tong P.

Site Conditions

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

Calibration Orifice

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

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	9.45	1.287	60.5	39.80	Slope 36.1461
2	7.75	1.167	55.3	36.38	Intercept -6.1754
3	6.50	1.069	50.7	33.36	Corr. Coeff 0.9935
4	5.75	1.006	45.3	29.80	SFR 1.115
5	4.60	0.901	39.6	26.05	SSP 51.87

of Observations: 5

Calculations

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

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

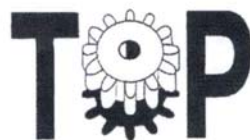
Qa = actual flow rate
IC = corrected chart response
m = calibrator slope
b = calibrator intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
For subsequent calculation of sampler flow:

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)

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



Trade & Engineering

PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 4 October 2022
 Sampler: TE-6070 PM10 Serial No: 3183 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 29.52 Corrected Pressure (mm Hg): 760.1
 Temperature (deg F): 77.1 Temperature (deg K): 298.1
 Average Press. (in Hg): 29.94 Corrected Average (mm Hg): 761.2
 Average Temp. (deg F): 76.8 Average Temp. (deg K): 297.9

Calibration Orifice

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

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	5.00	0.894	43.0	26.93	Slope 29.1674
2	4.10	0.811	40.0	25.05	Intercept 1.2156
3	3.70	0.770	38.2	23.92	Corr. Coeff 0.9972
4	3.00	0.695	34.6	21.67	SFR 1.132
5	1.90	0.555	27.4	17.16	SSP 54.68

of Observations: 5

Calculations

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

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

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

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

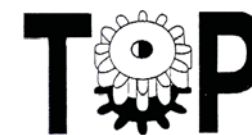
m = sampler slope
 b = sampler intercept
 I = chart response
 Tav = daily average temperature
 Pav = daily average pressure

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): 50.0
 Average Flow over Sample (m3/min)
 1.030708331
 Enter Total Time (Hrs): 24.0
 Total flow over sample (m3/min)
 1484.219996
 Total flow over sample (CFM)
 52407.80807

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: 3211 Tech: Tong P.

Site Conditions

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

Calibration Orifice

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

Calibration Data

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

of Observations: 5

Calculations

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

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

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

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

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)
 1.085070646
 Enter Total Time (Hrs): 24.0
 Total flow over sample (m3/min)
 1562.501731
 Total flow over sample (CFM)
 55171.9361



PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 4 October 2022
Sampler: TE-6070 PM10 Serial No: 3211 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 26.54 Corrected Pressure (mm Hg): 760.4
Temperature (deg F): 77.9 Temperature (deg K): 298.5
Average Press. (in Hg): 29.45 Corrected Average (mm Hg): 759.8
Average Temp. (deg F): 77.0 Average Temp. (deg K): 298.0

Calibration Orifice

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

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	7.30	1.079	55.0	34.46	Slope 30.9235
2	5.50	0.938	50.0	31.33	Intercept 1.6630
3	4.30	0.830	44.0	27.57	Corr. Coeff 0.9941
4	3.70	0.771	41.0	25.69	SFR 1.131
5	2.80	0.672	35.0	21.93	SSP 58.48
# of Observations:					5

Calculations

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

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

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): 55.1
Average Flow over Sample (m3/min)
1.062113613
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min)
1529.443603
Total flow over sample (CFM)
54004.65361

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



PM10 High Volume Sampler Verification

Site Information

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

Site Conditions

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

Calibration Orifice

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

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.10	1.193	59.2	38.97	Slope 31.6154
2	6.30	1.053	54.2	35.68	Intercept 1.8101
3	5.10	0.949	49.2	32.39	Corr. Coeff 0.9952
4	4.30	0.872	44.1	29.03	SFR 1.106
5	3.10	0.742	38.0	25.01	SSP 55.87
# of Observations:					5

Calculations

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

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

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)

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

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



PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 10 January 2023
Sampler: TE-6070 PM10 Serial No: 3275 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 26.90 Corrected Pressure (mm Hg): 683.3
Temperature (deg F): 75.4 Temperature (deg K): 297.1
Average Press. (in Hg): 26.40 Corrected Average (mm Hg): 670.6
Average Temp. (deg F): 75.0 Average Temp. (deg K): 296.9

Calibration Orifice

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

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	9.50	1.294	60.6	39.96	Slope 35.6263
2	7.70	1.166	55.6	36.66	Intercept -5.4804
3	6.50	1.072	50.6	33.37	Corr. Coeff 0.9939
4	5.70	1.004	45.5	30.00	SFR 1.110
5	4.50	0.893	39.4	25.98	SSP 51.65
# 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): 52.3
Average Flow over Sample (m3/min)
1.130638789
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min)
1628.119856
Total flow over sample (CFM)
57488.9121

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-6070 PM10 Serial No: 3310 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 29.47 Corrected Pressure (mm Hg): 760.1
Temperature (deg F): 77.0 Temperature (deg K): 298.0
Average Press. (in Hg): 28.70 Corrected Average (mm Hg): 761.3
Average Temp. (deg F): 77.1 Average Temp. (deg K): 298.1

Calibration Orifice

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

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	7.60	1.100	57.0	35.69	Slope 32.3375
2	5.80	0.962	51.0	31.93	Intercept 0.5255
3	4.60	0.858	46.0	28.80	Corr. Coeff 0.9972
4	3.80	0.781	41.0	25.67	SFR 1.132
5	2.80	0.671	35.0	21.91	SSP 59.28
# 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:

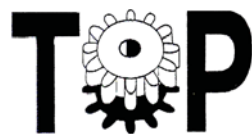
$$SFR = 1.13(Ps/Pa)(Ta/Ts)$$
$$SSP = (m*SFR+b)(\sqrt{(Pa/Ta)})$$

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): 55.6
Average Flow over Sample (m3/min)
1.059570151
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min)
1525.781017
Total flow over sample (CFM)
53875.32771

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:** 3482 **Tech:** Tong P.

Site Conditions

Barometric Pressure (in Hg): 26.65 **Corrected Pressure (mm Hg):** 676.9
Temperature (deg F): 75.3 **Temperature (deg K):** 297.1
Average Press. (in Hg): 26.50 **Corrected Average (mm Hg):** 673.1
Average Temp. (deg F): 76.3 **Average Temp. (deg K):** 297.6

Calibration Orifice

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

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	9.65	1.310	60.5	40.08	Slope 34.0516
2	7.50	1.156	55.5	36.77	Intercept -3.5657
3	6.45	1.072	50.6	33.52	Corr. Coeff 0.9827
4	5.35	0.978	45.8	30.34	SFR 1.122
5	4.60	0.907	39.4	26.10	SSP 52.27

of Observations: 5

Calculations

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

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

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

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

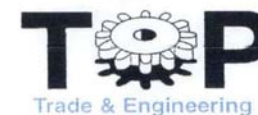
Qa = actual flow rate
IC = corrected chart response
m = calibrator slope
b = calibrator intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
For subsequent calculation
of sampler flow:

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)

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

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

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



Certificate of Analyzer Performance Testing

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

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

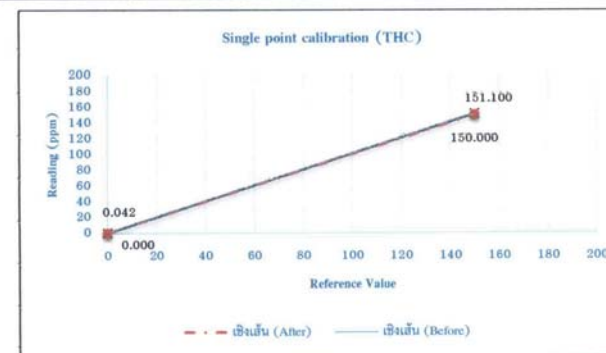
Environmental
Temperature: 24.7 °C
Humidity: 54.4 %RH

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

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

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
THC	0.042	0.000	0.042	151	150	0.733
After						
THC	0.000	0.000	0.000	150	150	0.000



Calibrated by:

Tong P.

(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 30-Jan-23 Certificate No. : 0123-002
Page : 1/1

Analyzer Instruments

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

Environmental

Temperature : 24.5 °C
Humidity : 56.3 %RH

Calibration System

Calibrator Units

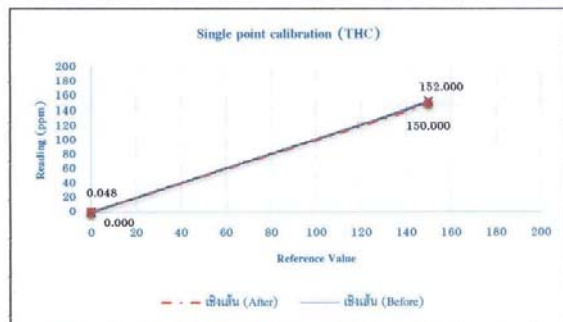
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514811458 Serial No. : 179

Standard Gas

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

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
THC	0.048	0.000	0.048	152	150	1.333
After						
THC	0.000	0.000	0.000	150	150	0.000



Calibrated by :

Thong
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 30-Jan-23 Certificate No. : 0123-002
Page : 1/1

Analyzer Instruments

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

Environmental

Temperature : 24.5 °C
Humidity : 56.3 %RH

Calibration System

Calibrator Units

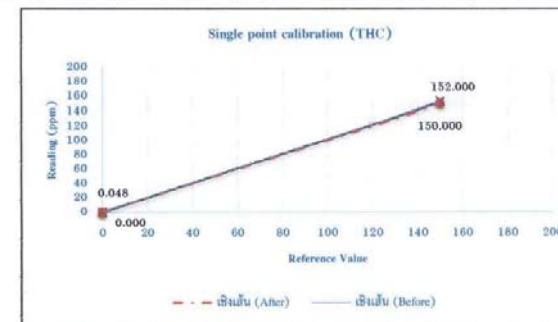
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514811458 Serial No. : 179

Standard Gas

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

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
THC	0.048	0.000	0.048	152	150	1.333
After						
THC	0.000	0.000	0.000	150	150	0.000



Calibrated by :

Thong
(Mr. Tong Piima)



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: 3262 Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 29.00 Corrected Pressure (mm Hg): 736.6
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): 75.8 Average Temp (Deg K): 297.5

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	8.20	1.792	62.0	61.08	Slope: 37.2576
2	6.40	1.584	55.0	54.18	Intercept: -5.2773
3	5.00	1.401	48.0	47.29	Corr. Coeff: 0.9987
4	4.50	1.330	45.0	44.33	
5	3.90	1.239	41.0	40.39	
# of Observations: 5					

Calculations

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

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

Inter 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: 9 Jan 23
Sampler: TE-5000 TSP Serial No: 3263 Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 28.00 Corrected Pressure (mm Hg): 711.2
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): 75.1 Average Temp (Deg K): 297.1

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	5.80	1.482	60.0	58.08	Slope: 28.6275
2	4.00	1.233	53.0	51.31	Intercept: 15.8460
3	2.60	0.996	46.0	44.53	Corr. Coeff: 0.9996
4	2.10	0.896	43.0	41.62	
5	1.50	0.759	38.5	37.27	
# of Observations: 5					

Calculations

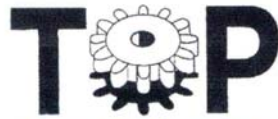
$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta)) - b]$
 $IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$

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

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

Inter 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
44816.6898

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



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

Site Information

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

Site Conditions

Barometric Pressure (in Hg): 28.00 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): 685.8
Average Temp (Deg F): 75.1 Average Temp (Deg K): 297.1

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	9.80	1.924	65.1	63.02	Slope: 43.1008
2	8.00	1.739	58.4	56.53	Intercept: -19.2099
3	6.60	1.581	51.2	49.56	Corr. Coeff: 0.9957
4	6.10	1.520	48.0	46.47	
5	5.50	1.444	43.5	42.11	
# of Observations: 5					

Calculations

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

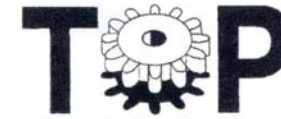
Qstd = standard flow rate
IC = corrected chart response
I = actual chart response
m = calibrator Qstd slope
b = calibrator Qstd intercept

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

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

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

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



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

Site Information

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

Site Conditions

Barometric Pressure (in Hg): 28.00 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): 685.8
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	8.20	1.761	63.6	61.57	Slope: 38.1692
2	6.40	1.557	56.9	55.08	Intercept: -5.0169
3	5.00	1.377	49.7	48.11	Corr. Coeff: 0.9967
4	4.50	1.307	46.5	45.01	
5	3.90	1.217	42.0	40.66	
# of Observations: 5					

Calculations

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

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

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

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

nter Average I (chart): 44.0
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



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: 3266	Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 28.00	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): 685.8
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	8.20	1.761	63.6	61.57	Slope: 38.1692
2	6.40	1.557	56.9	55.08	Intercept: -5.0169
3	5.00	1.377	49.7	48.11	Corr. Coeff: 0.9967
4	4.50	1.307	46.5	45.01	
5	3.90	1.217	42.0	40.66	
# of Observations: 5					

Calculations

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

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

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

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

nter Average I (chart):	44.0
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



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: 3267	Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 28.00	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): 685.8
Average Temp (Deg F): 75.0	Average Temp: (Deg K): 297.0

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	6.80	1.604	62.2	60.21	Slope: 33.1580
2	5.00	1.377	55.5	53.73	Intercept: 7.5236
3	3.60	1.170	48.3	46.76	Corr. Coeff: 0.9980
4	3.10	1.086	45.1	43.66	
5	2.50	0.976	40.6	39.30	
# of Observations: 5					

Calculations

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

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

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

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

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

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



Trade & Engineering

TSP High Volume Sampler TE-5000 TSP Sampler Verification

Site Information

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

Site Conditions

Barometric Pressure (in Hg): 28.00 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): 685.8
Average Temp (Deg F): 75.0 Average Temp: (Deg K): 297.0

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	6.80	1.604	62.2	60.21	Slope: 33.1580
2	5.00	1.377	55.5	53.73	Intercept: 7.5236
3	3.60	1.170	48.3	46.76	Corr. Coeff: 0.9980
4	3.10	1.086	45.1	43.66	
5	2.50	0.976	40.6	39.30	
# of Observations: 5					

Calculations

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

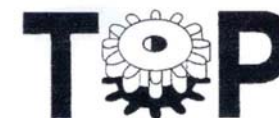
Qstd = standard flow rate
IC = corrected chart response
I = actual chart response
m = calibrator Qstd slope
b = calibrator Qstd intercept

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

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

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

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



Trade & Engineering

TSP High Volume Sampler TE-5000 TSP Sampler Verification

Site Information

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

Site Conditions

Barometric Pressure (in Hg): 27.60 Corrected Pressure (mm Hg): 701.0
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): 75.2 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	7.30	1.650	62.7	60.26	Slope: 35.0463
2	5.50	1.433	56.0	53.82	Intercept: 2.9864
3	4.10	1.239	48.8	46.90	Corr. Coeff: 0.9975
4	3.60	1.162	45.6	43.83	
5	3.00	1.061	41.1	39.50	
# of Observations: 5					

Calculations

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

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

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

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

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

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



Trade & Engineering

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

Location: -	Site ID: -	Date: 16 Oct 23
Sampler: TE-5000 TSP	Serial No: 3270	Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 27.60	Corrected Pressure (mm Hg): 701.0
Temperature (deg F): 76.0	Temperature (deg K): 297.6
Average Press. (in Hg): 27.50	Corrected Average (mm Hg): 698.5
Average Temp (Deg F): 74.8	Average Temp: (Deg K): 296.9

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	7.80	1.705	60.1	57.76	Slope: 28.1557
2	6.00	1.497	57.2	54.97	Intercept: 11.0629
3	5.30	1.407	53.4	51.32	Corr. Coeff: 0.9717
4	4.50	1.297	49.7	47.77	
5	3.90	1.209	45.6	43.83	# 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

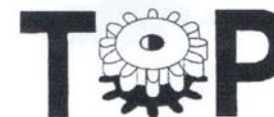
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg
For subsequent calculation of sampler flow:
 $1/m[(I[\text{Sqrt}(298/Tav)(Pav/760)])-b]$

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

Enter Average I (chart): 53.2
Average Flow Calculation m3/min
1.421779972
Average Flow Calculation in cfm
50.2040944
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min
2047.36316
Total flow in 24 hours cfm
72293.89593

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

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



Trade & Engineering

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

Location: -	Site ID: -	Date: 17 Oct 22
Sampler: TE-5000 TSP	Serial No: 3270	Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 29.30	Corrected Pressure (mm Hg): 758.6
Temperature (deg F): 76.4	Temperature (deg K): 297.8
Average Press. (in Hg): 29.90	Corrected Average (mm Hg): 760.1
Average Temp (Deg F): 76.0	Average Temp: (Deg K): 297.6

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	7.70	1.761	54.0	53.97	Slope: 28.6924
2	5.80	1.530	49.0	48.97	Intercept: 4.2033
3	4.60	1.364	44.0	43.97	Corr. Coeff: 0.9958
4	3.50	1.191	38.0	37.98	
5	2.90	1.085	35.0	34.98	# 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): 40.3
Average Flow Calculation m3/min
1.259109112
Average Flow Calculation in cfm
44.46006692
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min
1813.117121
Total flow in 24 hours cfm
64022.49637

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

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



Trade & Engineering

TSP High Volume Sampler TE-5000 TSP Sampler Verification

Site Information

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

Site Conditions

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

Calibration Orifice

Make: Tisch Qstd Slope: 1.58304
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	7.80	1.827	61.5	63.34	Slope: 31.5959 Intercept: 5.8641 Corr. Coeff: 0.9885 # of Observations: 5
2	6.70	1.694	57.7	59.43	
3	5.90	1.590	54.3	55.93	
4	4.40	1.374	49.5	50.98	
5	3.80	1.278	43.6	44.91	

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

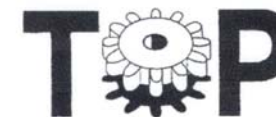
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg
For subsequent calculation of sampler flow:
 $1/m[(I[\text{Sqrt}(298/Tav)(Pav/760)]) - b]$

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

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

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

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



Trade & Engineering

TSP High Volume Sampler TE-5000 TSP Sampler Verification

Site Information

Location: - Site ID: - Date: 17 Oct 22
Sampler: TE-5000 TSP Serial No: 3272 Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 29.00 Corrected Pressure (mm Hg): 761.2
Temperature (deg F): 77.5 Temperature (deg K): 298.4
Average Press. (in Hg): 29.00 Corrected Average (mm Hg): 761.3
Average Temp (Deg F): 77.4 Average Temp: (Deg K): 298.4

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	7.80	1.774	56.0	56.00	Slope: 29.2820 Intercept: 4.3066 Corr. Coeff: 0.9993 # of Observations: 5
2	6.00	1.557	50.0	50.00	
3	4.90	1.408	46.0	46.00	
4	3.70	1.225	40.0	40.00	
5	3.10	1.122	37.0	37.00	

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): 38.9
Average Flow Calculation m3/min
1.181694711
Average Flow Calculation in cfm
41.7265076
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min
1701.640384
Total flow in 24 hours cfm
60086.17095

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

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



Trade & Engineering

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

Location: -	Site ID: -	Date: 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:

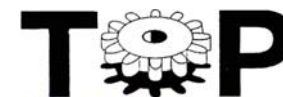
$1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)] - b)$

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



Trade & Engineering

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

Location: -	Site ID: -	Date: 17 Oct 23
Sampler: TE-5000 TSP	Serial No: 3274	Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 28.00	Corrected Pressure (mm Hg): 711.2
Temperature (deg F): 75.5	Temperature (deg K): 297.3
Average Press. (in Hg): 26.00	Corrected Average (mm Hg): 660.4
Average Temp (Deg F): 76.0	Average Temp: (Deg K): 297.6

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	7.20	1.651	60.5	58.59	Slope: 32.5892
2	5.50	1.444	56.9	55.11	Intercept: 6.1418
3	4.50	1.307	51.4	49.78	Corr. Coeff: 0.9737
4	4.00	1.233	47.7	46.20	
5	3.00	1.169	44.2	42.81	# 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): 52.1
Average Flow Calculation m3/min
1.303955992
Average Flow Calculation in cfm
46.0436432
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min
1877.696629
Total flow in 24 hours cfm
66302.8462

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

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



Trade & Engineering

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

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

Site Conditions

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

Calibration Orifice

Make: Tisch Qstd Slope: 1.58304
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	7.50	1.695	60.9	59.32	Slope: 39.2312
2	6.00	1.517	56.0	54.54	Intercept: -5.8658
3	4.80	1.358	50.7	49.38	Corr. Coeff: 0.9824
4	4.30	1.285	45.8	44.61	
5	3.60	1.177	39.7	38.67	

of Observations: 5

Calculations

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

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

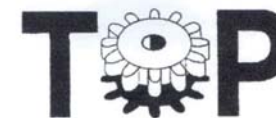
For subsequent calculation of sampler flow:
 $1/m[(I[\text{Sqrt}(298/Tav)(Pav/760)]) - b]$

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

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

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

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



Trade & Engineering

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

Location: - Site ID: - Date: 19 Oct 22
Sampler: TE-5000 TSP Serial No: 3280 Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 30.00 Corrected Pressure (mm Hg): 762.0
Temperature (deg F): 77.0 Temperature (deg K): 298.2
Average Press. (in Hg): 29.00 Corrected Average (mm Hg): 736.6
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	8.20	1.820	64.0	64.07	Slope: 37.2576
2	6.40	1.609	57.0	57.06	Intercept: -3.3546
3	5.00	1.424	50.0	50.05	Corr. Coeff: 0.9987
4	4.50	1.351	47.0	47.05	
5	3.90	1.258	43.0	43.05	

of Observations: 5

Calculations

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

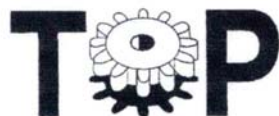
Qstd = standard flow rate
IC = corrected chart response
I = actual chart response
m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg
For subsequent calculation of 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): 45.6
Average Flow Calculation m3/min
1.295216625
Average Flow Calculation in cfm
45.7350497
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min
1865.111939
Total flow in 24 hours cfm
65858.47157

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

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



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

Site Information

Location: - Date: 19 Oct 22
Sampler: TE-5000 TSP Serial No: 3281 Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 31.00 Corrected Pressure (mm Hg): 787.4
Temperature (deg F): 76.0 Temperature (deg K): 297.6
Average Press. (in Hg): 28.00 Corrected Average (mm Hg): 711.2
Average Temp (Deg F): 75.9 Average Temp (Deg K): 297.5

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	8.30	1.863	63.0	64.17	Slope: 37.5798
2	6.50	1.650	56.0	57.04	Intercept: -5.4367
3	5.10	1.463	49.0	49.91	Corr. Coeff: 0.9986
4	4.60	1.390	46.0	46.85	
5	4.00	1.296	42.0	42.78	

of Observations: 5

Calculations

$$Qstd = 1/m[\text{Sqrt}(H_2O(Pa/Pstd)(Tstd/Ta)) - b]$$

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

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): 43.0
Average Flow Calculation m3/min
1.252415345
Average Flow Calculation in cfm
44.2237051
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min
1803.478097
Total flow in 24 hours cfm
63682.13534

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



Certificate of Analyzer Performance Testing

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

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

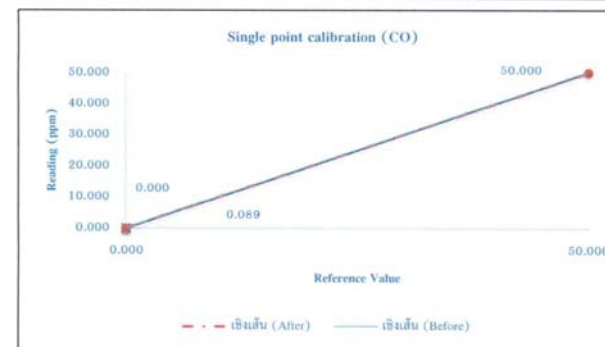
Environmental
Temperature : 24.2 °C
Humidity : 52.0 %RH

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

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

Calibration Check

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



Calibrated by :

Tong.P
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

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

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

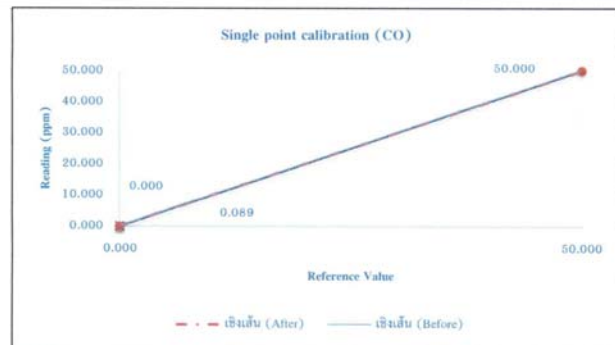
Environmental
Temperature : 24.2 °C
Humidity : 52.0 %RH

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

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

Calibration Check

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



Calibrated by :

Tong Piima
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 11-Mar-23 Certificate No. : 0323-001
Page : 1/1

Analyzer Instruments
Analyzer Type : CO Analyzer Manufacturer : Thermo Environmental
Model : 48C Serial No. : 65775350

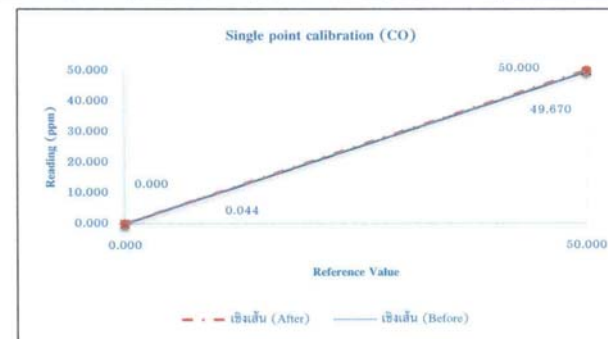
Environmental
Temperature : 24.3 °C
Humidity : 51.4 %RH

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

Standard Gas
NO Conc. : 2 ppm Cylinder No. : CC750227
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	0.044	0.000	0.04	49.670	50.000	-0.66
After						
CO	0.000	0.000	0.00	50.000	50.000	0.00



Calibrated by :

Tong Piima
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 6-Apr-22 Certificate No. : 0422-054
Page : 1/1

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

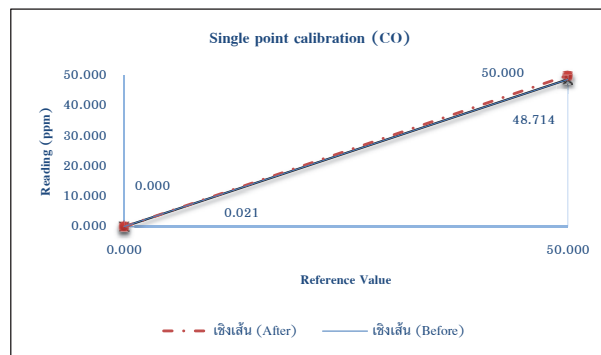
Environmental
Temperature : 24.1 °C
Humidity : 49.3 %RH

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

Standard Gas
NO Conc. : 2 ppm Cylinder No. : CC750227
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	0.021	0.000	0.02	48.714	50.000	-2.57
After						
CO	0.000	0.000	0.00	50.000	50.000	0.00



Calibrated by :

Tong Prima
(Mr. Tong Prima)

Certificate of Analyzer Performance Testing

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

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

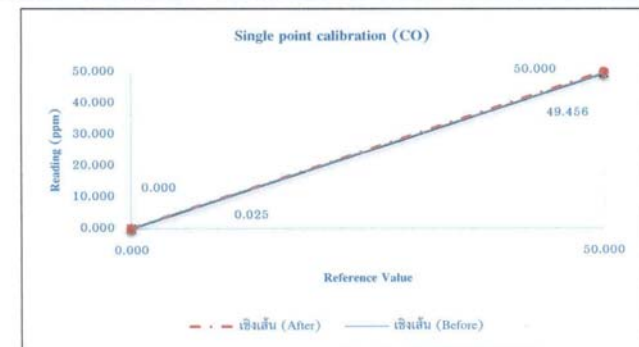
Environmental
Temperature : 25.2 °C
Humidity : 52.3 %RH

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

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

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
CO	0.025	0.000	0.03	49.456	50.000	-1.09
After						
CO	0.000	0.000	0.00	50.000	50.000	0.00



Calibrated by :

Tong Prima
(Mr. Tong Prima)

Certificate of Analyzer Performance Testing

Calibrated Date : 1-Sep-22 Certificate No. : 0922-004
Page : 1/1

Analyzer Instruments

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

Environmental

Temperature : 25.2 °C
Humidity : 51.2 %RH

Calibration System

Calibrator Units

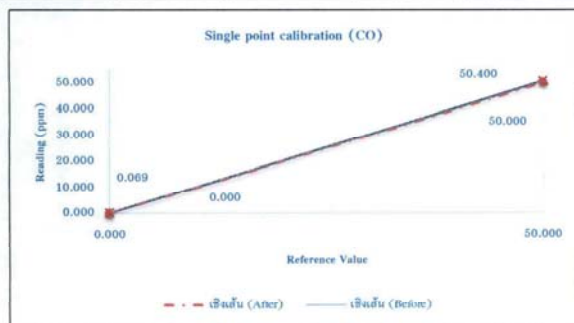
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514811458 Serial No. : 179

Standard Gas

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

Calibration Check

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



Calibrated by :

Tong
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 1-Sep-22 Certificate No. : 0922-005
Page : 1/1

Analyzer Instruments

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

Environmental

Temperature : 26.7 °C
Humidity : 56.9 %RH

Calibration System

Calibrator Units

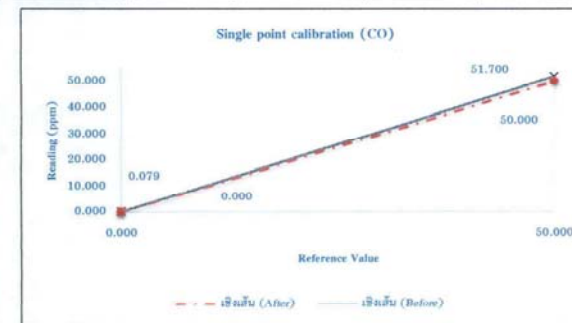
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514811458 Serial No. : 179

Standard Gas

NO Conc. : 2 ppm Cylinder No. : CC750227
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	0.079	0.000	0.08	51.7	50.000	3.40
After						
CO	0.000	0.000	0.00	50.0	50.000	0.00



Calibrated by :

Tong
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 26-Aug-23 Certificate No. : 0823-006
Page : 1/1

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

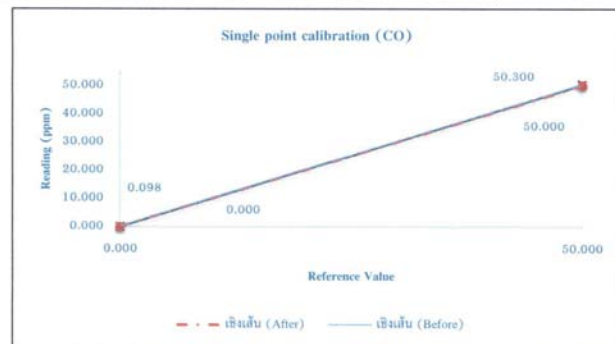
Environmental
Temperature : 24.9 °C
Humidity : 41.3 %RH

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

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

Calibration Check

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



Calibrated by :

Tong Piima
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 10-Jun-23 Certificate No. : 0623-001
Page : 1/1

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

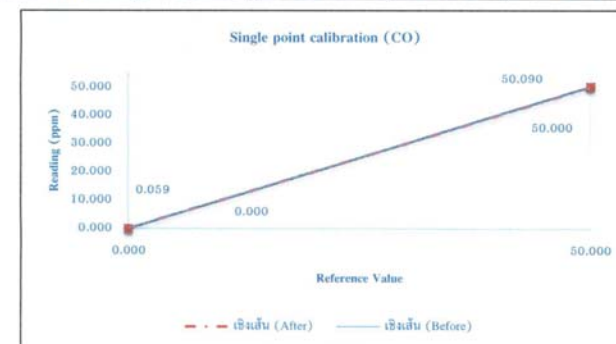
Environmental
Temperature : 25.2 °C
Humidity : 51.3 %RH

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

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

Calibration Check

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



Calibrated by :

Tong Piima
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 21-Jan-23 Certificate No. : 0123-003
Page : 1/1

Analyzer Instruments
Analyzer Type : CO Analyzer Manufacturer : Thermo Environmental
Model : 48C Serial No. : 71021-367

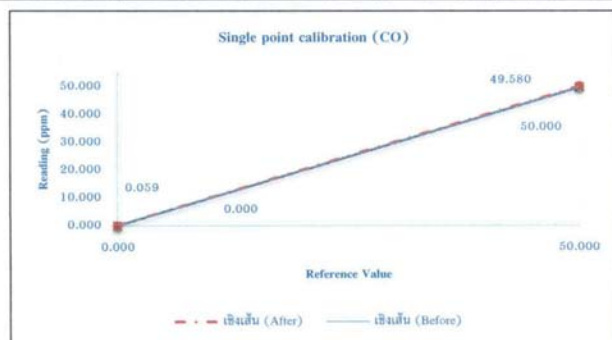
Environmental
Temperature : 26.4 °C
Humidity : 52.7 %RH

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

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

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
CO	0.059	0.000	0.06	49.580	50.000	-0.84
After						
CO	0.000	0.000	0.00	50.000	50.000	0.00



Calibrated by :

Tong Piima
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

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

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

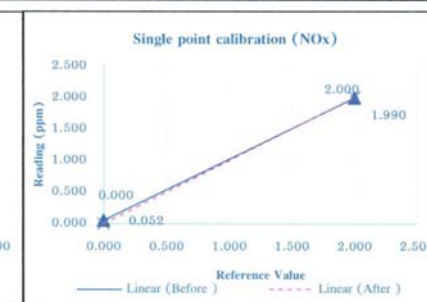
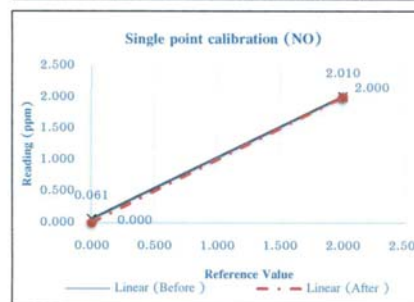
Environmental
Temperature : 25.3 °C
Humidity : 40.2 %RH

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

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

Calibration Check

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



Calibrated by :

Tong Piima
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 11-Mar-23 Certificate No. : 0323-003
Page : 1/1

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

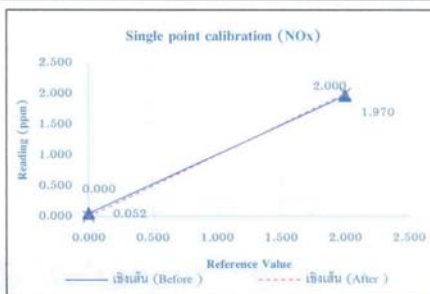
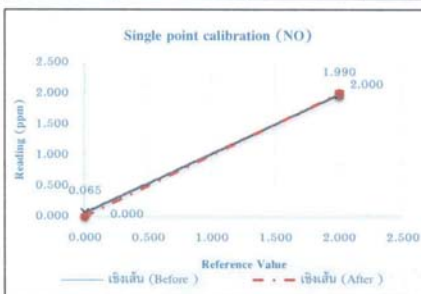
Environmental
Temperature : 24.3 °C
Humidity : 51.4 %RH

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

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

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.065	0.000	0.07	1.99	2.00	-0.50
NO _x	0.052	0.000	0.05	1.97	2.00	-1.50
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NO _x	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by :

Tong
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

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

Analyzer Instruments
Analyzer Type : NO/NO_x/NO_x Analyzer Manufacturer : Thermo Environmental
Model : 42C Serial No. : 72454-371

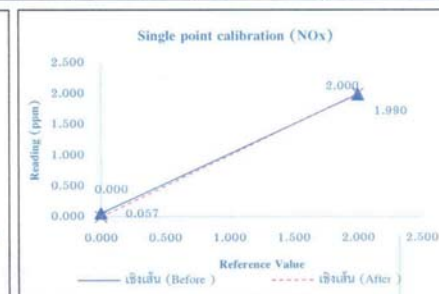
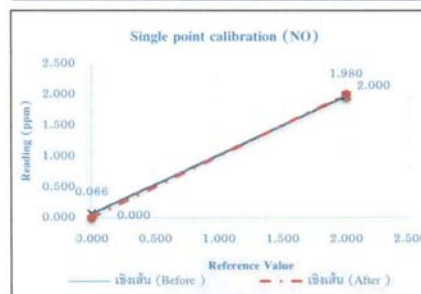
Environmental
Temperature : 25.2 °C
Humidity : 52.3 %RH

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

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

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.066	0.000	0.07	1.98	2.00	-1.00
NO _x	0.057	0.000	0.06	1.99	2.00	-0.50
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NO _x	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by :

Tong
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

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

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

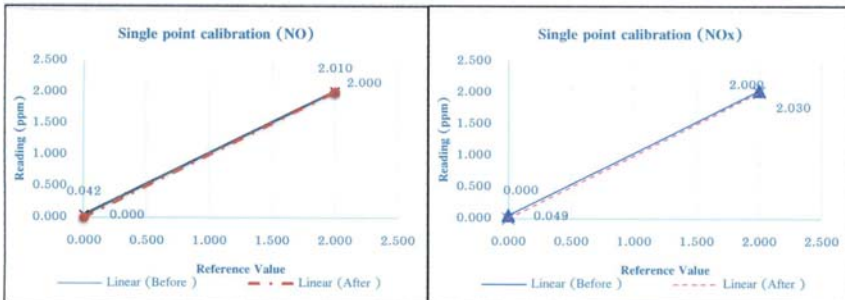
Environmental
Temperature : 25.1 °C
Humidity : 40.4 %RH

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

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

Calibration Check

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



Calibrated by :

Tong Piima
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 4-Aug-23 Certificate No. : 0823-002
Page : 1/1

Analyzer Instruments
Analyzer Type : NO/NO/NOx Analyzer Manufacturer : Thermo Environmental
Model : 42C Serial No. : 508011077

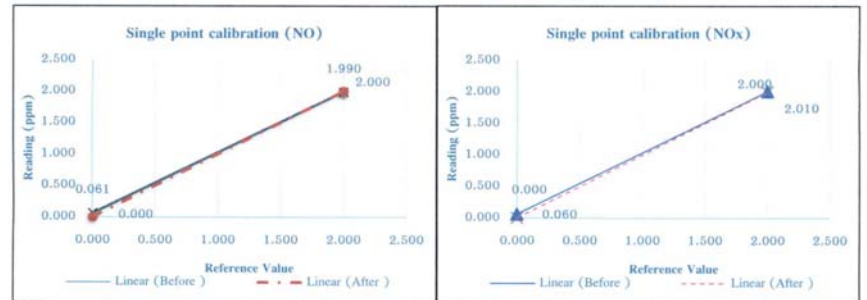
Environmental
Temperature : 24.9 °C
Humidity : 41.3 %RH

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

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

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.061	0.000	0.06	1.99	2.00	-0.50
NOx	0.060	0.000	0.06	2.01	2.00	0.50
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NOx	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by :

Tong Piima
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 4-Aug-23 Certificate No. : 0823-003
Page : 1/1

Analyzer Instruments
Analyzer Type : NO/NO/NOx Analyzer Manufacturer : Thermo Environmental
Model : 42C Serial No. : 59406-323

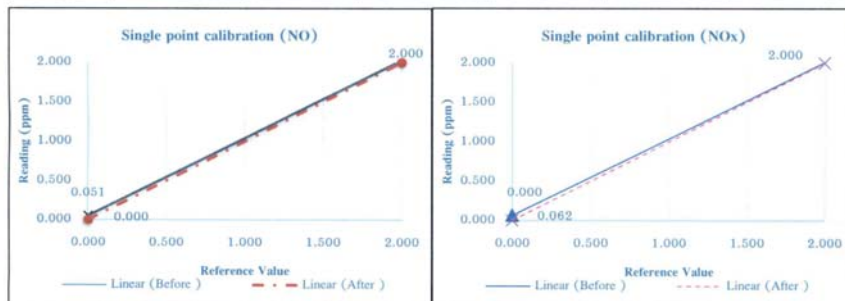
Environmental
Temperature : 26.3 °C
Humidity : 42.5 %RH

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

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

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.051	0.000	0.05	2.03	2.00	1.50
NOx	0.062	0.000	0.06	2.01	2.00	0.50
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NOx	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by :

Tong Pi
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 1-Sep-22 Certificate No. : 0922-003
Page : 1/1

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

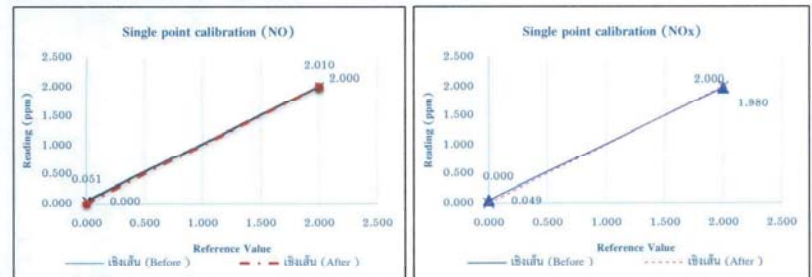
Environmental
Temperature : 26.7 °C
Humidity : 56.9 %RH

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

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

Calibration Check

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

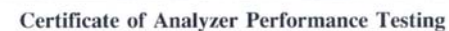


Calibrated by :

Tong Pi
(Mr. Tong Piima)



Tonglu.
(Mr. Tong Piima)




(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 30-Aug-22 Certificate No. : 0822-005
Page : 1/1

Analyzer Instruments
Analyzer Type : SO2 Analyzer Manufacturer : Thermo Environmental
Model : 43C Serial No. : 70853-367

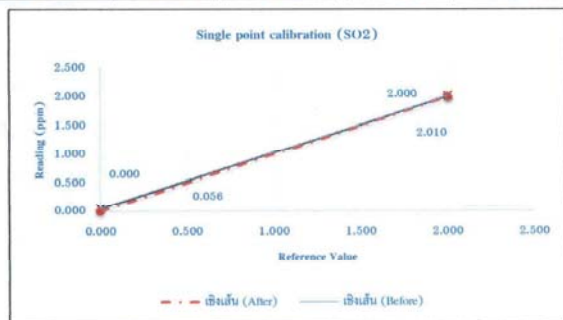
Environmental
Temperature : 25.7 °C
Humidity : 54.1 %RH

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

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

Calibration Check

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



Calibrated by :

Tong
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 26-Aug-23 Certificate No. : 0823-002
Page : 1/1

Analyzer Instruments
Analyzer Type : SO2 Analyzer Manufacturer : Thermo Environmental
Model : 43C Serial No. : 43C-70853-367

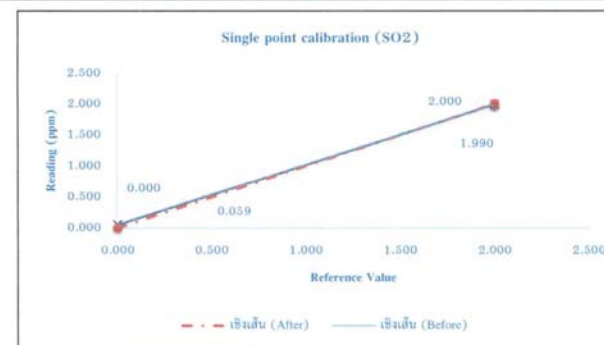
Environmental
Temperature : 25.1 °C
Humidity : 47.9 %RH

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

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

Calibration Check

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



Calibrated by :

Tong
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 3-Oct-22 Certificate No. : 1022-001
Page : 1/1

Analyzer Instruments
Analyzer Type : SO2 Analyzer Manufacturer : Thermo Environmental
Model : 43C Serial No. : CTL63588-340

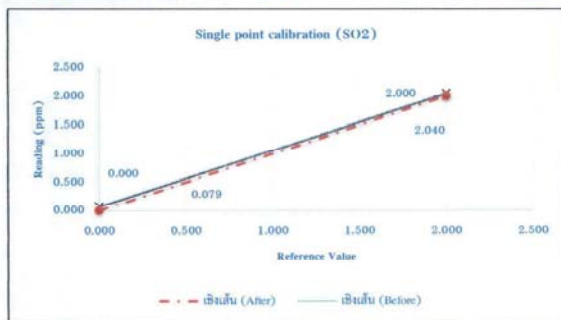
Environmental
Temperature : 24.1 °C
Humidity : 52.1 %RH

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

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

Calibration Check

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



Calibrated by :

Tong
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 30-Sep-23 Certificate No. : 0923-006
Page : 1/1

Analyzer Instruments
Analyzer Type : SO2 Analyzer Manufacturer : Thermo Environmental
Model : 43C Serial No. : CTL63588-340

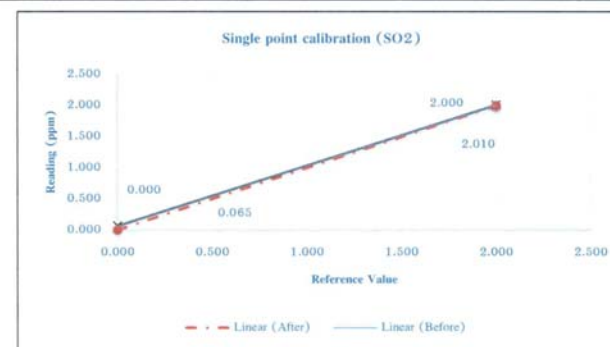
Environmental
Temperature : 26.7 °C
Humidity : 44.0 %RH

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

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

Calibration Check

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



Calibrated by :

Tong
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 1-Sep-22 Certificate No. : 0922-001
Page : 1/1

Analyzer Instruments
Analyzer Type : SO2 Analyzer Manufacturer : Thermo Environmental
Model : 43C Serial No. : 70852-367

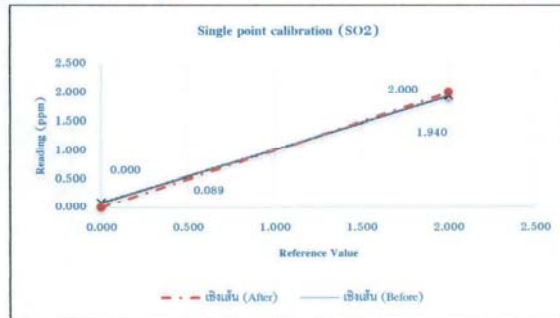
Environmental
Temperature : 25.2 °C
Humidity : 52.0 %RH

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

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

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
SO2	0.089	0.000	0.09	1.94	2.000	-3.00
After						
SO2	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by :

Tong
(Mr. Tong Pima)

Certificate of Analyzer Performance Testing

Calibrated Date : 1-Sep-22 Certificate No. : 0922-002
Page : 1/1

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

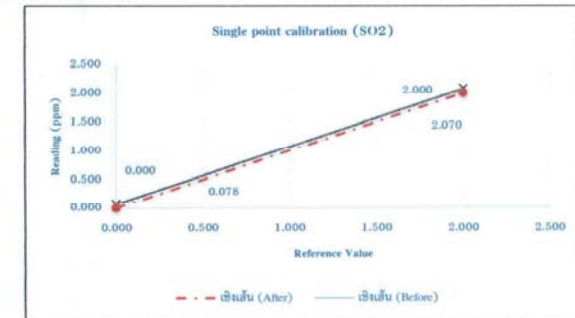
Environmental
Temperature : 25.2 °C
Humidity : 52.0 %RH

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

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

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
SO2	0.078	0.000	0.08	2.07	2.000	3.50
After						
SO2	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by :

Tong
(Mr. Tong Pima)

Certificate of Analyzer Performance Testing

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

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

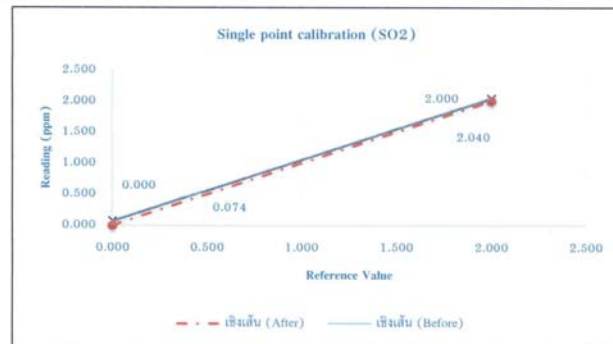
Environmental
Temperature : 25.1 °C
Humidity : 46.2 %RH

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

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

Calibration Check

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



Calibrated by :

Tong Piima
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

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

Analyzer Instruments
Analyzer Type : SO2 Analyzer Manufacturer : Thermo Environmental
Model : 43C Serial No. : 69858-364

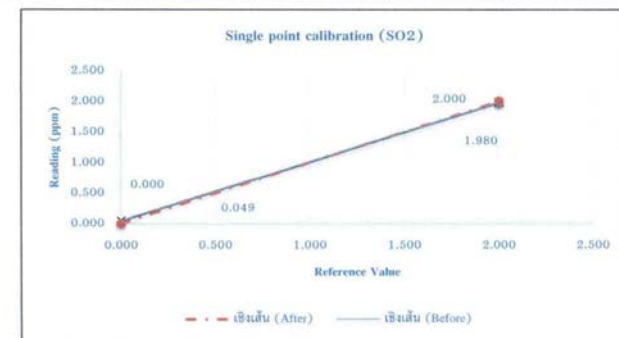
Environmental
Temperature : 25.2 °C
Humidity : 52.3 %RH

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

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

Calibration Check

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



Calibrated by :

Tong Piima
(Mr. Tong Piima)

เอกสารการสอบเทียบเครื่องมือตรวจวัดความชื้นสะท้อน

Certificate of Analyzer Performance Testing

Calibrated Date : 5-Aug-23 Certificate No. : 0823-001
Page : 1/1

Analyzer Instruments
Analyzer Type : SO2 Analyzer Manufacturer : Thermo Environmental
Model : 43C Serial No. : 43C-62201-334

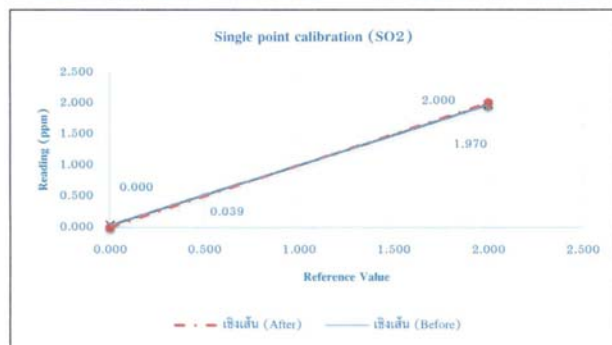
Environmental
Temperature : 25.0 °C
Humidity : 51.9 %RH

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

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

Calibration Check

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



Calibrated by :

Tong Piima
(Mr. Tong Piima)

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

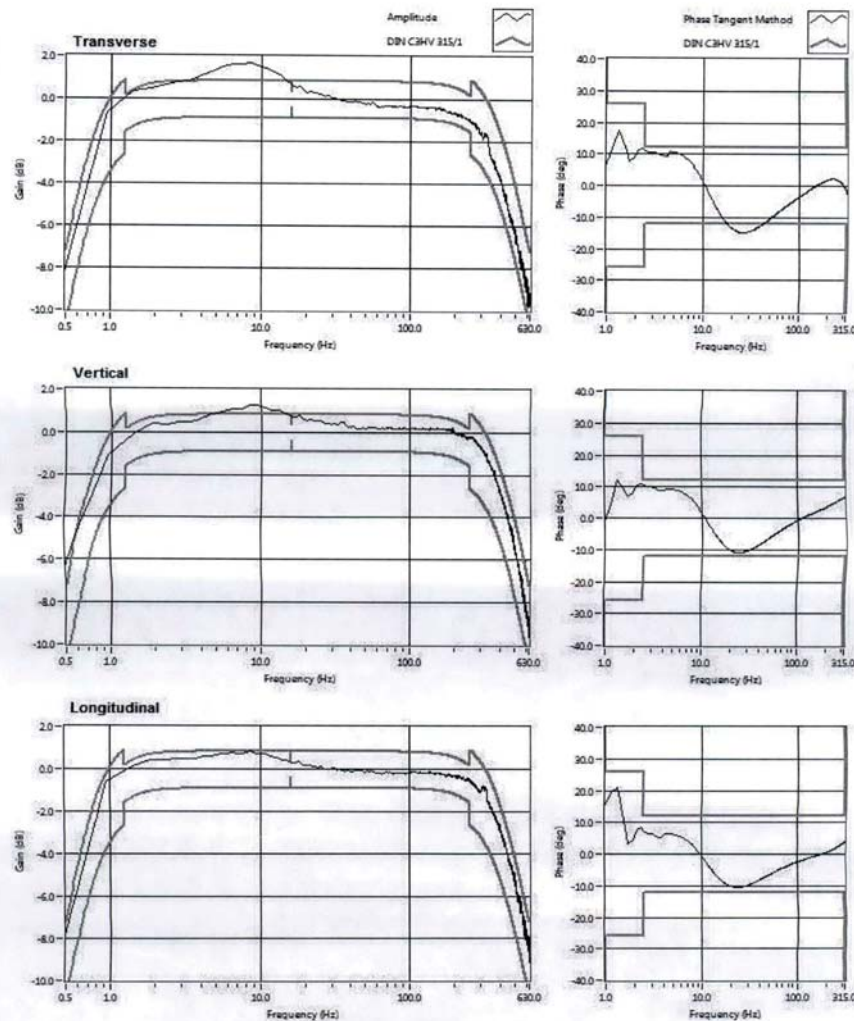
Martin Hogue



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

Instantel

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.: CP20230379EA
Operation No.: CP2023100002

Certificate of Calibration

Equipment: Vibration Meter
Manufacturer: InstanTel
Model/Type: Micromate
Serial No.: UM14163
ID No.: VB-01-001
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran,
Nakorn Phatom 73210
Received Date: 6 October 2023
Calibrated Date: 18 - 20 October 2023
Issued Date: 31 October 2023
Calibrated by: Ms. Juntaporn Kunhakom

Approved by: _____

(Mr. Sittichai Swaksuriyawong)
Group Manager

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

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

Certificate No.: CP20230379EA

Calibration Report

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

Method of Calibration :-

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

Condition of this result of calibration

1. Reference standards instrument :-

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

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

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

- National Institute of Metrology (Thailand)

Certificate No.: CP20230379EA

Calibration Report

Result of Calibration:-

Function : Frequency response and Linearity test at 16 Hz

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

Certificate No.: CP20230379EA

Calibration Report

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

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

Certificate No.: CP20230379EA

Calibration Report

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

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
4.0	10.000	10.008	10.002	-0.006	1.50	Vertical (V)
5.0	10.000	9.991	10.136	0.145	1.50	
6.3	10.000	9.997	10.365	0.368	1.50	
8.0	10.000	10.008	10.270	0.262	1.50	
10.0	10.000	9.990	10.278	0.288	1.50	
12.5	10.000	9.997	10.238	0.241	1.50	
16.0	10.000	9.994	10.175	0.181	1.50	
	20.000	19.997	20.445	0.448	1.50	
	30.000	29.995	30.597	0.602	1.50	
	50.000	49.992	51.043	1.051	1.50	
20.0	10.000	10.003	10.231	0.228	1.50	
25.0	10.000	9.997	9.726	-0.271	1.50	
31.5	10.000	10.000	10.057	0.057	1.50	
40.0	10.000	9.996	10.168	0.172	1.50	
50.0	10.000	9.996	10.199	0.203	1.50	
52.0	10.000	9.994	10.309	0.315	1.50	
63.0	10.000	9.984	10.396	0.412	1.50	
80.0	10.000	9.998	10.672	0.674	1.50	

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

- - End of Report - -



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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

Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

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

Certificate No.: CP20220309EA
Operation No.: CP2022090011

Certificate of Calibration

Equipment: Vibration Meter
Manufacturer: Instantel
Model/Type: Micromate
Serial No.: UM14163
ID No.: VB-01-001
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran,
Nakorn Phatom 73210
Received Date: 15 September 2022
Calibrated Date: 4 - 6 October 2022
Issued Date: 12 October 2022
Calibrated by: Ms. Juntaporn Kunhakom

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

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

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



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20220309EA

Calibration Report

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

Method of Calibration :-

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

Condition of this result of calibration

1. Reference standards instrument :-

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) PULSE Multi-analyzer system	3050-A-060	2705645	CQ20210015EA	1-Dec-2022
4) Pressure humidity and Temperature Transmitter	HMT331	K3810009	CD20220120EA	22-Apr-2023

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

3. This certification is traceable to the international system of unit maintained at :-
- National Institute of Metrology (Thailand)

Certificate No.: CP20220309EA

Calibration Report

Result of Calibration:-

Function : Frequency response and Linearity test at 16 Hz

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty \pm (%)	Direction
4.0	10	9.993	9.553	-0.440	1.5	Longitudinal (L)
5.0	10	9.994	9.742	-0.252	1.5	
6.3	10	10.013	10.049	0.036	1.5	
8.0	10	10.007	9.915	-0.092	1.5	
10.0	10	9.996	9.931	-0.065	1.5	
12.5	10	9.998	9.892	-0.106	1.5	
16.0	10	10.011	9.947	-0.064	1.5	
	20	19.983	19.917	-0.066	1.5	
	30	29.995	29.904	-0.091	1.5	
	50	50.021	49.955	-0.066	1.5	
20.0	10	10.001	9.939	-0.062	1.5	
25.0	10	9.997	9.947	-0.050	1.5	
31.5	10	9.997	9.907	-0.090	1.5	
40.0	10	10.010	9.876	-0.134	1.5	
50.0	10	10.015	9.837	-0.178	1.5	
52.0	10	10.008	9.789	-0.219	1.5	
63.0	10	10.013	9.781	-0.232	1.5	
80.0	10	10.001	9.710	-0.291	1.5	

Certificate No.: CP20220309EA

Calibration Report

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

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty \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	

Certificate No.: CP20220309EA

Calibration Report

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

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
4.0	10	10.004	9.797	-0.207	1.5	Vertical (V)
5.0	10	9.998	10.010	0.012	1.5	
6.3	10	10.003	10.428	0.425	1.5	
8.0	10	10.007	10.357	0.350	1.5	
10.0	10	10.004	10.388	0.384	1.5	
12.5	10	10.004	10.357	0.353	1.5	
16.0	10	10.004	10.333	0.329	1.5	
	20	19.997	20.832	0.835	1.5	
	30	30.010	31.173	1.163	1.5	
	50	49.964	51.957	1.993	1.5	
20.0	10	10.000	10.317	0.317	1.5	
25.0	10	10.001	9.931	-0.070	1.5	
31.5	10	10.001	10.215	0.214	1.5	
40.0	10	10.006	10.278	0.272	1.5	
50.0	10	10.003	10.357	0.354	1.5	
52.0	10	9.983	10.396	0.413	1.5	
63.0	10	9.977	10.483	0.506	1.5	
80.0	10	10.020	11.775	1.755	1.5	

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

-- End of Report --

Certificate No.: 0315SV21
Operation No.: CP2021080021

Certificate of Calibration

Equipment: Vibration Meter
Manufacturer: Instantel
Model/Type: Micromate
Serial No.: UM14163
ID No.: VB-01-001
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran, Nakorn Phatom 73210

Received Date: 20 April 2023
Calibrated Date: 10 - 13 May 2023
Issued Date: 15 May 2023
Calibrated by: Mr. Phooanart Reechomrut

Approved by: _____

(Mr. Sittichai Swaksuriyawong)
Group Manager

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

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor $k = 2.00$, providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

Certificate No.: 0315SV21

Calibration Report

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

Method of Calibration :-

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

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard Accelerometer	8305	2708237	AV-0010-21	31-May-2024
2) Measuring Amplifier	2525	2685967	AV-0006-21	1-Mar-2024
3) LAN XI Analyzer	3050-A-060	3050-110127	0318SV21	2-Sep-2024
4) LAN XI Analyzer	3160-4-042	3060-106135	0317SV21	2-Sep-2024
5) Pressure humidity and Temperature Transmitter	PTU301	L3950483	0177TE21	1-Apr-2024

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

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

- National Institute of Metrology (Thailand)

Certificate No.: 0315SV21

Calibration Report

Result of Calibration:-

Function : Frequency response and Linearity test at 16 Hz

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
1.0	10	10.002	9.907	-0.095	1.5	Longitudinal (L)
2.0	10	10.002	11.263	1.261	1.5	
3.2	10	10.002	12.505	2.503	1.5	
4.0	10	10.191	11.058	0.867	1.5	
5.0	10	10.000	10.932	0.932	1.5	
6.3	10	10.000	11.823	1.823	1.5	
8.0	10	10.000	10.648	0.648	1.5	
10.0	10	10.000	10.546	0.546	1.5	
12.5	10	10.001	10.499	0.498	1.5	
16.0	10	10.003	10.372	0.369	1.5	
	20	20.001	20.792	0.791	1.5	
	30	30.001	31.078	1.077	1.5	
	50	50.001	51.610	1.609	1.5	
20.0	10	10.001	10.349	0.348	1.5	
25.0	10	10.002	10.333	0.331	1.5	
31.5	10	10.000	10.349	0.349	1.5	
40.0	10	10.000	10.325	0.325	1.5	
50.0	10	10.004	10.168	0.164	1.5	
52.0	10	10.004	10.428	0.424	1.5	
63.0	10	10.003	10.475	0.472	1.5	
80.0	10	10.000	10.782	0.782	1.5	
100.0	10	10.000	10.845	0.845	2.5	
125.0	5	5.001	5.699	0.698	3.5	

Certificate No.: 0315SV21

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
1.0	10	9.996	9.466	-0.530	1.5	Transverse (T)
2.0	10	10.008	11.074	1.066	1.5	
3.2	10	10.000	11.492	1.492	1.5	
4.0	10	10.000	10.940	0.940	1.5	
5.0	10	9.998	10.908	0.910	1.5	
6.3	10	10.003	11.074	1.071	1.5	
8.0	10	10.001	10.806	0.805	1.5	
10.0	10	10.003	10.688	0.685	1.5	
12.5	10	10.001	10.609	0.608	1.5	
16.0	10	10.000	10.491	0.491	1.5	
	20	19.997	20.997	1.000	1.5	
	30	30.008	31.385	1.377	1.5	
	50	49.998	52.304	2.306	1.5	
20.0	10	10.001	10.451	0.450	1.5	
25.0	10	10.001	10.412	0.411	1.5	
31.5	10	10.000	10.372	0.372	1.5	
40.0	10	10.000	10.270	0.270	1.5	
50.0	10	10.001	10.349	0.348	1.5	
52.0	10	10.001	10.309	0.308	1.5	
63.0	10	10.003	10.365	0.362	1.5	
80.0	10	10.000	10.711	0.711	1.5	
100.0	10	10.000	10.774	0.774	2.5	
125.0	5	5.001	5.730	0.729	3.5	

Certificate No.: 0315SV21

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
1.0	10	10.006	9.237	-0.769	1.5	Vertical (V)
2.0	10	9.998	10.396	0.398	1.5	
3.2	10	10.006	10.546	0.540	1.5	
4.0	10	10.001	10.380	0.379	1.5	
5.0	10	10.002	10.081	0.079	1.5	
6.3	10	10.000	11.239	1.239	1.5	
8.0	10	10.000	10.215	0.215	1.5	
10.0	10	10.001	10.183	0.182	1.5	
12.5	10	10.000	10.175	0.175	1.5	
16.0	10	10.004	10.141	0.137	1.5	
	20	20.004	20.359	0.355	1.5	
	30	30.003	30.342	0.339	1.5	
	50	50.000	50.822	0.822	1.5	
20.0	10	10.000	10.191	0.191	1.5	
25.0	10	10.000	9.900	-0.100	1.5	
31.5	10	10.000	10.097	0.097	1.5	
40.0	10	10.001	10.275	0.273	1.5	
50.0	10	10.000	10.443	0.443	1.5	
52.0	10	10.001	10.499	0.498	1.5	
63.0	10	10.000	10.759	0.759	1.5	
80.0	10	10.000	11.350	1.350	1.5	
100.0	5	5.001	6.124	1.123	2.5	
125.0	5	5.000	6.408	1.408	3.5	

Remark

UUC: Unit Under Calibration

-- End of Report --



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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

Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

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

Certificate No.: CP20230080EA
Operation No.: CP2022100031

Certificate of Calibration

Equipment: Vibration Meter
Manufacturer: Instantel
Model/Type: Micromate
Serial No.: UM15904
ID No.: VB-01-002
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran,
Nakorn Phatom 73210
Received Date: 26 October 2022
Calibrated Date: 7 - 9 February 2023
Issued Date: 15 February 2023
Calibrated by: Ms. Juntaporn Kunhakom

Approved by: _____

(Mr. Sittichai Swaksuriyawong)
Group Manager

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

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



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20230080EA

Calibration Report

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

Method of Calibration :-

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

Condition of this result of calibration

1. Reference standards instrument :-

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-0007-22	9-Jun-2023
3) PULSE Multi-analyzer system	3560-C	2705645	CQ20230003EA	25-Dec-2023
4) Humidity and Temperature Transmitter	HMT331	K3810009	CD20220120EA	22-Apr-2023

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

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

- National Institute of Metrology (Thailand)

Certificate No.: CP20230080EA

Calibration Report

Result of Calibration:-

Function : Frequency response and Linearity test at 16 Hz

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty \pm (%)	Direction
4.0	10.000	9.997	10.514	0.517	1.50	Longitudinal (L)
5.0	10.000	10.027	10.908	0.881	1.50	
6.3	10.000	10.015	10.813	0.798	1.50	
8.0	10.000	10.027	10.489	0.462	1.50	
10.0	10.000	9.986	10.483	0.497	1.50	
12.5	10.000	10.003	10.341	0.338	1.50	
16.0	10.000	9.984	10.215	0.231	1.50	
	20.000	20.025	20.248	0.223	1.50	
	30.000	29.981	30.298	0.317	1.50	
	50.000	49.922	50.507	0.585	1.50	
20.0	10.000	9.996	10.199	0.203	1.50	
25.0	10.000	9.980	10.191	0.211	1.50	
31.5	10.000	9.974	10.183	0.209	1.50	
40.0	10.000	10.006	10.270	0.264	1.50	
50.0	10.000	10.000	10.199	0.199	1.50	
52.0	10.000	10.013	10.286	0.273	1.50	
63.0	10.000	9.976	10.325	0.349	1.50	
80.0	10.000	9.976	10.317	0.341	1.50	

Certificate No.: CP20230080EA

Calibration Report

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

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

Certificate No.: CP20230080EA

Calibration Report

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

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

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

-- End of Report --

Certificate No.: 0316SV21

Operation No.: CP2021080022

Certificate of Calibration

Equipment: Vibration Meter

Manufacturer: Instantel

Model/Type: Micromate

Serial No.: UM15904

ID No.: VB-01-002

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

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

Received Date: 20 April 2023

Calibrated Date: 10 - 13 May 2023

Issued Date: 15 May 2023

Calibrated by: Mr. Phooanart Reechomrut

Approved by: _____

(Mr. Sittichai Swaksuriyawong)
Group Manager

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

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor $k = 2.00$, providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

Certificate No.: 0316SV21

Calibration Report

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

Method of Calibration :-

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

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard Accelerometer	8305	2708237	AV-0010-21	31-May-2024
2) Measuring Amplifier	2525	2685967	AV-0006-21	1-Mar-2024
3) LAN XI Analyzer	3050-A-060	3050-110127	0318SV21	2-Sep-2024
4) LAN XI Analyzer	3160-4-042	3060-106135	0317SV21	2-Sep-2024
5) Pressure humidity and Temperature Transmitter	PTU301	L3950483	0177TE21	1-Apr-2024

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

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

- National Institute of Metrology (Thailand)

Certificate No.: 0316SV21

Calibration Report

Result of Calibration:-

Function : Frequency response and Linearity test at 16 Hz

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
1.0	10	10.001	9.942	-0.059	1.5	Longitudinal (L)
2.0	10	10.003	11.161	1.158	1.5	
3.2	10	9.998	11.476	1.478	1.5	
4.0	10	10.006	10.956	0.950	1.5	
5.0	10	10.003	10.806	0.803	1.5	
6.3	10	10.003	10.838	0.835	1.5	
8.0	10	10.007	10.601	0.594	1.5	
10.0	10	10.001	10.562	0.561	1.5	
12.5	10	10.000	10.467	0.467	1.5	
16.0	10	9.998	10.420	0.422	1.5	
	20	19.997	20.800	0.803	1.5	
	30	30.000	31.086	1.086	1.5	
	50	50.001	51.736	1.735	1.5	
20.0	10	10.000	10.420	0.420	1.5	
25.0	10	10.003	10.475	0.472	1.5	
31.5	10	10.004	10.412	0.408	1.5	
40.0	10	9.998	10.380	0.382	1.5	
50.0	10	10.006	10.238	0.232	1.5	
52.0	10	10.007	10.428	0.421	1.5	
63.0	10	9.998	10.443	0.445	1.5	
80.0	10	9.998	10.711	0.713	1.5	
100.0	10	10.004	10.672	0.668	2.5	
125.0	5	5.002	5.683	0.681	3.5	

Certificate No.: 0316SV21

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
1.0	10	9.997	9.491	-0.506	1.5	Transverse (T)
2.0	10	10.001	10.711	0.710	1.5	
3.2	10	10.002	12.028	2.026	1.5	
4.0	10	10.003	10.648	0.645	1.5	
5.0	10	10.001	10.499	0.498	1.5	
6.3	10	10.001	11.484	1.483	1.5	
8.0	10	10.003	10.365	0.362	1.5	
10.0	10	10.003	10.380	0.377	1.5	
12.5	10	10.000	10.309	0.309	1.5	
16.0	10	10.000	10.380	0.380	1.5	
	20	20.005	20.603	0.598	1.5	
	30	30.001	30.834	0.833	1.5	
	50	50.289	51.445	1.156	1.5	
20.0	10	10.004	10.325	0.321	1.5	
25.0	10	10.003	10.333	0.330	1.5	
31.5	10	10.004	10.349	0.345	1.5	
40.0	10	10.000	10.191	0.191	1.5	
50.0	10	10.006	10.089	0.083	1.5	
52.0	10	10.000	10.294	0.294	1.5	
63.0	10	10.000	10.302	0.302	1.5	
80.0	10	10.004	10.767	0.763	1.5	
100.0	10	10.003	10.838	0.835	2.5	
125.0	5	5.002	5.777	0.775	3.5	

Certificate No.: 0316SV21

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
1.0	10	10.001	9.308	-0.693	1.5	Vertical (V)
2.0	10	10.001	10.152	0.151	1.5	
3.2	10	10.001	10.120	0.119	1.5	
4.0	10	10.177	9.892	-0.285	1.5	
5.0	10	10.004	9.639	-0.365	1.5	
6.3	10	10.002	10.609	0.607	1.5	
8.0	10	10.000	9.655	-0.345	1.5	
10.0	10	10.002	9.718	-0.284	1.5	
12.5	10	10.000	9.805	-0.195	1.5	
16.0	10	10.001	9.931	-0.070	1.5	
	20	20.000	20.020	0.020	1.5	
	30	30.000	30.022	0.022	1.5	
	50	49.999	50.026	0.027	1.5	
20.0	10	10.000	10.057	0.057	1.5	
25.0	10	10.000	9.805	-0.195	1.5	
31.5	10	10.002	10.065	0.063	1.5	
40.0	10	10.001	10.191	0.190	1.5	
50.0	10	10.000	10.302	0.302	1.5	
52.0	10	10.003	10.294	0.291	1.5	
63.0	10	10.001	10.382	0.381	1.5	
80.0	10	10.000	10.743	0.743	1.5	
100.0	5	5.000	5.541	0.541	2.5	
125.0	5	5.002	5.746	0.744	3.5	

Remark

UUC: Unit Under Calibration

-- End of Report --



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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

Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

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

Certificate No.: CP20230148EA
Operation No.: CP2023020060

Certificate of Calibration

Equipment: Vibration Meter
Manufacturer: Instantel
Model/Type: Micromate
Serial No.: UM16048
ID No.: VB-01-003
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran,
Nakorn Phatom 73210
Received Date: 28 February 2023
Calibrated Date: 7 - 9 March 2023
Issued Date: 14 March 2023
Calibrated by: Ms. Juntaporn Kunhakom

Approved by: _____

(Mr. Sittichai Swaksuriyawong)
Group Manager

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

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



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20230148EA

Calibration Report

Equipment: Vibration Meter
Manufacturer: Instantel
Model: Micromate
Serial No.: UM16048
ID No.: VB-01-003
Ambient Temperature: (23 ± 5) °C
Relative Humidity: (50 ± 15) %
Method of Calibration :-
In-house method : CC-SV004 by comparison with standard accelerometer.

Condition of this result of calibration

1. Reference standards instrument :-

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

2. This result of calibration was found accurate as shown on date and place of calibration only.
3. This certification is traceable to the international system of unit maintained at :-
- National Institute of Metrology (Thailand)

Certificate No.: 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	10.008	10.554	0.546	1.50	Longitudinal (L)
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	10.365	0.357	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	10.372	0.362	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	
52.0	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	

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 \pm (%)	Direction
4.0	10.000	9.970	10.853	0.883	1.50	Transverse (T)
5.0	10.000	9.998	10.869	0.871	1.50	
6.3	10.000	10.000	10.901	0.901	1.50	
8.0	10.000	10.003	10.538	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	0.483	1.50	
25.0	10.000	10.000	10.475	0.475	1.50	
31.5	10.000	10.008	10.530	0.522	1.50	
40.0	10.000	10.004	10.609	0.605	1.50	
50.0	10.000	9.994	10.593	0.599	1.50	
52.0	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	Nominal	Standard	UUC	Deviation	Uncertainty	Direction
(Hz)	(mm/s)	(mm/s)	(mm/s)	(mm/s)	± (%)	
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	
52.0	10.000	10.000	10.374	0.374	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: Unit Under Calibration
2. The coverage factor $k = 2.00$

-- End of Report --

Calibration Certificate

Part Number: 721A2601
Description: Micromate with DIN Geophone
Serial Number: UM20453
Calibration Date: April 21, 2023
Calibration Reference Equipment: SRV-AFR 714J7401
*Calibrated with Geo UM6231

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

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

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

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

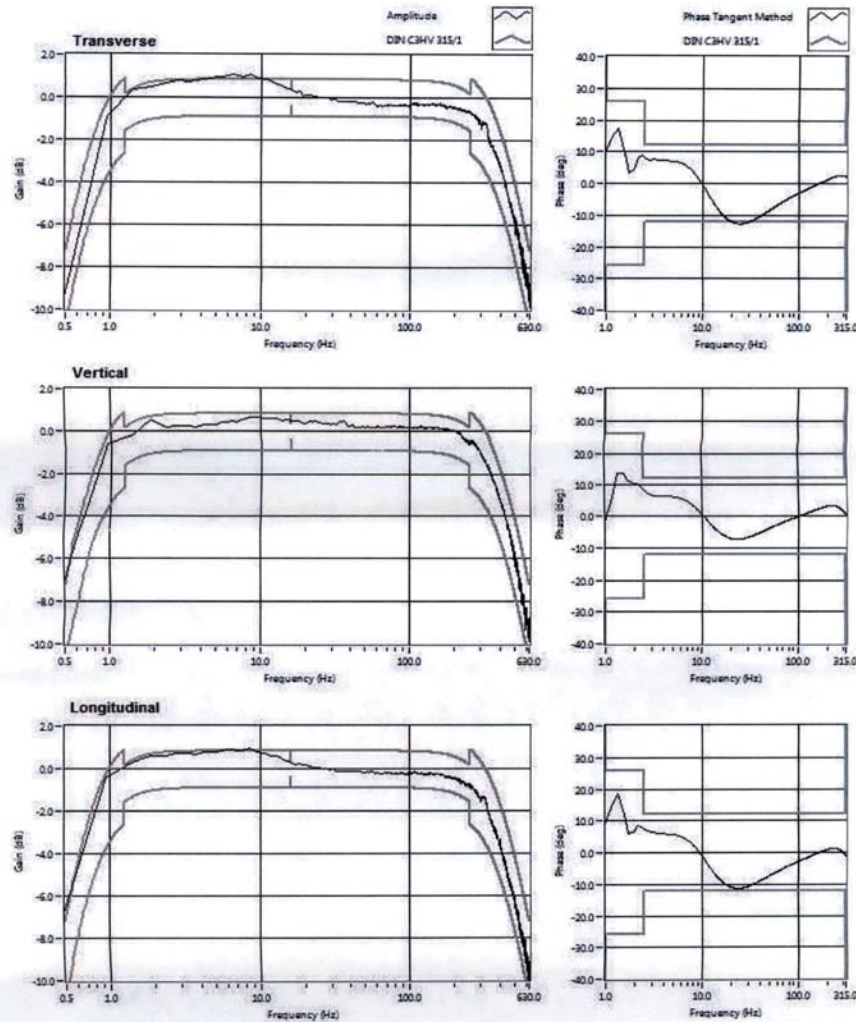
Calibrated By: Yaksh Patel

Yaksh Patel



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

Frequency Response of UM20453 (As Found)



Calibration Certificate

Part Number: 721A2601
 Description: Micromate with DIN Geophone
 Serial Number: UM21467
 Calibration Date: MAY 29 2023
 Calibration Reference Equipment: 714J7403

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

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

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

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

Calibrated By:

Xiaoming Yang

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

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพน้ำ



Merci d'avoir choisi Instantel!

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

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

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

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

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

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

Thermo
SCIENTIFIC

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: 22178-60018

Aquion Final Test

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

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

Tester's Signature: Angel Ruiz

Date: 22 Dec 2022

60-069566 Rev B

Aquion Pump Summary Test Report

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

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

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

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

Angel Ruiz
 Test Technician

22 Dec 2022
 Date

Aquion Detector Summary Test Report

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

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

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

Detector Noise & Drift Test					
	Background Signal		Drift	Noise	
Test Run	Measured	0.05 - 0.50 μ S	Measured <=10.0 nS/hour	Measured	<=0.2 nS
Cell DI Water Noise and Drift	0.090 μ S	Pass	-4.715 nS/hour	Pass	0.139 nS Pass

Detector Linearity Test					
	Correlation Coefficient		%RSD	Calibration Curve	
Test Run	Measured	>= 0.999	Measured	<=5.0 %	Offset Slope
Cell Linearity Test 5 ppm	0.99998	Pass	4.30	Pass	0.000 0.553

Injector Precision Test					
	Area			Retention Time	
Test Run	Average	%RSD	<= 1%	Average	Max-Min
Injector Precision: 50 ppm	2.576 μ S*min	0.106%	Pass	0.373 min	0.0100 min

Angel Ruiz
 Test Technician

22 Dec 2022
 Date

Thermo Aquion System Calibration Summary

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

Column Heater	Column Calibration	
	Electrical Offset	0.000
	Heater Offset	1.95
	Heater Slope	1.02

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

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

China RoHS
Electrical and Electronic Products Restriction of Hazardous Substances Management Measures
For applicable products, the Hazardous Substance Information Table is located at:
<http://www.thermofisher.com/us/en/home/technical-resources/rohs-certificates.html>



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

CERT.No.: HS-T059I

Certificate of Calibration

Calibration Date : 1 Sep 22

Model : YSI 5000

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

S/N : 18L109487

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

Probe : YSI 5010

Samutsakorn 74130

S/N : 22G100123

ID NO. :

Avg Room Temp : 20 °C

Air Temp ref : S/N. E00522

Avg Water Temp : 20 °C

Barometric ref : S/N. E00522

Air Pressure : 760.00 mmHg

Water Temp ref : S/N. 11431

Salinity : 0 ppt

Technician : Kittipong M.

Calibration Details

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

Mean Measurement	9.09	mg/l	-	-
Inaccuracy	0.00	mg/l	-	-

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

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

Technician Signature

Laboratory Manager



Calibration Result

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

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

Service Engineer Signature:

(Teerapon Tawonwong)

Date:

21.12.2022



Gases Flow Rate Validation Result

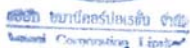
Carrier Gases			
Set point (mL/min)	Measured (mL/min)	Criteria (mL/min)	Status
25	25.0	24.0-26.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail
Detector Gases			
Reference Gas			
Set point (mL/min)	Measured (mL/min)	Criteria (mL/min)	Status
Low 9	9.3	8.0-12.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail
High 50	46.7	45.0-55.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail
Make-up Gas			
Set point (mL/min)	Measured (mL/min)	Criteria (mL/min)	Status
Low 9	9.7	8.0-12.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail
High 30	31.3	28.0-32.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail

Service Engineer Signature:

(Teerapon Tawonwong)

Date:

21.12.2022



Temperature Validation Result

Injector Temperature			
Set point (°C)	Measured (°C)	Status	Note
60 +/- 1.0	60.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail	
Detector Temperature			
Block Temp			
Set point (°C)	Measured (°C)	Status	Note
60 +/- 1.0	60.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail	
Transfer Temp			
Set point (°C)	Measured (°C)	Status	Note
60 +/- 1.0	60.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail	
Column Oven			
Set point (°C)	Measured (°C)	Status	Note
40 +/- 1	40.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail	RTD OFFSET = 6.2
120 +/- 1	120.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail	

Service Engineer Signature:

(Teerapon Tawonwong)

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:

(Teerapon Tawonwong)

Date:

21.12.2022

บริษัท อามานี จำกัด
Amani Corporation Limited



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)

Date:

21.12.2022

บริษัท อามานี จำกัด
Amani Corporation Limited



Certificate of Calibration

Certificate No.: C31230380

Page: 2 of 3

Equipment: Cooled Incubator
Model: KB 240
Serial No.(or ID): 20180000012164 (WW-16-001)
Manufacturer: Binder
Condition: In Condition
Shelves(pc.): 3

Certificate No.: C31230380
Issued Date: 21 February 2023
Job No.: KSPR2302594
Page: 1 of 3
Ventilation Valve: None

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

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

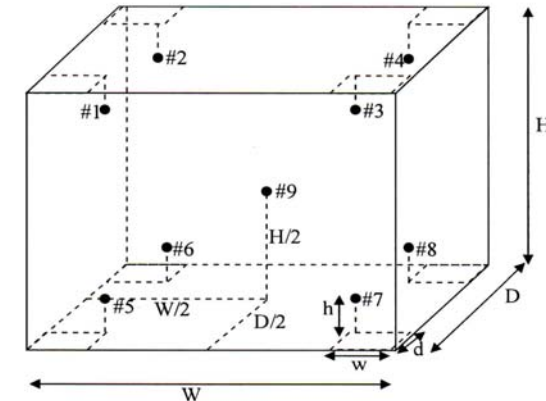
Calibration Place: C.E.M Technology (Thailand) Co., Ltd. (Laboratory Room)
 219/43 Moo 12 Petchkasem Road,
 Omnoi Krathum Baen, Samut Sakhon 74130 Thailand

Calibration By: Mr. Suphanimit Khamnonphoem

Calibration Date: 15 February 2023

The Method used: In house method, CAL-WI-16, base on TLAS-G20

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C10220016



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.

(Mr. Suphanimit Khamnonphoem)

Person in charge

(Mr. Udon Srichana)

Authorized signatory

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

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

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

บริษัท ดีเคเอส อีเซีย จำกัด
 DKSH Technology Limited
 2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
 2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
 Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

CAL-FM-C31-10: 12 Sep 2022

บริษัท ดีเคเอส อีเซีย จำกัด
 DKSH Technology Limited
 2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
 2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
 Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

CAL-FM-C31-10: 12 Sep 2022

Calibration Results:

Without adjustment

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

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

Temperature Distribution

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

Chamber Characterization

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

Note: * Maximum uncertainty of the each position

The End of Certificate

Statements of conformity:

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

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

Tolerance and Decision rules:

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

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



(Mr. Udon Srichana)
Authorized signatory

Without adjustment

Desired Temperature : 20.0°C Tolerances : 1.0 °C

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

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

Correction of UUC.* = Measured Temperature - Desired Temperature

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

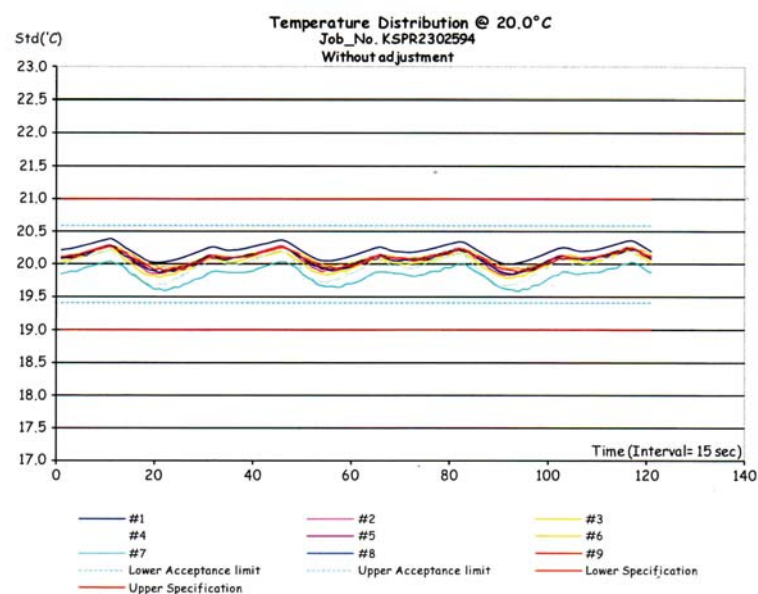
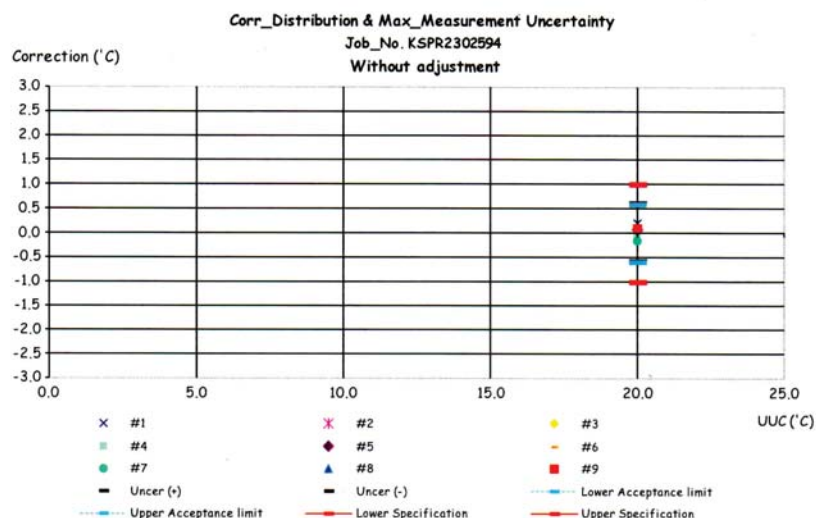
The End of Statements of Conformity

ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: KSPR2302594

ชนิดเครื่องมือ: Cooled Incubator รุ่น: KB 240

หมายเลขเครื่อง: 20180000012164 (WW-16-001)



ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
15 Feb 2023			15 Feb 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน พัดลม	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	6. สภาพ Lever of Ventilation valve	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพ Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพ Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. การทำงานของระบบทำความเย็น	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. การทำงานของระบบทำความร้อน	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ :

Mr. Suphanimit Khamnonphoem
Service Engineer



Certificate of Calibration

Equipment: Hot Air Oven
Model: UF 55
Serial No.(or ID): B219.0142 (WW-05-002)
Manufacturer: Memmert
Condition: In Condition
Shelves(pc.): 2

Certificate No.: C31230315
Issued Date: 16 February 2023
Job No.: KSPR2302593
Page: 1 of 4
Ventilation Valve: Closed

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

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

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

Calibration By: Mr. Apiwit Chaosap

Calibration Date: 15 February 2023

The Method used: In house method, CAL-WI-16, base on TLAS-G20

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C10220016

(Mr. Apiwit Chaosap)

Person in charge

(Mr. Udon Srichana)

Authorized signatory

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

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

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

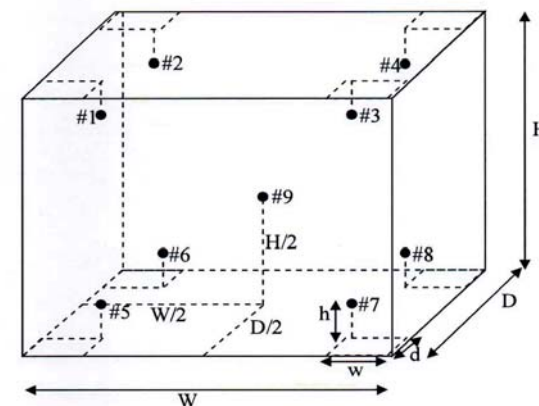
บริษัท เทคโนโลยี จำกัด
 DKSH Technology Limited
 2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
 2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
 Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

CAL-FM-C31-10: 12 Sep 2022

Certificate No.: C31230315

Page: 2 of 4



Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

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

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

Standard Locations (#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.

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

Delivering Growth - in Asia and Beyond.

CAL-FM-C31-10: 12 Sep 2022

Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	104.08	0.08	0.39
#2	103.99	-0.01	0.39
#3	104.30	0.30	0.39
#4	104.24	0.24	0.39
#5	104.33	0.33	0.39
#6	104.22	0.22	0.39
#7	103.71	-0.29	0.39
#8	104.24	0.24	0.39
#9	104.36	0.36	0.39

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.0	104.0	104.08	103.99	104.30	104.24	104.33	104.22	103.71	104.24	104.36	0.39

Chamber Characterization

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

Note: * Maximum uncertainty of the each position

Without adjustment (Cont.)

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

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

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
180.0	180.0	180.0	179.63	179.69	180.34	180.23	180.59	180.23	179.42	180.28	180.67	0.48

Chamber Characterization

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

Note: * Maximum uncertainty of the each position

The End of Certificate

Statements of conformity:

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

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

Tolerance and Decision rules:

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

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



(Mr. Udon Srichana)
Authorized signatory

Without adjustment

Desired Temperature : 104.0°C Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

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

Correction of UUC.* = Measured Temperature - Desired Temperature

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

Statements of conformity:(Cont.)

Without adjustment (Cont.)

Desired Temperature : 180.0°C Tolerances : 2.0 °C

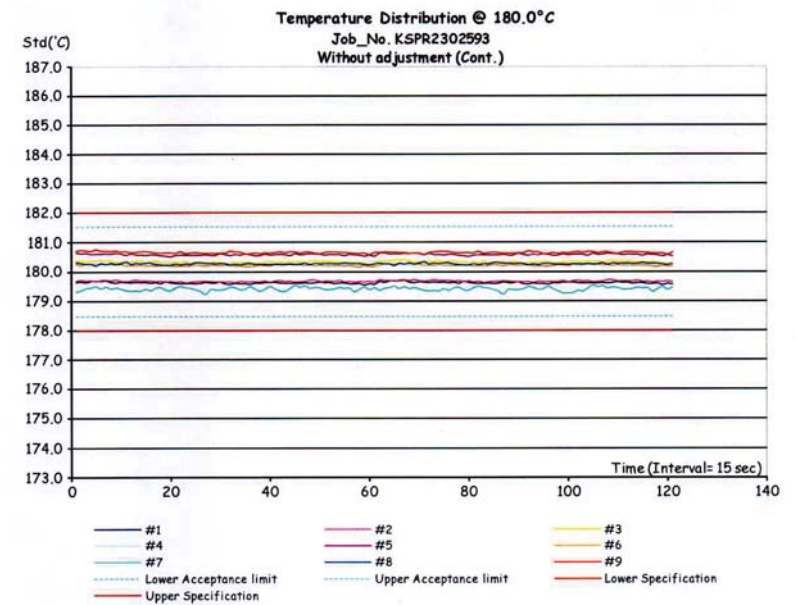
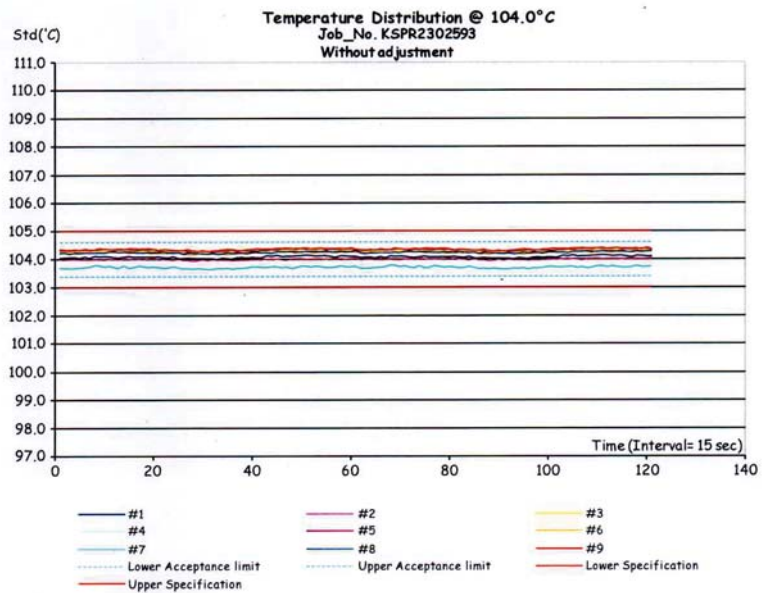
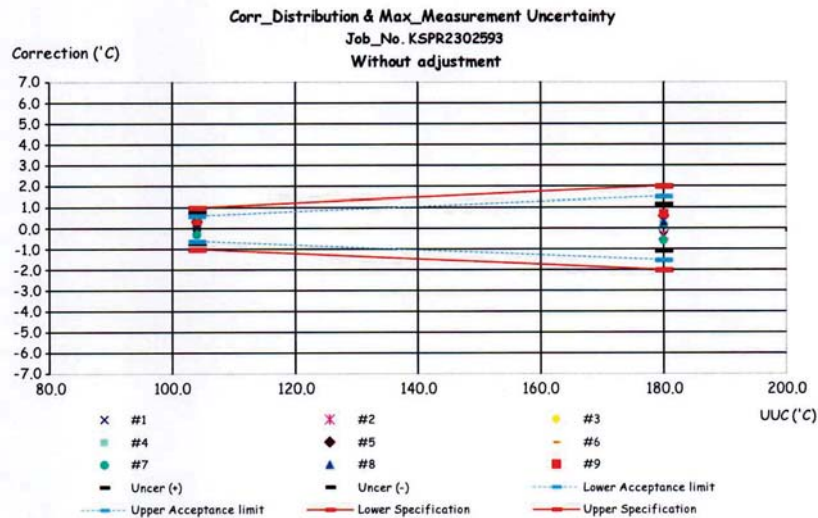
Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

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

Correction of UUC.* = Measured Temperature - Desired Temperature

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

The End of Statements of Conformity





ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: KSPR2302593

ชนิดเครื่องมือ: Hot Air Oven

รุ่น: UF 55

หมายเลขเครื่อง: B219.0142 (WW-05-002)

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
15 Feb 2023			15 Feb 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน พัดลม	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. สภาพ Lever of Ventilation valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพ Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพ Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. การทำงานของระบบทำความเย็น	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input type="checkbox"/>	<input type="checkbox"/>	11. การทำงานของระบบทำความร้อน	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ขอแนะนำ :

Mr. Apiwit Chaosap
Service Engineer

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phraekhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

CAL

Calibratech Co.,Ltd.

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

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



Certificate of Calibration

Certificate No. : 66-420017-1

Page : 1 of 2

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

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

Equipment : pH Meter with electrode

pH meter

Manufacturer : Thermo Scientific Model : VERSA STAR PRO

Range : N/A pH Resolution : 0.01 pH

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

Electrode

Model : 9156BNWP Serial No. : VV1-15843

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

Ambient Temperature : (22.0 to 22.6) °C

Relative Humidity : (55 to 58) %

Date of Received : 13 February 2023

Date of Calibration : 13 February 2023

Date of Issue : 18 February 2023

Calibrated by : Bunjerd Masri

Calibration Method : In-house method CAL-M4201 direct measurement by using standard voltage calibrator and using certified reference material (CRM)

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

1. Multiproduct Calibrator

ID No.	Cert. No.	Due Date	Traceability
400005	SG-E-00473/64	27 Aug 2023	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

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

Approved by :

(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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

CAL-F0031-03



Certificate of Calibration

Certificate No. : 66-420017-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

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

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

Function : pH meter with electrode

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

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

Remark

UUC : Unit Under Calibration

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$,

providing a level of confidence of approximately 95%

- o() o -

Certificate of Calibration

Certificate No. : 66-400084-1

Page : 1 of 2

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

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

Equipment : Digital Thermometer with Thermistor probe

Temperature Indicator

Manufacturer : Thermo Scientific Model : VERSA STAR PRO

Range : N/A °C Resolution : 0.1 °C

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

Thermistor probe

Model : N/A Sheath Material : Stainless

Diameter : 6.5 mm. Length : 120 mm.

Serial No. : PT1-18812 ID No. : WW-03-001

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

Ambient Temperature : (22.0 to 22.6) °C

Relative Humidity : (55 to 58) %

Line Voltage : (224.5 to 226.0) VAC

Date of Received : 13 February 2023

Date of Calibration : 13 February 2023

Date of Issue : 18 February 2023

Calibrated by : Bunjerd Masri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003

by compared with PRT in the dry-well calibrator at the constant controlled temperature.

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

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

2. Standard Digital Thermometer

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

Approved by :

(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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



CAL

Calibratech Co.,Ltd.

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

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

Certificate of Calibration

Certificate No. : 66-400084-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
120	25.004	25.0	0.0	0.19

Remark

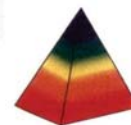
UUC : Unit Under Calibration

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

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

- o0o -

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



NSC-TIS-TIS 17025
CALIBRATION 0366

CERTIFICATE OF CALIBRATION

Certificate No : S2022/168

Page : 1/5

Order No : 316/2022

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

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

Instrument : UV/VIS spectrophotometer

Manufacture : MERCK

Model : Prove100

Serial Number : 1714112078

Environment : Temperature (26.6 - 26.4) °C

Humidity (58 - 60) %RH

Received Date : September 29, 2022

Calibration Date : September 29, 2022

Issued Date : October 3, 2022

Calibrate Status : No Adjustment

Calibration Area : Customer area

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

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

Approved By :
(Mr.Wanchai Meesiri)
Manager



Certificate No : S2022/168
Page : 2/5

1. Photometric Accuracy

CRMs: Neutral Density Glass Filters

CRMs Serial Number: A404

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

Spectral slit width : 4.00 nm

1.1 Reading scale at 420.0 nm

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

1.2 Reading scale at 440.0 nm

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

1.3 Reading scale at 465.0 nm

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

1.4 Reading scale at 546.1 nm

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



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
0.9464	0.945	0.0014	0.0029
1.9021	1.899	0.0031	0.0061

1.6 Reading scale at 635.0 nm

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

2. Photometric Accuracy

CRMs: Potassium Dichromate in Perchloric acid

CRMs Serial Number: 15086

Blank Serial Number: 15178

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

Spectral slit width : 4.00 nm

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



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: W184/H

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

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

3.2 CRMs: Didymium Glass Filter

CRMs Serial Number: W184/D

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

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



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 Sarna certificate report no. 88922

Spectral slit width : 4.00 nm

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

5. *Spectral Resolution

CRMs: Toluene in Hexane

CRMs Serial Number: 8697

Blank Serial Number: 8716

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

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

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

Remark:

Calibrate Method

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

- End of Report -



Certificate of Calibration

Certificate No.: C15230305

Page: 2 of 2

Equipment: Digital Thermometer with Sensor
Model: TK 61
Serial No.: 1P181269184
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, Bangchak,
Phrakhanong, Bangkok 10260 Thailand

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



(Mr. Anat Karapitak)
Person in charge



(Mr. Pramote Ramrong)
Authorized signatory

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

Calibration Results:

Without Adjustment

Sensor Type: TC Type K

Channel: T1

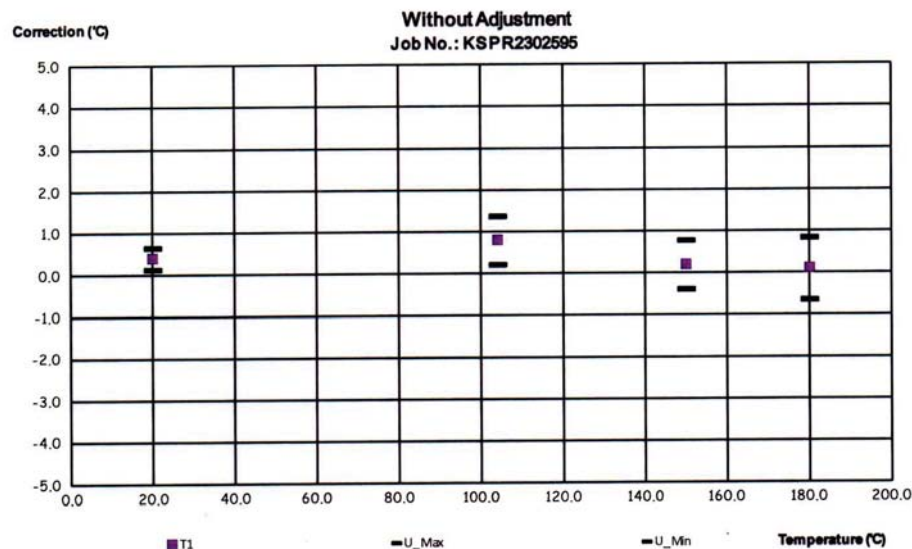
Diameter (mm) 2

Length (mm): -

Immersion (mm): 110

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

The End of Certificate



ใบตรวจสอบสภาพเครื่องมือวัดอุณหภูมิ

เลขที่ใบงาน: KSPR2302595

ชนิดเครื่องมือ: Digital Thermometer with Sensor

รุ่น: TK 61

หมายเลขเครื่อง: 1P181269184

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

ข้อแนะนำ :

Mr. Anat Karapitak

Service Engineer



THAI HEART CALIBRATION CO., LTD.

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



CERTIFICATE OF CALIBRATION

Certificate No.: T1-2103001/23 Page 1 of total 4 pages

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

Equipment Thermo Reactor
Manufacturer Merck **Model** TR420
Serial No. 19490640 **ID No.** WW-07-002
Description Resolution of UUC : 1 °C

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

Calibration Location Laboratory

Received Date 21 March 2023

Calibration Date 21 March 2023

Date of Issue 22 March 2023

Condition of Artifacts Used conditions but can be calibrated

Checked by

Act as Technical Manager

Approved by

Representative of Managing Director

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

(Dr. Ekachai Puttitwong)

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

FE-169

REV.02 02/24/21



THAI HEART CALIBRATION CO., LTD.

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



Certificate No.: T1-2103001/23

Page 2 of total 4 pages

Reference Method :

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

Reference Standard Instruments:

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Data Logger with Sensors	34972A/ 34901A	MY57010717/ MY59004982	10-1308001/22	Aug. 12, 2023	THC

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

- THC, Thai Heart Calibration Co., Ltd.

Calibrated by Apisit

REV.02 02/24/21

FE-169

Certificate No.: T1-2103001/23

Page 3 of total 4 pages

Measurement Results:

(L)

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

(R)

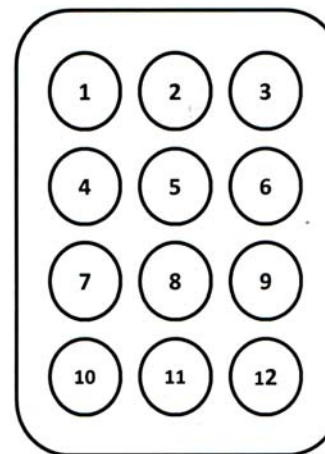
Hole No.	UUC Setting (°C)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Stability of UUC (± °C)	Uncertainty (± °C)
# 1	150	148.2	150	-1.8	0.12	0.61
# 2	150	148.0	150	-2.0	0.13	
# 3	150	148.5	150	-1.5	0.21	
# 4	150	149.0	150	-1.0	0.18	
# 5	150	149.6	150	-0.4	0.16	
# 6	150	149.3	150	-0.7	0.15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

UUC : Unit Under Calibration

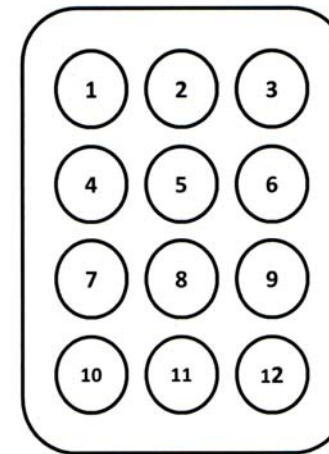
Calibrated by Apisit
REV.02 02/24/21

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 -

Calibrated by Apisit
REV.02 02/24/21

CAL

Calibratech Co.,Ltd.

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



Certificate of Calibration

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

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

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

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


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

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

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

Standard Buffer Solution

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

Approved by : 
(Bunjerd Masri)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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



CAL-F0031-03

CAL

Calibratech Co.,Ltd.

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

Certificate of Calibration

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

Result of Calibration :

UUC Condition As-Received : Good

Function : Conductivity measurement

Before Adjustment

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

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

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

Remark

UUC : Unit Under Calibration

* This parameter are out of accreditation's scope.

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

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

- 000 -





CAL-F0031-03

**THAI CALIBRATION SERVICES CO., LTD.**

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

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

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

**CALIBRATION CERTIFICATE**

Certificate No.S2303153S

page 1 of 2

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

31/8 Moo 13 Raikhing,

Samphran, Nakhornpathom 73210

Equipment : Non-automatic weighing instrument (Electronic instrument)**Manufacturer :** Sartorius**Order No. :** 66S0828-1**Model :** BSA224S-CW**Ambient temperature :** (24.1 ± 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 conditions**Place of calibration :** ห้องเครื่องชั่ง**Calibration method**

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

Condition of reference standard weight

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

Traceability of the reference standard weight

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

Calibrated By :

Teerawat Intanom
Technician

Approved By :

Chonlatee Pongwatvisanon
Approved Signatory

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

**THAI CALIBRATION SERVICES CO., LTD.**

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

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

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

**CALIBRATION CERTIFICATE**

Certificate No.S2303153S

page 2 of 2

The repeatability of indication

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

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

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

**The error of indication**

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

Remark : Adjustment, Internal weight

Uncertainty of measurement

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

This report will certify of the calibrated equipment only.

--End--