ภาคผนวกที่ 4

สรุปเอกสารสอบเทียบอุปกรณ์เครื่องมือ

เอกสารการสอบเทียบเครื่องมือตรวจวัดระดับเสียงในบรรยากาศ

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

**Request No.** 21-66/0012 **MTC No.** EEL. BP. 20/1065

# CALIBRATION CERTIFICATE

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

**Address** : 31/8 Moo 13, Raikhing, 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. : 222185 (NS-03-015)

Microphone : Type 7052NR No.84149

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



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**Request No.** 21-66/0012 **MTC No.** EEL. BP. 20/1065

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



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**Request No.** 21-66/0012 **MTC No.** EEL. BP. 20/1065

### 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 | 114.1 | 114.0 | 0.0 | 1.0 | 0.30 | N/A |

**Note:** The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 114.5 dB.

### 2. Self-generated noise

#### 2.1 Normal test

| Measured value (dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---|---|---|
| 20.9 | 0.10 | N/A |

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

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

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**Request No.** 21-66/0012 **MTC No.** EEL. BP. 20/1065

### 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 | -0.2 | -0.1 | -0.1 | 1.5 | 0.45 | 0.6 |
| 1 000 | 0.0 | 0.0 | 0.0 | 1.0 | 0.45 | 0.6 |
| 8 000 | -1.3 | -1.4 | -1.2 | 5.0 | 0.45 | 0.7 |

### 4. Electrical signal test of frequency weightings

| Frequency (Hz) | Deviation from frequency response (dB) | | | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---|---|---|---|---|---|---|
| | A-weight | C-weight | Flat | | | |
| 63 | -0.3 | -0.1 | 0.0 | 2.0 | 0.20 | 0.6 |
| 125 | -0.4 | 0.1 | 0.0 | 1.5 | 0.20 | 0.6 |
| 250 | -0.2 | 0.0 | 0.0 | 1.5 | 0.20 | 0.6 |
| 500 | -0.2 | 0.1 | 0.0 | 1.5 | 0.20 | 0.6 |
| 1 000 | 0.0 | 0.0 | 0.0 | 1.0 | 0.20 | 0.6 |
| 2 000 | 0.0 | 0.0 | 0.0 | 2.0 | 0.20 | 0.6 |
| 4 000 | -0.2 | -0.3 | -0.1 | 3.0 | 0.20 | 0.6 |
| 8 000 | -0.4 | -0.4 | -0.2 | 5.0 | 0.20 | 0.7 |

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**Request No.** 21-66/0012 **MTC No.** EEL. BP. 20/1065

### 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 |

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**Request No.** 21-66/0012 **MTC No.** EEL. BP. 20/1065

### 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 | 122.1 | 0.1 | 1.1 | 0.30 | 0.3 |
| 121 | 121.1 | 0.1 | 1.1 | 0.30 | 0.3 |
| 120 | 120.1 | 0.1 | 1.1 | 0.30 | 0.3 |
| 119 | 119.1 | 0.1 | 1.1 | 0.30 | 0.3 |
| 114 | 114.0 | 0.0 | 1.1 | 0.30 | 0.3 |
| 109 | 109.0 | 0.0 | 1.1 | 0.30 | 0.3 |
| 104 | 104.0 | 0.0 | 1.1 | 0.30 | 0.3 |
| 99 | 99.0 | 0.0 | 1.1 | 0.30 | 0.3 |
| 94 | 94.0 | 0.0 | 1.1 | 0.30 | 0.3 |
| 89 | 89.0 | 0.0 | 1.1 | 0.30 | 0.3 |
| 84 | 84.0 | 0.0 | 1.1 | 0.30 | 0.3 |
| 79 | 79.0 | 0.0 | 1.1 | 0.30 | 0.3 |
| 74 | 74.1 | 0.1 | 1.1 | 0.30 | 0.3 |
| 69 | 69.0 | 0.0 | 1.1 | 0.30 | 0.3 |
| 64 | 63.8 | -0.2 | 1.1 | 0.30 | 0.3 |
| 59 | 58.9 | -0.1 | 1.1 | 0.30 | 0.3 |
| 54 | 53.8 | -0.2 | 1.1 | 0.30 | 0.3 |
| 49 | 48.8 | -0.2 | 1.1 | 0.30 | 0.3 |

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

| Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---|---|---|---|---|---|
| 44 | 43.8 | -0.2 | 1.1 | 0.30 | 0.3 |
| 39 | 38.8 | -0.2 | 1.1 | 0.30 | 0.3 |
| 34 | 34.1 | 0.1 | 1.1 | 0.30 | 0.3 |
| 33 | 33.2 | 0.2 | 1.1 | 0.30 | 0.3 |
| 32 | 32.2 | 0.2 | 1.1 | 0.30 | 0.3 |
| 31 | 31.4 | 0.4 | 1.1 | 0.30 | 0.3 |
| 30 | 30.5 | 0.5 | 1.1 | 0.30 | 0.3 |

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

At reference sound level on the reference level range

| Range | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---|---|---|---|---|---|---|
| 40-130 | 94.0 | 94.0 | 0.0 | 1.1 | 0.30 | 0.3 |
| 30-120 | 94.0 | 94.0 | 0.0 | 1.1 | 0.30 | 0.3 |
| 20-110 | 94.0 | 94.0 | 0.0 | 1.1 | 0.30 | 0.3 |
| 20-100 | 94.0 | 94.0 | 0.0 | 1.1 | 0.30 | 0.3 |



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**Request No.** 21-66/0012 **MTC No.** EEL. BP. 20/1065

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

At reference level at 5 dB greater than the under-range on a level range

| Range | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---|---|---|---|---|---|---|
| 40-130 | 45.0 | 44.9 | -0.1 | 1.1 | 0.30 | 0.3 |
| 30-120 | 35.0 | 35.0 | 0.0 | 1.1 | 0.30 | 0.3 |
| 20-110 | 25.0 | 25.5 | 0.5 | 1.1 | 0.30 | 0.3 |
| 20-100 | 25.0 | 25.4 | 0.4 | 1.1 | 0.30 | 0.3 |
| 20-90 | 25.0 | 25.5 | 0.5 | 1.1 | 0.30 | 0.3 |
| 20-80 | 25.0 | 25.5 | 0.5 | 1.1 | 0.30 | 0.3 |

**9. Tone burst response**

| Time Weighting | Toneburst Duration, Tb (ms) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---|---|---|---|---|---|---|
| Fast | 200 | 116.0 | 0.0 | ±1.0 | 0.20 | 0.3 |
| | 2 | 98.9 | -0.1 | +1.0; -2.5 | 0.20 | 0.3 |
| | 0.25 | 89.8 | -0.2 | +1.5; -5.0 | 0.20 | 0.3 |
| Slow | 200 | 109.5 | -0.1 | ±1.0 | 0.20 | 0.3 |
| | 2 | 89.8 | -0.2 | +1.0; -5.0 | 0.20 | 0.3 |
| SEL | 200 | 109.9 | -0.1 | ±1.0 | 0.20 | 0.3 |
| | 2 | 90.0 | 0.0 | +1.0; -2.5 | 0.20 | 0.3 |
| | 0.25 | 80.9 | -0.1 | +1.5; -5.0 | 0.20 | 0.3 |



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**Request No.** 21-66/0012 **MTC No.** EEL. BP. 20/1065

**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 | 125.2 | -0.2 | 3.0 | 0.20 | 0.35 |
| Positive half cycle | 124.4 | 124.3 | -0.1 | 2.0 | 0.20 | 0.35 |
| Negative half cycle | 124.4 | 124.2 | -0.2 | 2.0 | 0.20 | 0.35 |

**11. Overload indication**

| Measured value (dB) | | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---|---|---|---|---|---|
| Positive one-half cycle | Negative one-half cycle | | | | |
| 131.0 | 131.1 | -0.1 | 1.5 | 0.20 | 0.25 |

**12. High-level stability**

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

**Calibrated by :**

(Mr. Tawikiat Iamsamran)

**Approved by :**

(Mr. Prawate 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** : 2011265100504293003

End of Certificate



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# CERTIFICATE OF CALIBRATION

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

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

**Equipment** : Sound Level Meter
**Manufacturer** : ACO
**Model** : 6236
**Serial No.** : 222186
**Identity No.** : NS-03-016
**Range** : See to Data

**Ambient temperature** : ( 20 ± 2 ) °C
**Relative humidity** : ( 50 ± 15 ) %
**Atmospheric pressure** : -
**Date of received** : 03-Feb-2023
**Date of calibration** : 07-Feb-2023
**Date of issued** : 09-Feb-2023

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

**Reference Standard Instruments** :

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

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

**Calibrated By** : *Mr. Boonyarit Auejirakarn*

**Approved By** :
[ ] Ms. Bhacharin Phanangkaew (MD)
[✓] Mr. Boonyarit Auejirakarn

**Reviewed By** : [ ] Mr. Sompong Srisert
[✓] Ms. Natthaprakarn Thammaphan

The reported expanded uncertainty is based uncertainty multipied by a coverage factor k = 2, providing a level of confidence appoximately 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 -



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# CERTIFICATE OF CALIBRATION

**Certificate No. :** 66S0205-4 **Job No. :** 66S0205 **Page :** 1 of 2

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

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

Location : Laboratory

| | | | |
|---|---|---|---|
| Equipment | : Sound Level Meter | Ambient temperature | : ( 20 ± 2 ) °C |
| Manufacturer | : ACO | Relative humidity | : ( 50 ± 15 ) % |
| Model | : 6236 | Atmospheric pressure | : - |
| Serial No. | : 222187 | Date of received | : 03-Feb-2023 |
| Identity No. | : NS-03-017 | Date of calibration | : 07-Feb-2023 |
| Range | : See to Data | Date of issued | : 09-Feb-2023 |

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

Reference Standard Instruments :

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

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

- National Institute of Metrology Thailand, (NIMT).

Calibrated By : *Mr. Boonyarit Auejirakarn*

Approved By :

[ ] Ms. Bhacharin Phanangkaew (MD)

[ ✓ ] Mr. Boonyarit Auejirakarn

Reviewed By : [ ] Mr. Sompong Srisert

[ ✓ ] Ms. Natthaprakarn Thammaphan

The reported expanded uncertainty is based uncertainty multipied by a coverage factor k = 2, providing a level of confidence appoximately 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 | 104.0 | 0.0 | 0.20 |
| | 114 | 113.9 | -0.1 | 0.20 |
| B | 94 | 94.2 | 0.2 | 0.20 |
| | 104 | 104.1 | 0.1 | 0.20 |
| | 114 | 113.8 | -0.2 | 0.20 |
| Z | 94 | 94.2 | 0.2 | 0.20 |
| | 104 | 104.1 | 0.1 | 0.20 |
| | 114 | 113.8 | -0.2 | 0.20 |

*UUC* = Unit Under Calibration*

- The End -



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# 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)

[✓] Mr. Boonyarit Auejirakarn

Reviewed By : [ ] Mr. Sompong Srisert

[✓] Ms. Natthaprakarn Thammaphan

The reported expanded uncertainty is based uncertainty multipied by a coverage factor k = 2, providing a level of confidence appoximately 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 -



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# CERTIFICATE OF CALIBRATION

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

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

| | | | |
|---|---|---|---|
| Equipment | : Sound Level Meter | Ambient temperature | : ( 20 ± 2 ) °C |
| Manufacturer | : ACO | Relative humidity | : ( 50 ± 15 ) % |
| Model | : 6236 | Atmospheric pressure | : - |
| Serial No. | : 222192 | Date of received | : 30-Mar-2023 |
| Identity No. | : NS-03-022 | 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)
[✓] Mr. Boonyarit Auejirakarn

**Reviewed By** : [ ] Mr. Sompong Srisert
[✓] Ms. Natthaprakarn Thammaphan

The reported expanded uncertainty is based uncertainty multipied by a coverage factor k = 2, providing a level of confidence appoximately 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 | 93.9 | -0.1 | 0.20 |
| | 104 | 103.9 | -0.1 | 0.20 |
| | 114 | 114.0 | 0.0 | 0.20 |
| B | 94 | 93.9 | -0.1 | 0.20 |
| | 104 | 103.9 | -0.1 | 0.20 |
| | 114 | 113.9 | -0.1 | 0.20 |
| Z | 94 | 93.9 | -0.1 | 0.20 |
| | 104 | 103.9 | -0.1 | 0.20 |
| | 114 | 114.0 | 0.0 | 0.20 |

*UUC* = Unit Under Calibration*

- The End -



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# CERTIFICATE OF CALIBRATION

**Certificate No. :** 66S0330-3 **Job No. :** 66S0330 **Page :** 1 of 2

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

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

Location : Laboratory

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

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

**Reference Standard Instruments** :

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

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

- National Institute of Metrology Thailand, (NIMT).

**Calibrated By** : *Mr. Boonyarit Auejirakarn*

**Approved By** :

[ ] Ms. Bhacharin Phanangkaew (MD)

[✓] Mr. Boonyarit Auejirakarn

**Reviewed By** : [ ] Mr. Sompong Srisert

[✓] Ms. Natthaprakarn Thammaphan

The reported expanded uncertainty is based uncertainty multipied by a coverage factor k = 2, providing a level of confidence appoximately 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 | 104.0 | 0.0 | 0.20 |
| | 114 | 113.7 | -0.3 | 0.20 |
| C | 94 | 94.1 | 0.1 | 0.20 |
| | 104 | 104.0 | 0.0 | 0.20 |
| | 114 | 114.0 | 0.0 | 0.20 |
| Z | 94 | 94.3 | 0.3 | 0.20 |
| | 104 | 104.3 | 0.3 | 0.20 |
| | 114 | 114.3 | 0.3 | 0.20 |

*UUC* = Unit Under Calibration*

- The End -



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# CERTIFICATE OF CALIBRATION

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

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

**Equipment** : Sound Level Meter
**Manufacturer** : ACO
**Model** : 6236
**Serial No.** : 222196
**Identity No.** : NS-03-026
**Range** : See to Data

**Ambient temperature** : ( 20 ± 2 ) °C
**Relative humidity** : ( 50 ± 15 ) %
**Atmospheric pressure** : -
**Date of received** : 08-Mar-2023
**Date of calibration** : 10-Mar-2023
**Date of issued** : 13-Mar-2023

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

**Reference Standard Instruments :**

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

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

**Calibrated By :** *Mr. Boonyarit Auejirakarn*

**Approved By :**
[ ] Ms. Bhacharin Phanangkaew (MD)
[✓] Mr. Boonyarit Auejirakarn

**Reviewed By :** [ ] Mr. Sompong Srisert
[✓] Ms. Natthaprakarn Thammaphan

The reported expanded uncertainty is based uncertainty multipied by a coverage factor k = 2, providing a level of confidence appoximately 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 -



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# 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)
[✓] Mr. Boonyarit Auejirakarn

**Reviewed By** : [ ] Mr. Sompong Srisert
[✓] Ms. Natthaprakarn Thammaphan

The reported expanded uncertainty is based uncertainty multipied by a coverage factor k = 2, providing a level of confidence appoximately 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 | 104.3 | 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 -



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# 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
**Manufacturer** : Scarlet Tech
**Model** : ST-11D
**Serial No.** : 820891
**Identity No.** : NS-12-002
**Range** : See to Data

**Ambient temperature** : ( 20 ± 2 ) °C
**Relative humidity** : ( 50 ± 15 ) %
**Atmospheric pressure** : -
**Date of received** : 08-Mar-2023
**Date of calibration** : 10-Mar-2023
**Date of issued** : 13-Mar-2023

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

**Reference Standard Instruments :**

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

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

**Calibrated By :** *Mr. Boonyarit Auejirakarn*

**Approved By :**
[ ] Ms. Bhacharin Phanangkaew (MD)
[✓] Mr. Boonyarit Auejirakarn

**Reviewed By :** [ ] Mr. Sompong Srisert
[✓] Ms. Natthaprakarn Thammaphan

The reported expanded uncertainty is based uncertainty multipied by a coverage factor k = 2, providing a level of confidence appoximately 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 -



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# 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
**Manufacturer** : Scarlet Tech
**Model** : ST-11D
**Serial No.** : 820892
**Identity No.** : NS-12-003
**Range** : See to Data

**Ambient temperature** : ( 20 ± 2 ) °C
**Relative humidity** : ( 50 ± 15 ) %
**Atmospheric pressure** : -
**Date of received** : 08-Mar-2023
**Date of calibration** : 10-Mar-2023
**Date of issued** : 13-Mar-2023

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

**Reference Standard Instruments :**

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

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

**Calibrated By :** *Mr. Boonyarit Auejirakarn*

**Approved By :**
[ ] Ms. Bhacharin Phanangkaew (MD)
[✓] Mr. Boonyarit Auejirakarn

**Reviewed By :** [ ] Mr. Sompong Srisert
[✓] Ms. Natthaprakarn Thammaphan

The reported expanded uncertainty is based uncertainty multipied by a coverage factor k = 2, providing a level of confidence appoximately 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.

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## Continuation of Calibration Report

Certificate No. : 66S0330-8 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 | 94.1 | 0.1 | 0.20 |
| | 104 | 104.0 | 0.0 | 0.20 |
| | 114 | 114.0 | 0.0 | 0.20 |
| B | 94 | 93.8 | -0.2 | 0.00 |
| | 104 | 103.7 | -0.3 | 0.00 |
| | 114 | 113.7 | -0.3 | 0.00 |
| Z | 94 | 93.9 | -0.1 | 0.00 |
| | 104 | 103.9 | -0.1 | 0.00 |
| | 114 | 113.9 | -0.1 | 0.00 |

*UUC* = Unit Under Calibration*

- The End -



# G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 17 E 30062 PAGE : 1 OF 2

## *Certificate of Calibration*

| | | |
|---|---|---|
| **EQUIPMENT** | : | SOUND LEVEL METER |
| **MANUFACTURER** | : | ACO |
| **MODEL** | : | TYPE 6226 |
| **SERIAL No.** | : | 060209 |
| **ID No.** | : | CEM-SI-01 |
| **SUBMITTED BY** | : | C.E.M TECHNOLOGY (THAILAND) CO.,LTD.<br>219/43 MOO 12, PETCHKASEM RD., OMNOI,<br>KRATHUMBAN SAMUTSAKORN 74130 |
| **CALIBRATED BY** | : | Suwawit K. |
| **CALIBRATION DATE** | : | 9-May-23 |
| **APPROVED BY** | : | Dongporn (Po)<br>PHUDIT P. |
| **ISSUED DATE** | : | 9-May-23 |

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

# G.Ruamkit Panich Co.,Ltd.

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



## Calibration Report

| | | | | | |
|---|---|---|---|---|---|
| **EQUIPMENT** | : | SOUND LEVEL METER | | | |
| **MANUFACTURER** | : | ACO | | | |
| **MODEL** | : | TYPE 6226 | **SERIAL NUMBER** | : | 060209 |
| **ID No.** | : | CEM-SI-01 | | | |
| **RECEIVED DATE** | : | 4-May-23 | **CALIBRATION DATE** | : | 9-May-23 |
| **AMBIENT TEMPERATURE** | : | 22 °C ± 3°C | **RELATIVE HUMIDITY** | : | 50%RH ± 20%RH |

**CONDITION OF THIS RESULTS OF CALIBRATION**

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

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

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

**RESULT OF CALIBRATION :** WITHOUT ADJUSTMENT

1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

3. SOUND LEVEL LINEARITY TEST AT 1000 Hz

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

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

**END OF CALIBRATION REPORT**

# G.Ruamkit Panich Co.,Ltd.

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



## Certificate of Calibration

| | | |
|---|---|---|
| **EQUIPMENT** | : | SOUND LEVEL METER |
| **MANUFACTURER** | : | ACO |
| **MODEL** | : | TYPE 6226 |
| **SERIAL No.** | : | 090057 |
| **ID No.** | : | CEM-SI-02 |
| **SUBMITTED BY** | : | C.E.M TECHNOLOGY (THAILAND) CO.,LTD.<br>219/43 MOO 12, PETCHKASEM RD., OMNOI,<br>KRATHUMBAN SAMUTSAKORN 74130 |
| **CALIBRATED BY** | : | Suwawit K. |
| **CALIBRATION DATE** | : | 9-May-23 |
| **APPROVED BY** | : | Dongporn (Po)<br>PHUDIT P. |
| **ISSUED DATE** | : | 9-May-23 |

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

# Calibration Report

| | | | | | |
|---|---|---|---|---|---|
| **EQUIPMENT** | : | SOUND LEVEL METER | | | |
| **MANUFACTURER** | : | ACO | | | |
| **MODEL** | : | TYPE 6226 | **SERIAL NUMBER** | : | 090057 |
| **ID No.** | : | CEM-SI-02 | | | |
| **RECEIVED DATE** | : | 4-May-23 | **CALIBRATION DATE** | : | 9-May-23 |
| **AMBIENT TEMPERATURE** | : | 22 °C ± 3°C | **RELATIVE HUMIDITY** | : | 50%RH ± 20%RH |

**CONDITION OF THIS RESULTS OF CALIBRATION**

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

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

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

**RESULT OF CALIBRATION :** WITHOUT ADJUSTMENT

1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

3. SOUND LEVEL LINEARITY TEST AT 1000 Hz

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

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

**END OF CALIBRATION REPORT**



# Certificate of Calibration

| | | |
|---|---|---|
| **EQUIPMENT** | : | SOUND LEVEL METER |
| **MANUFACTURER** | : | ACO |
| **MODEL** | : | TYPE 6226 |
| **SERIAL No.** | : | 122024 |
| **ID No.** | : | CEM-SI-04 |
| **SUBMITTED BY** | : | C.E.M TECHNOLOGY (THAILAND) CO.,LTD.<br>219/43 MOO 12, PETCHKASEM RD., OMNOI,<br>KRATHUMBAN SAMUTSAKORN 74130 |
| **CALIBRATED BY** | : | Suwawit K. |
| **CALIBRATION DATE** | : | 9-May-23 |
| **APPROVED BY** | : | Dongporn (Po)<br>PHUDIT P. |
| **ISSUED DATE** | : | 9-May-23 |

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

# Calibration Report

| | | | | | |
|---|---|---|---|---|---|
| **EQUIPMENT** | : | SOUND LEVEL METER | | | |
| **MANUFACTURER** | : | ACO | | | |
| **MODEL** | : | TYPE 6226 | **SERIAL NUMBER** | : | 122024 |
| **ID No.** | : | CEM-SI-04 | | | |
| **RECEIVED DATE** | : | 4-May-23 | **CALIBRATION DATE** | : | 9-May-23 |
| **AMBIENT TEMPERATURE** | : | 22 °C ± 3°C | **RELATIVE HUMIDITY** | : | 50%RH ± 20%RH |

**CONDITION OF THIS RESULTS OF CALIBRATION**

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

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

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

**RESULT OF CALIBRATION :** WITHOUT ADJUSTMENT

1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

3. SOUND LEVEL LINEARITY TEST AT 1000 Hz

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

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

**END OF CALIBRATION REPORT**



# Certificate of Calibration

| | | |
|---|---|---|
| **EQUIPMENT** | : | SOUND LEVEL METER |
| **MANUFACTURER** | : | ACO |
| **MODEL** | : | TYPE 6226 |
| **SERIAL No.** | : | 150005 |
| **ID No.** | : | CEM-SI-05 |
| **SUBMITTED BY** | : | C.E.M TECHNOLOGY (THAILAND) CO.,LTD.<br>219/43 MOO 12, PETCHKASEM RD., OMNOI,<br>KRATHUMBAN SAMUTSAKORN 74130 |
| **CALIBRATED BY** | : | Surawit K. |
| **CALIBRATION DATE** | : | 9-May-23 |
| **APPROVED BY** | : | Dongporn (Po)<br>PHUDIT P. |
| **ISSUED DATE** | : | 9-May-23 |

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

# G.Ruamkit Panich Co.,Ltd.

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



## Calibration Report

| | | | | | |
|---|---|---|---|---|---|
| **EQUIPMENT** | : | SOUND LEVEL METER | | | |
| **MANUFACTURER** | : | ACO | | | |
| **MODEL** | : | TYPE 6226 | **SERIAL NUMBER** | : | 150005 |
| **ID No.** | : | CEM-SI-05 | | | |
| **RECEIVED DATE** | : | 4-May-23 | **CALIBRATION DATE** | : | 9-May-23 |
| **AMBIENT TEMPERATURE** | : | 22 °C ± 3°C | **RELATIVE HUMIDITY** | : | 50%RH ± 20%RH |

**CONDITION OF THIS RESULTS OF CALIBRATION**

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

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

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

**RESULT OF CALIBRATION :** WITHOUT ADJUSTMENT

1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

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

3. SOUND LEVEL LINEARITY TEST AT 1000 Hz

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

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

**END OF CALIBRATION REPORT**

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในบรรยากาศ

TOP Trade & Engineering

# Certificate of Calibration

**Calibrated Date** : 2-Sep-23

Certificate No. : 0223-002

Page : 1/1

**Instruments**

Instruments : PM2.5-PM10 Air Sampler

Manufacturer : Thermo Scientific

Model : 2000-D

Serial No. : 200DA200310704

**Environmental**

Temperature : 24.7 °C

Humidity : 52.8 %RH

**Calibration System**

Instruments : Drycal

Manufacturer : Bios

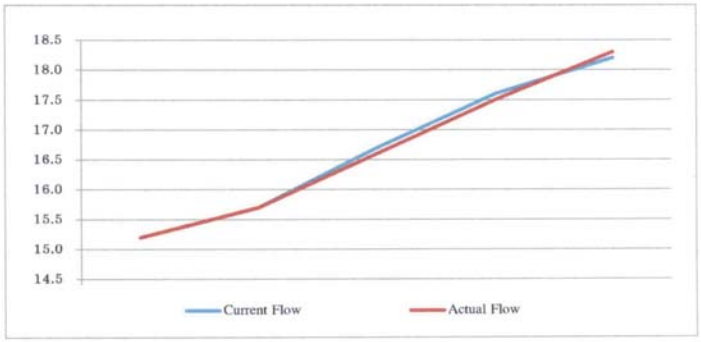
Model : DCL-H

Serial No. : 102591

Calibration due date : 24-Oct-23

**Flow Tetsing**

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




Calibrated by :

(Mr. Tong Piima)

TOP Trade & Engineering

# Certificate of Calibration

**Calibrated Date** : 1-Apr-23

Certificate No. : 0423-002

Page : 1/1

**Instruments**

Instruments : PM2.5-PM10 Air Sampler

Manufacturer : Thermo Scientific

Model : 2000-H

Serial No. : 200FA201309703

**Environmental**

Temperature : 25.2 °C

Humidity : 52.3 %RH

**Calibration System**

Instruments : Drycal

Manufacturer : Bios

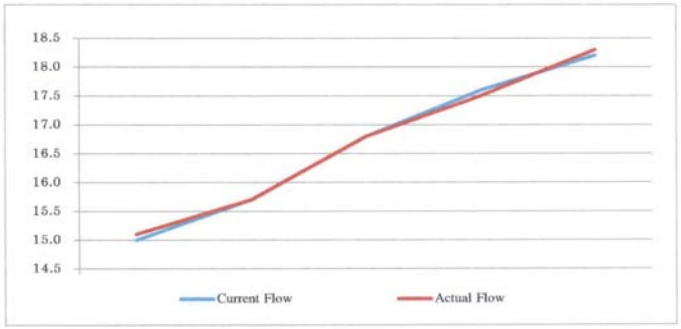
Model : DCL-H

Serial No. : 102591

Calibration due date : 24-Oct-23

**Flow Tetsing**

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




Calibrated by :

(Mr. Tong Piima)

TOP
Trade & Engineering

# Certificate of Calibration

**Calibrated Date** : 2-Sep-23

Certificate No. : 0223-002

Page : 1/1

**Instruments**

Instruments : PM2.5-PM10 Air Sampler

Manufacturer : Thermo Scientific

Model : 2000-D

Serial No. : 200DA200310704

**Environmental**

Temperature : 24.7 °C

Humidity : 52.8 %RH

**Calibration System**

Instruments : Drycal

Manufacturer : Bios

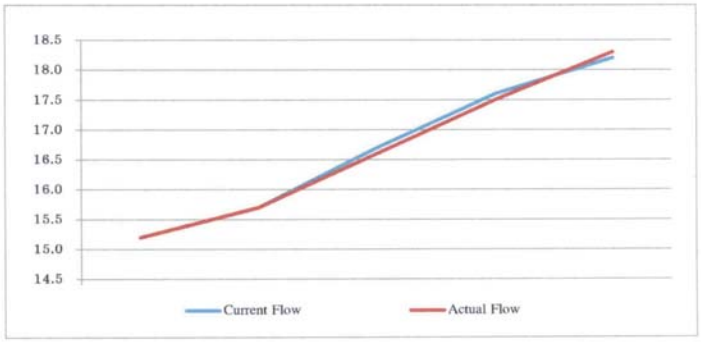
Model : DCL-H

Serial No. : 102591

Calibration due date : 24-Oct-23

**Flow Tetsing**

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




Calibrated by :

(Mr. Tong Piima)

TOP
Trade & Engineering

# Certificate of Calibration

**Calibrated Date** : 11-Mar-23

Certificate No. : 0323-002

Page : 1/1

**Instruments**

Instruments : PM2.5-PM10 Air Sampler

Manufacturer : Thermo Scientific

Model : 2000-H

Serial No. : 200FA201669708

**Environmental**

Temperature : 24.3 °C

Humidity : 51.4 %RH

**Calibration System**

Instruments : Drycal

Manufacturer : Bios

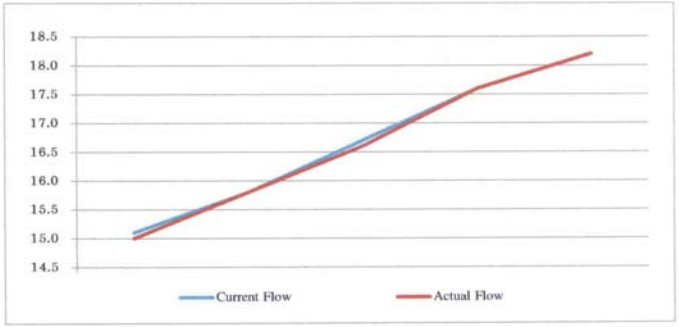
Model : DCL-H

Serial No. : 102591

Calibration due date : 24-Oct-23

**Flow Tetsing**

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




Calibrated by :

(Mr. Tong Piima)

TOP Trade & Engineering

## Certificate of Calibration

**Calibrated Date** : 5-Sep-23

Certificate No. : 0923-002

Page : 1/1

### Instruments

Instruments : PM2.5-PM10 Air Sampler

Manufacturer : BGI

Model : PQ-200

Serial No. : 140AB25409410

### Environmental

Temperature : 25.8 °C

Humidity : 41.9 %RH

### Calibration System

Instruments : Drycal

Manufacturer : Bios

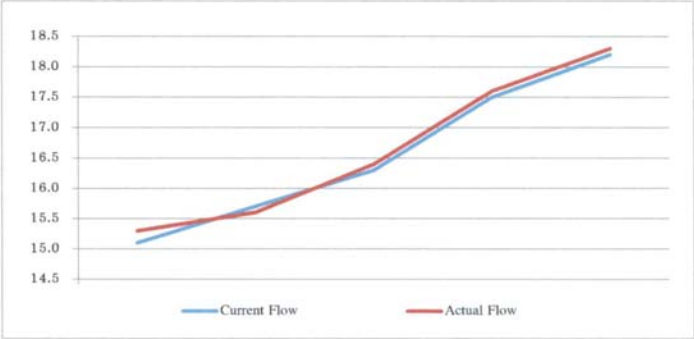
Model : DCL-H

Serial No. : 102591

Calibration due date : 20-Oct-22

### Flow Tetsing

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




Calibrated by :

(Mr. Tong Piima)

TOP Trade & Engineering

## Certificate of Calibration

**Calibrated Date** : 5-Sep-23

Certificate No. : 0923-004

Page : 1/1

### Instruments

Instruments : PM2.5-PM10 Air Sampler

Manufacturer : TEOM Control Unit (RP)

Model : 1400a

Serial No. : 140AB254490412

### Environmental

Temperature : 23.8 °C

Humidity : 42.5 %RH

### Calibration System

Instruments : Drycal

Manufacturer : Bios

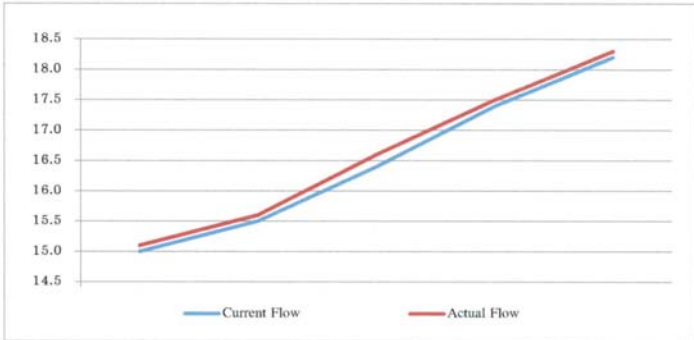
Model : DCL-H

Serial No. : 102591

Calibration due date : 20-Oct-22

### Flow Tetsing

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




Calibrated by :

(Mr. Tong Piima)

Trade & Engineering

# 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) |
|---|---|---|---|---|
| 1 | 8.60 | 1.229 | 59.7 | 39.30 |
| 2 | 6.80 | 1.094 | 54.7 | 36.01 |
| 3 | 5.60 | 0.994 | 49.7 | 32.72 |
| 4 | 4.80 | 0.921 | 44.6 | 29.36 |
| 5 | 3.60 | 0.799 | 38.5 | 25.35 |

**Linear Regression**
**Slope** 33.1155
**Intercept** -0.8080
**Corr. Coeff** 0.9947
**SFR** 1.110
**SSP** 54.60

**# of Observations:** 5

## Calculations

Qa = 1/m(Sqrt((H2O)(Ta/Pa))-b)
IC = I(Sqrt(Ta/Pa))

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

SFR = 1.13(Ps/Pa)(Ta/Ts)
SSP = (m*SFR+b)(Sqrt(Pa/Ta))

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

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

**Average I(chart):** 50.1
**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 us**



Trade & Engineering

# 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) |
|---|---|---|---|---|
| 1 | 8.80 | 1.220 | 59.9 | 38.68 |
| 2 | 7.00 | 1.089 | 54.9 | 35.45 |
| 3 | 5.80 | 0.992 | 49.9 | 32.22 |
| 4 | 5.00 | 0.922 | 44.8 | 28.93 |
| 5 | 3.80 | 0.805 | 38.7 | 24.99 |

**Linear Regression**
**Slope** 33.6928
**Intercept** -1.8198
**Corr. Coeff** 0.9945
**SFR** 1.087
**SSP** 53.92

**# 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):** 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 u**

Trade & Engineering

# 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) |
|---|---|---|---|---|
| 1 | 8.10 | 1.152 | 59.2 | 37.62 |
| 2 | 6.30 | 1.017 | 54.2 | 34.44 |
| 3 | 5.10 | 0.916 | 49.2 | 31.26 |
| 4 | 4.30 | 0.842 | 44.1 | 28.02 |
| 5 | 3.10 | 0.716 | 38.0 | 24.15 |

**Linear Regression**
**Slope** 31.6154
**Intercept** 1.7368
**Corr. Coeff** 0.9952
**SFR** 1.111
**SSP** 58.03

**# 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):** 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 us**



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# 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 Intercapt :** -0.01520
**Serial#:** 1179 **Calibration Due Date:** 12 Dec 23

## Calibration Data

| Plate or Test # | In H2O | Qa (m3/min) | I (chart) | IC (corrected) |
|---|---|---|---|---|
| 1 | 5.00 | 0.894 | 43.0 | 26.93 |
| 2 | 4.10 | 0.811 | 40.0 | 25.05 |
| 3 | 3.70 | 0.770 | 38.2 | 23.92 |
| 4 | 3.00 | 0.695 | 34.6 | 21.67 |
| 5 | 1.90 | 0.555 | 27.4 | 17.16 |

**Linear Regression**
**Slope** 29.1674
**Intercept** 1.2156
**Corr. Coeff** 0.9972
**SFR** 1.132
**SSP** 54.68

**# of Observations:** 5

## Calculations

Qa = 1/m(Sqrt((H2O)(Ta/Pa))-b)
IC = I(Sqrt(Ta/Pa))

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

SFR = 1.13(Ps/Pa)(Ta/Ts)
SSP = (m*SFR+b)(Sqrt(Pa/Ta))

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

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

**Average I(chart):** 50.0
**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 us**

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

Trade & Engineering

# PM10 High Volume Sampler Verification

## Site Information

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

## Site Conditions

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

## Calibration Orifice

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

## Calibration Data

| Plate or Test # | In H2O | Qa (m3/min) | I (chart) | IC (corrected) |
|---|---|---|---|---|
| 1 | 9.35 | 1.269 | 60.0 | 39.12 |
| 2 | 7.65 | 1.149 | 55.4 | 36.12 |
| 3 | 6.55 | 1.064 | 50.9 | 33.19 |
| 4 | 5.70 | 0.993 | 45.5 | 29.67 |
| 5 | 4.65 | 0.898 | 39.4 | 25.69 |

**Linear Regression**
**Slope** 36.6800
**Intercept** -6.6541
**Corr. Coeff** 0.9908
**SFR** 1.086
**SSP** 50.91

**# of Observations:** 5

## Calculations

Qa = 1/m(Sqrt((H2O)(Ta/Pa))-b)
IC = I(Sqrt(Ta/Pa))

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

SFR = 1.13(Ps/Pa)(Ta/Ts)
SSP = (m*SFR+b)(Sqrt(Pa/Ta))

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

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

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

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



Trade & Engineering

# PM10 High Volume Sampler Verification

## Site Information

**Location:** - **Site ID:** - **Date:** 4 October 2022
**Sampler:** TE-6070 PM10 **Serial No:** 3245 **Tech:** Tong P.

## Site Conditions

**Barometric Pressure (in Hg):** 29.47 **Corrected Pressure (mm Hg):** 759.0
**Temperature (deg F):** 76.9 **Temperature (deg K):** 297.9
**Average Press. (in Hg):** 28.70 **Corrected Average (mm Hg):** 760.2
**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) |
|---|---|---|---|---|
| 1 | 7.40 | 1.086 | 56.0 | 35.09 |
| 2 | 5.60 | 0.946 | 50.0 | 31.33 |
| 3 | 4.40 | 0.840 | 45.0 | 28.19 |
| 4 | 3.60 | 0.761 | 40.0 | 25.06 |
| 5 | 2.70 | 0.660 | 34.0 | 21.30 |

**Linear Regression**
**Slope** 32.3113
**Intercept** 0.4536
**Corr. Coeff** 0.9961
**SFR** 1.132
**SSP** 59.08

**# 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)**
1.063332321
**Enter Total Time (Hrs):** 24.0
**Total flow over sample (m3/min)**
1531.198543
**Total flow over sample (CFM)**
54066.62055

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

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) |
|---|---|---|---|---|
| 1 | 9.65 | 1.310 | 60.5 | 40.08 |
| 2 | 7.50 | 1.156 | 55.5 | 36.77 |
| 3 | 6.45 | 1.072 | 50.6 | 33.52 |
| 4 | 5.35 | 0.978 | 45.8 | 30.34 |
| 5 | 4.60 | 0.907 | 39.4 | 26.10 |

**Linear Regression**
**Slope** 34.0516
**Intercept** -3.5657
**Corr. Coeff** 0.9827
**SFR** 1.122
**SSP** 52.27

**# of Observations:** 5

## Calculations

Qa = 1/m(Sqrt((H2O)(Ta/Pa))-b)
IC = I(Sqrt(Ta/Pa))

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

SFR = 1.13(Ps/Pa)(Ta/Ts)
SSP = (m*SFR+b)(Sqrt(Pa/Ta))

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

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

**Average I(chart):** 50.4
**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 u**



Trade & Engineering

# Certificate of Analyzer Performance Testing

**Calibrated Date** : 9-Feb-22 Certificate No. : 0222-089
Page : 1/1

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

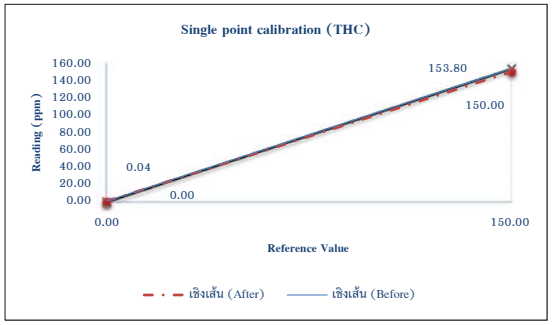
**Environmental**
Temperature : 25.2 °C
Humidity : 52.8 %RH

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

**Standard Gas**
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 | 0.04 | 0.00 | 0.04 | 153.80 | 150.00 | 2.53 |
| After | | | | | | |
| THC | 0.00 | 0.00 | 0.00 | 150.00 | 150.00 | 0.00 |




Calibrated by : (Mr. Tong Puima)

TOP Trade & Engineering

# 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**

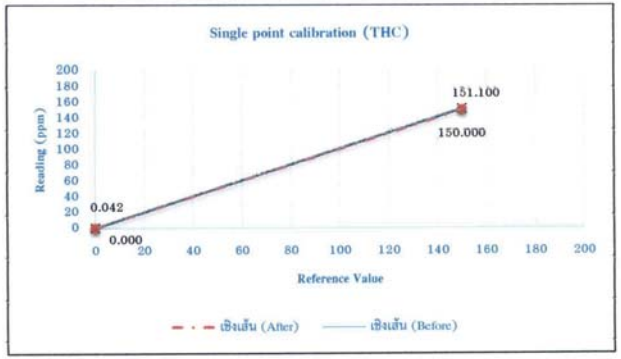
Gas Calibration : Thermo Environmental
Zero Air Generator : API
Model : 146C
Model : 701
Serial No. : 514811458
Serial No. : 179

**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 :

(Mr. Tong Piima)

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# Certificate of Analyzer Performance Testing

**Calibrated Date** : 8-Mar-22

Certificate No. : 0322-067
Page : 1/1

**Analyzer Instruments**

Analyzer Type : THC Analyzer
Manufacturer : Thermo Environmental
Model : 8800
Serial No. : 0500710288

**Environmental**

Temperature : 26.1 °C
Humidity : 54.6 %RH

**Calibration System**

**Calibrator Units**

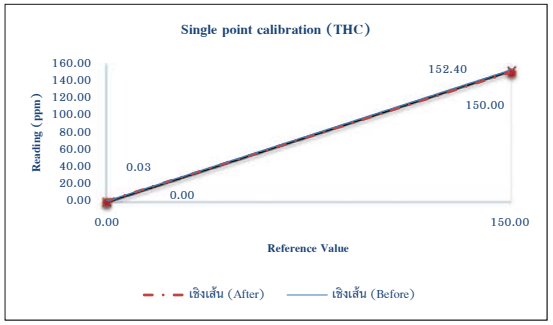
Gas Calibration : Thermo Environmental
Zero Air Generator : API
Model : 146C
Model : 701
Serial No. : 514811458
Serial No. : 179

**Standard Gas**

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 | 0.03 | 0.00 | 0.03 | 152.40 | 150.00 | 1.60 |
| After | | | | | | |
| THC | 0.00 | 0.00 | 0.00 | 150.00 | 150.00 | 0.00 |




Calibrated by :

(Mr. Tong Puima)

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# Certificate of Analyzer Performance Testing

**Calibrated Date** : 30-Jan-23

Certificate No. : 0123-002
Page : 1/1

**Analyzer Instruments**

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

**Environmental**

| | | | |
|---|---|---|---|
| Temperature | : | 24.5 | °C |
| Humidity | : | 56.3 | %RH |

**Calibration System**

**Calibrator Units**

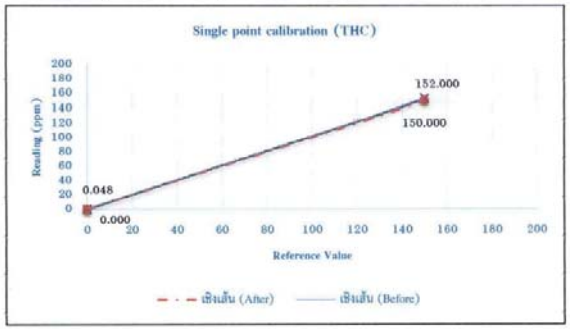
| | | | | |
|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : API |
| Model | : | 146C | Model | : 701 |
| Serial No. | : | 514811458 | Serial No. | : 179 |

**Standard Gas**

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

**Calibration Check**

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




Calibrated by :
(Mr. Tong Piima)

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Certificate of Analyzer Performance Testing

Calibrated Date : 30-Jan-23

Certificate No. : 0123-002
Page : 1/1

Analyzer Instruments

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

Environmental

Temperature : 24.5 °C
Humidity : 56.3 %RH

Calibration System

Calibrator Units

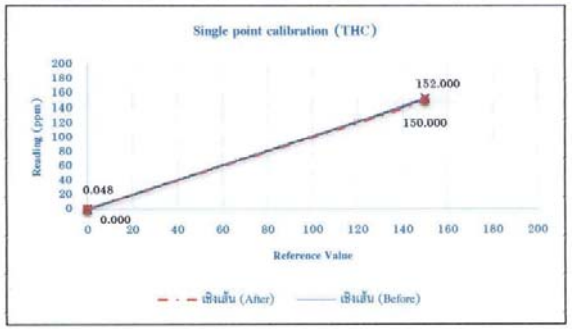
Gas Calibration : Thermo Environmental
Zero Air Generator : API
Model : 146C
Model : 701
Serial No. : 514811458
Serial No. : 179

Standard Gas

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

Calibration Check

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




Calibrated by :
(Mr. Tong Piima)

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) |
|---|---|---|---|---|
| 1 | 5.80 | 1.482 | 60.0 | 58.08 |
| 2 | 4.00 | 1.233 | 53.0 | 51.31 |
| 3 | 2.60 | 0.996 | 46.0 | 44.53 |
| 4 | 2.10 | 0.896 | 43.0 | 41.62 |
| 5 | 1.50 | 0.759 | 38.5 | 37.27 |

**Linear Regression**
**Slope:** 28.6275
**Intercept:** 15.8460
**Corr. Coeff:** 0.9996

**# 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**
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:** 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) |
|---|---|---|---|---|
| 1 | 8.20 | 1.792 | 62.0 | 61.08 |
| 2 | 6.40 | 1.584 | 55.0 | 54.18 |
| 3 | 5.00 | 1.401 | 48.0 | 47.29 |
| 4 | 4.50 | 1.330 | 45.0 | 44.33 |
| 5 | 3.90 | 1.239 | 41.0 | 40.39 |

**Linear Regression**
**Slope:** 37.2576
**Intercept:** -5.2773
**Corr. Coeff:** 0.9987

**# 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**
1.264452021
**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**

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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) |
|---|---|---|---|---|
| 1 | 8.20 | 1.792 | 62.0 | 61.08 |
| 2 | 6.40 | 1.584 | 55.0 | 54.18 |
| 3 | 5.00 | 1.401 | 48.0 | 47.29 |
| 4 | 4.50 | 1.330 | 45.0 | 44.33 |
| 5 | 3.90 | 1.239 | 41.0 | 40.39 |

**Linear Regression**
**Slope:** 37.2576
**Intercept:** -5.2773
**Corr. Coeff:** 0.9987
**# 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**
1.264452021
**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) |
|---|---|---|---|---|
| 1 | 5.80 | 1.482 | 60.0 | 58.08 |
| 2 | 4.00 | 1.233 | 53.0 | 51.31 |
| 3 | 2.60 | 0.996 | 46.0 | 44.53 |
| 4 | 2.10 | 0.896 | 43.0 | 41.62 |
| 5 | 1.50 | 0.759 | 38.5 | 37.27 |

**Linear Regression**
**Slope:** 28.6275
**Intercept:** 15.8460
**Corr. Coeff:** 0.9996
**# 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**
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**

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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) |
|---|---|---|---|---|
| 1 | 8.20 | 1.761 | 63.6 | 61.57 |
| 2 | 6.40 | 1.557 | 56.9 | 55.08 |
| 3 | 5.00 | 1.377 | 49.7 | 48.11 |
| 4 | 4.50 | 1.307 | 46.5 | 45.01 |
| 5 | 3.90 | 1.217 | 42.0 | 40.66 |

**Linear Regression**

**Slope:** 38.1692
**Intercept:** -5.0169
**Corr. Coeff:** 0.9967

**# 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:** 16 Oct 23 |
| **Sampler:** TE-5000 TSP | **Serial No:** 3269 | **Tech:** Tong.P |

## Site Conditions

| | | | |
|---|---|---|---|
| **Barometric Pressure (in Hg):** | 27.80 | **Corrected Pressure (mm Hg):** | 706.1 |
| **Temperature (deg F):** | 76.1 | **Temperature (deg K):** | 297.7 |
| **Average Press. (in Hg):** | 27.30 | **Corrected Average (mm Hg):** | 693.4 |
| **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) |
|---|---|---|---|---|
| 1 | 7.50 | 1.678 | 59.7 | 57.58 |
| 2 | 6.30 | 1.539 | 55.4 | 53.43 |
| 3 | 5.20 | 1.399 | 47.9 | 46.20 |
| 4 | 4.50 | 1.302 | 43.7 | 42.15 |
| 5 | 3.10 | 1.112 | 40.1 | 38.68 |

**Linear Regression**

**Slope:** 35.4041
**Intercept:** -2.1709
**Corr. Coeff:** 0.9834

**# of Observations:** 5

## Calculations

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

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

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

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

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

Trade & Engineering

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

## Site Information

| | | |
|---|---|---|
| **Location:** - | **Site ID:** - | **Date:** 16 Oct 23 |
| **Sampler:** TE-5000 TSP | **Serial No:** 3272 | **Tech:** Tong.P |

## Site Conditions

| | |
|---|---|
| **Barometric Pressure (in Hg):** 27.00 | **Corrected Pressure (mm Hg):** 685.8 |
| **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) |
|---|---|---|---|---|
| 1 | 6.80 | 1.575 | 62.1 | 59.03 |
| 2 | 5.50 | 1.418 | 58.4 | 55.51 |
| 3 | 4.40 | 1.269 | 50.6 | 48.10 |
| 4 | 4.00 | 1.211 | 48.7 | 46.29 |
| 5 | 3.50 | 1.133 | 43.5 | 41.35 |

**Linear Regression**
**Slope:** 39.9337
**Intercept:** -2.7031
**Corr. Coeff:** 0.9857

**# of Observations:** 5

## Calculations

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

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

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

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

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

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Trade & Engineering

# Certificate of Analyzer Performance Testing

Calibrated Date : 22-Jul-23

Certificate No. : 0723-001
Page : 1/1

**Analyzer Instruments**

| | | | |
|---|---|---|---|
| Analyzer Type | CO Analyzer | Manufacturer | Thermo Environmental |
| Model | 48C | Serial No. | 508011061 |

**Environmental**

| | | |
|---|---|---|
| Temperature | 24.2 | °C |
| Humidity | 52.0 | %RH |

**Calibration System**

**Calibrator Units**

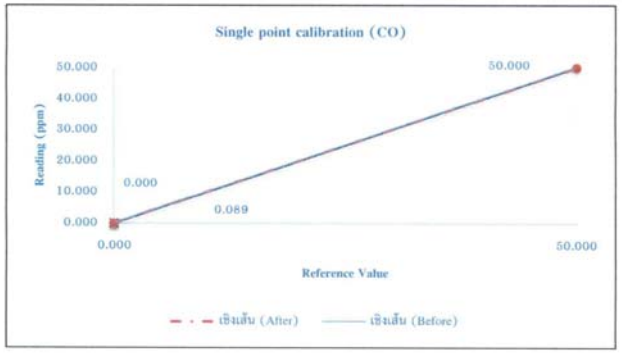
| | | | |
|---|---|---|---|
| Gas Calibration | Thermo Environmental | Zero Air Generator | API |
| Model | 146C | Model | 701 |
| Serial No. | 514811458 | Serial No. | 179 |

**Standard Gas**

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

Calibration Check

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




Calibrated by :

(Mr. Tong Piima)

TOP Trade & Engineering

# 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**

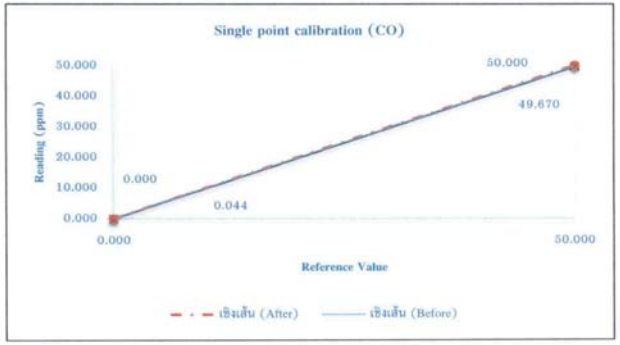
| | | | |
|---|---|---|---|
| Gas Calibration | Thermo Environmental | Zero Air Generator | API |
| Model | 146C | Model | 701 |
| Serial No. | 514811458 | Serial No. | 179 |

**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 :

(Mr. Tong Piima)

TOP Trade & Engineering

# 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**

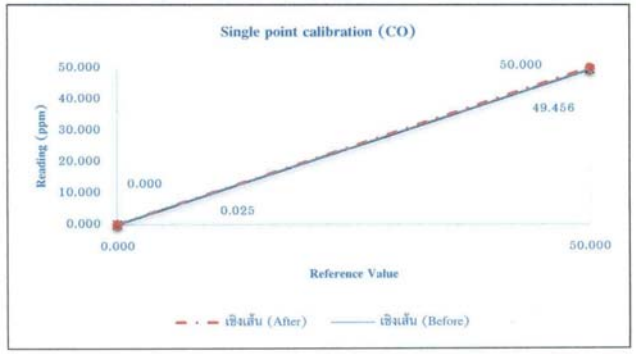
| | | | |
|---|---|---|---|
| Gas Calibration | Thermo Environmental | Zero Air Generator | API |
| Model | 146C | Model | 701 |
| Serial No. | 514811458 | Serial No. | 179 |

**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 :

(Mr. Tong Piima)

TOP
Trade & Engineering

## 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**

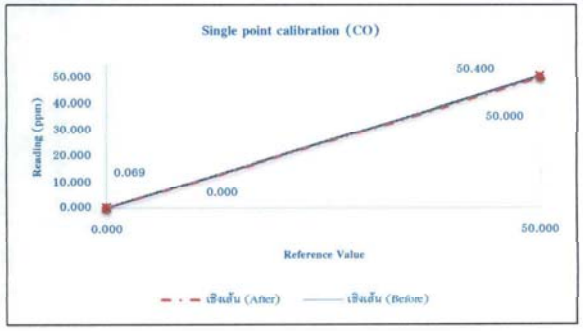
| | | | | |
|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : API |
| Model | : | 146C | Model | : 701 |
| Serial No. | : | 514811458 | Serial No. | : 179 |

**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 |

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## 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**

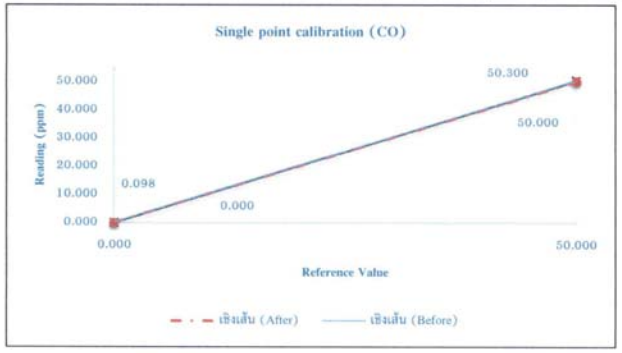
| | | | | |
|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : API |
| Model | : | 146C | Model | : 701 |
| Serial No. | : | 514811458 | Serial No. | : 179 |

**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 |

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## Certificate of Analyzer Performance Testing

**Calibrated Date** : 15-Jun-22

Certificate No. : 0622-001
Page : 1/1

**Analyzer Instruments**

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

**Environmental**

| | | | |
|---|---|---|---|
| Temperature | : | 24.1 | ˚C |
| Humidity | : | 52.1 | %RH |

**Calibration System**

**Calibrator Units**

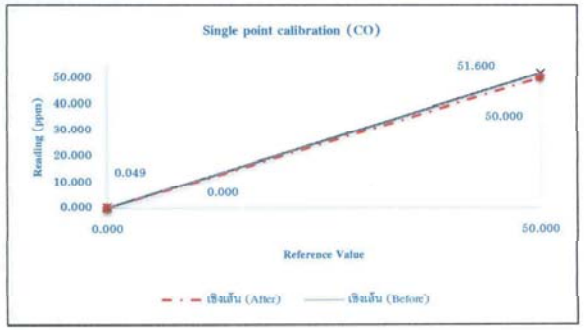
| | | | | |
|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : API |
| Model | : | 146C | Model | : 701 |
| Serial No. | : | 514811458 | Serial No. | : 179 |

**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 | | | | | | |
| CO | 0.049 | 0.000 | 0.05 | 51.6 | 50.000 | 3.20 |
| After | | | | | | |
| CO | 0.000 | 0.000 | 0.00 | 50.0 | 50.000 | 0.00 |

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## 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**

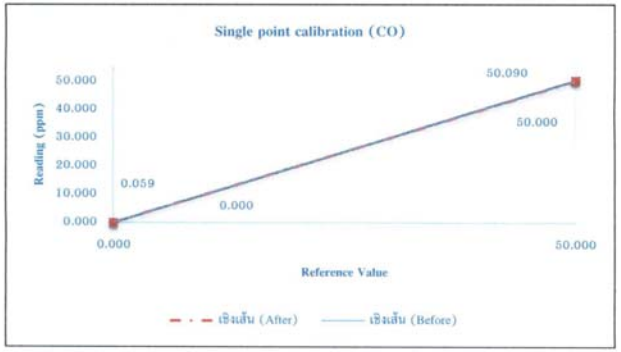
| | | | | |
|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : API |
| Model | : | 146C | Model | : 701 |
| Serial No. | : | 514811458 | Serial No. | : 179 |

**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 |

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# Certificate of Analyzer Performance Testing

**Calibrated Date** : 4-Feb-23

Certificate No. : 0223-001
Page : 1/1

**Analyzer Instruments**

| | | | | | |
|---|---|---|---|---|---|
| Analyzer Type | : | CO Analyzer | Manufacturer | : | Thermo Environmental |
| Model | : | 48i | Serial No. | : | 1172750062 |

**Environmental**

| | | | |
|---|---|---|---|
| Temperature | : | 24.7 | ˚C |
| Humidity | : | 52.8 | %RH |

**Calibration System**

**Calibrator Units**

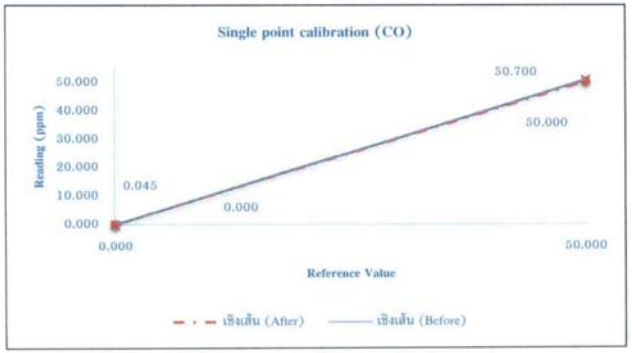
| | | | | | |
|---|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : | API |
| Model | : | 146C | Model | : | 701 |
| Serial No. | : | 514811458 | Serial No. | : | 179 |

**Standard Gas**

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

**Calibration Check**

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

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# Certificate of Analyzer Performance Testing

**Calibrated Date** : 26-Aug-23

Certificate No. : 0823-001
Page : 1/1

**Analyzer Instruments**

| | | | | | |
|---|---|---|---|---|---|
| Analyzer Type | : | NO/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**

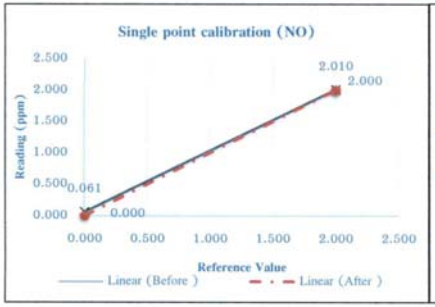
| | | | | | |
|---|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : | API |
| Model | : | 146C | Model | : | 701 |
| Serial No. | : | 514811458 | Serial No. | : | 179 |

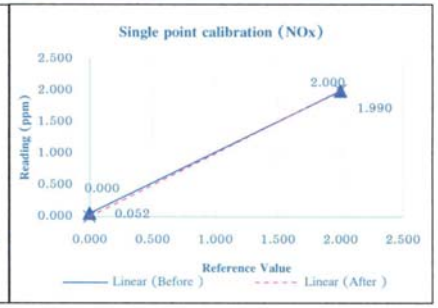
**Standard Gas**

| | | | | | | |
|---|---|---|---|---|---|---|
| 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 |
| . | | | | | | |
| 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 |

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# Certificate of Analyzer Performance Testing

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

**Analyzer Instruments**

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

**Environmental**

| | | | |
|---|---|---|---|
| Temperature | : | 24.3 | ˚C |
| Humidity | : | 51.4 | %RH |

**Calibration System**

**Calibrator Units**

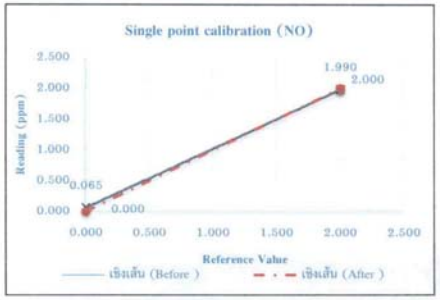
| | | | | | |
|---|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : | API |
| Model | : | 146C | Model | : | 701 |
| Serial No. | : | 514811458 | Serial No. | : | 179 |

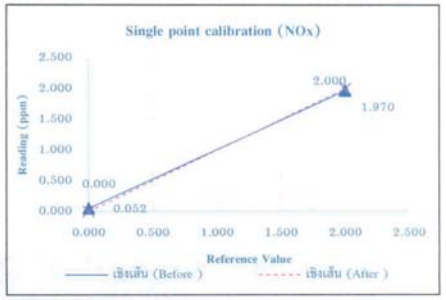
**Standard Gas**

| | | | | | | |
|---|---|---|---|---|---|---|
| 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 |
| NOx | 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 |
| NOx | 0.000 | 0.000 | 0.00 | 2.00 | 2.00 | 0.00 |

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# Certificate of Analyzer Performance Testing

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

**Analyzer Instruments**

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

**Environmental**

| | | | |
|---|---|---|---|
| Temperature | : | 25.2 | ˚C |
| Humidity | : | 52.3 | %RH |

**Calibration System**

**Calibrator Units**

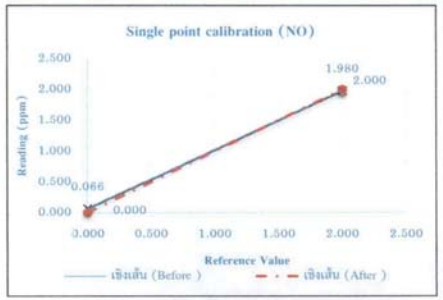
| | | | | | |
|---|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : | API |
| Model | : | 146C | Model | : | 701 |
| Serial No. | : | 514811458 | Serial No. | : | 179 |

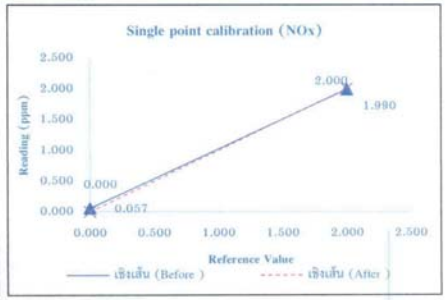
**Standard Gas**

| | | | | | | |
|---|---|---|---|---|---|---|
| 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 |
| NOx | 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 |
| NOx | 0.000 | 0.000 | 0.00 | 2.00 | 2.00 | 0.00 |

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# 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**

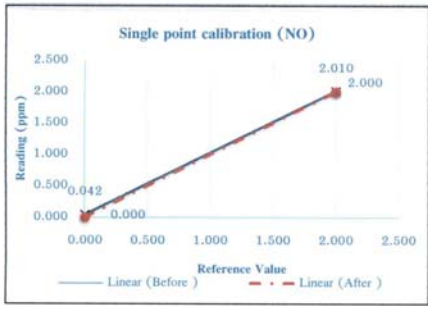
| | | | | |
|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : API |
| Model | : | 146C | Model | : 701 |
| Serial No. | : | 514811458 | Serial No. | : 179 |

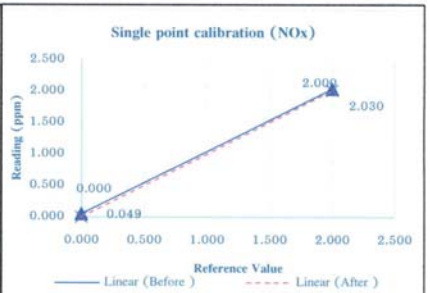
**Standard Gas**

| | | | | | |
|---|---|---|---|---|---|
| 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 |

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# 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**

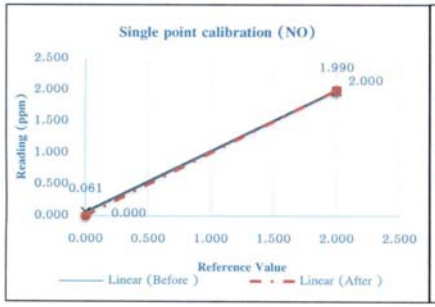
| | | | | |
|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : API |
| Model | : | 146C | Model | : 701 |
| Serial No. | : | 514811458 | Serial No. | : 179 |

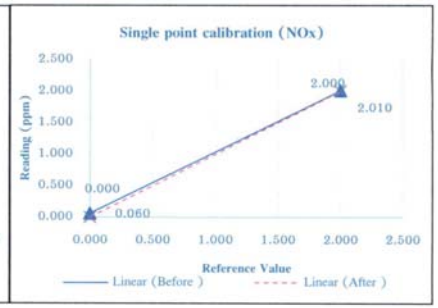
**Standard Gas**

| | | | | | |
|---|---|---|---|---|---|
| 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 |

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# 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**

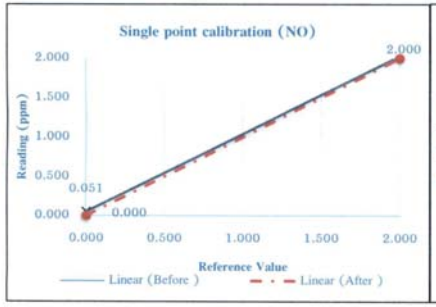
| | | | | | |
|---|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : | API |
| Model | : | 146C | Model | : | 701 |
| Serial No. | : | 514811458 | Serial No. | : | 179 |

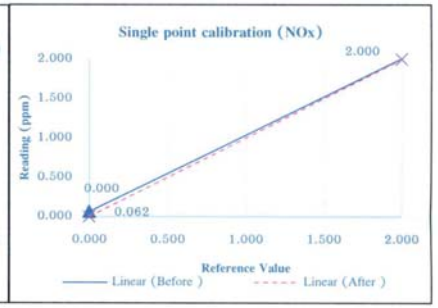
**Standard Gas**

| | | | | | | |
|---|---|---|---|---|---|---|
| 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 :
(Mr. Tong Piima)

TOP Trade & Engineering

# Certificate of Analyzer Performance Testing

**Calibrated Date** : 6-Apr-22

Certificate No. : 0422-055
Page : 1/1

**Analyzer Instruments**

| | | | | | |
|---|---|---|---|---|---|
| Analyzer Type | : | NO/NO2/Nox Analyzer | Manufacturer | : | Thermo Environmental |
| Model | : | 42C | Serial No. | : | 72454-371 |

**Environmental**

| | | | |
|---|---|---|---|
| Temperature | : | 25.4 | °C |
| Humidity | : | 52.3 | %RH |

**Calibration System**

**Calibrator Units**

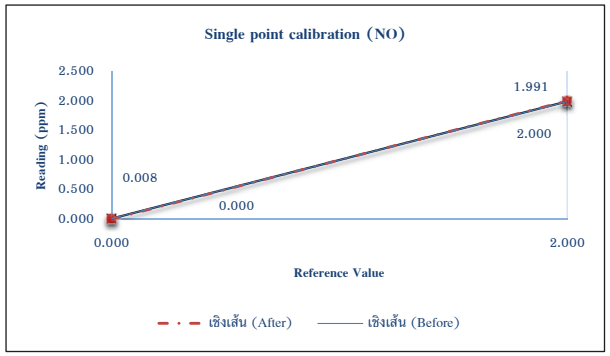
| | | | | | |
|---|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : | API |
| Model | : | 146C | Model | : | 701 |
| Serial No. | : | 514811458 | Serial No. | : | 179 |

**Standard Gas**

| | | | | | | |
|---|---|---|---|---|---|---|
| NO Conc. | : | 2 | ppm | Cylinder No. | : | CC750227 |
| 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 | | | | | | |
| NO | 0.008 | 0.000 | 0.01 | 1.991 | 2.000 | -0.45 |
| NOx | 0.012 | 0.000 | 0.01 | 2.012 | 2.000 | 0.60 |
| Afer | | | | | | |
| NO | 0.000 | 0.000 | 0.00 | 2.000 | 2.000 | 0.00 |
| NOx | 0.000 | 0.000 | 0.00 | 2.000 | 2.000 | 0.00 |




Calibrated by :
(Mr. Tong Piima)

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Trade & Engineering

# Certificate of Analyzer Performance Testing

**Calibrated Date** : 10-Aug-22

Certificate No. : 0822-004
Page : 1/1

**Analyzer Instruments**

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

**Environmental**

| | | | |
|---|---|---|---|
| Temperature | : | 24.3 | °C |
| Humidity | : | 53.4 | %RH |

**Calibration System**

**Calibrator Units**

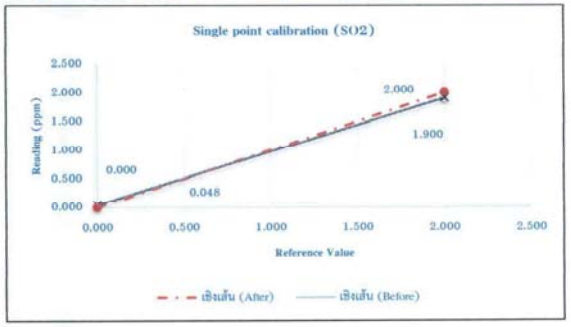
| | | | | |
|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : API |
| Model | : | 146C | Model | : 701 |
| Serial No. | : | 514811458 | Serial No. | : 179 |

**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 | | | | | | |
| SO2 | 0.048 | 0.000 | 0.05 | 1.90 | 2.000 | -5.00 |
| After | | | | | | |
| SO2 | 0.000 | 0.000 | 0.00 | 2.00 | 2.000 | 0.00 |




Calibrated by :
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# Certificate of Analyzer Performance Testing

**Calibrated Date** : 5-Aug-23

Certificate No. : 0823-001
Page : 1/1

**Analyzer Instruments**

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

**Environmental**

| | | | |
|---|---|---|---|
| Temperature | : | 25.0 | °C |
| Humidity | : | 51.9 | %RH |

**Calibration System**

**Calibrator Units**

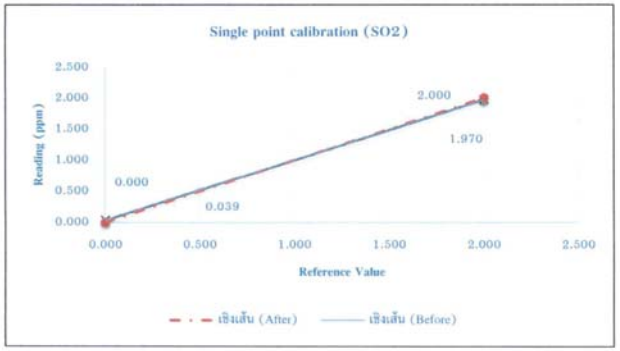
| | | | | |
|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : API |
| Model | : | 146C | Model | : 701 |
| Serial No. | : | 514811458 | Serial No. | : 179 |

**Standard Gas**

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

**Calibration Check**

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




Calibrated by :
(Mr. Tong Piima)

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# Certificate of Analyzer Performance Testing

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

**Analyzer Instruments**

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

**Environmental**

| | | | |
|---|---|---|---|
| Temperature | : | 25.1 | °C |
| Humidity | : | 47.9 | %RH |

**Calibration System**

**Calibrator Units**

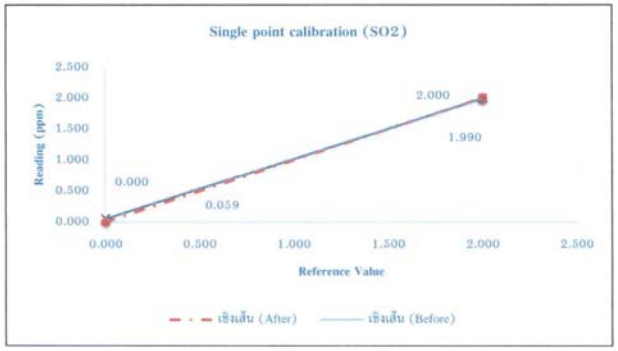
| | | | | | |
|---|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : | API |
| Model | : | 146C | Model | : | 701 |
| Serial No. | : | 514811458 | Serial No. | : | 179 |

**Standard Gas**

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

**Calibration Check**

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




Calibrated by :

(Mr. Tong Piima)

TOP Trade & Engineering

# 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**

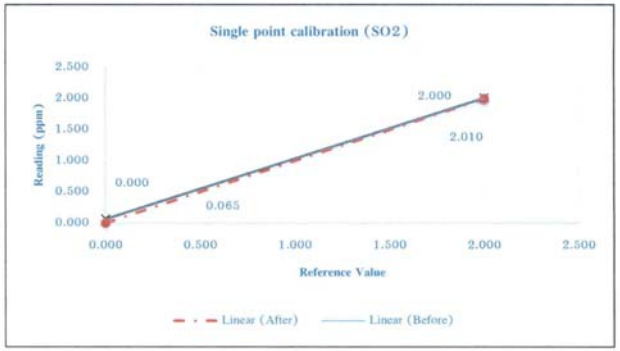
| | | | | | |
|---|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : | API |
| Model | : | 146C | Model | : | 701 |
| Serial No. | : | 514811458 | Serial No. | : | 179 |

**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 :

(Mr. Tong Piima)

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# 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**

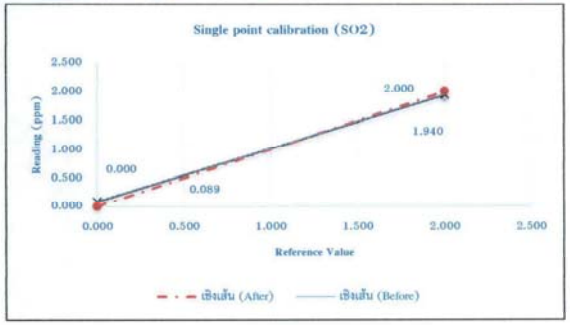
| | | | | |
|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : API |
| Model | : | 146C | Model | : 701 |
| Serial No. | : | 514811458 | Serial No. | : 179 |

**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 :

(Mr. Tong Piima)

TOP Trade & Engineering

# Certificate of Analyzer Performance Testing

**Calibrated Date** : 16-Sep-21

Certificate No. : 0921-062
Page : 1/1

**Analyzer Instruments**

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

**Environmental**

| | | | |
|---|---|---|---|
| Temperature | : | 26.3 | °C |
| Humidity | : | 51.7 | %RH |

**Calibration System**

**Calibrator Units**

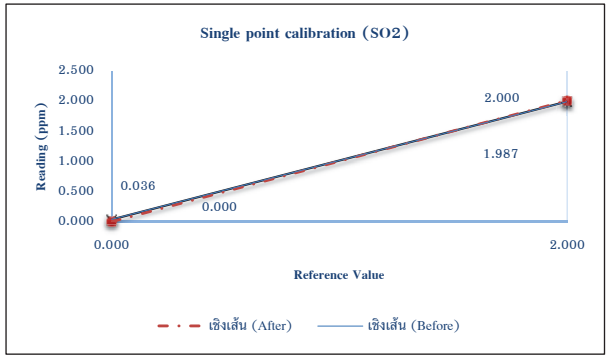
| | | | | |
|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : API |
| Model | : | 146C | Model | : 701 |
| Serial No. | : | 514811458 | Serial No. | : 179 |

**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 | | | | | | |
| SO2 | 0.036 | 0.000 | 0.04 | 1.987 | 2.000 | -0.65 |
| Afer | | | | | | |
| SO2 | 0.000 | 0.000 | 0.00 | 2.000 | 2.000 | 0.00 |




Calibrated by :

(Mr. Tong Piima)

TOP Trade & Engineering

# Certificate of Analyzer Performance Testing

**Calibrated Date** : 26-Aug-23

Certificate No. : 0823-003
Page : 1/1

**Analyzer Instruments**

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

**Environmental**

| | | | |
|---|---|---|---|
| Temperature | : | 24.9 | °C |
| Humidity | : | 46.9 | %RH |

**Calibration System**

**Calibrator Units**

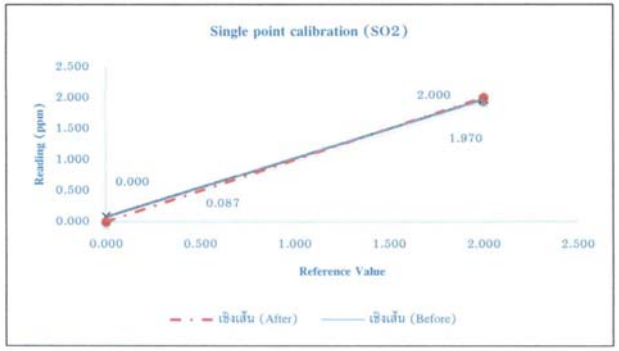
| | | | | |
|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : API |
| Model | : | 146C | Model | : 701 |
| Serial No. | : | 514811458 | Serial No. | : 179 |

**Standard Gas**

| | | | | | |
|---|---|---|---|---|---|
| NO Conc. | : | 2 | ppm | Cylinder No. | : 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 | 0.087 | 0.000 | 0.09 | 1.97 | 2.000 | -1.50 |
| After | | | | | | |
| SO2 | 0.000 | 0.000 | 0.00 | 2.00 | 2.000 | 0.00 |




Calibrated by :

(Mr. Tong Piima)

TOP Trade & Engineering

# 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**

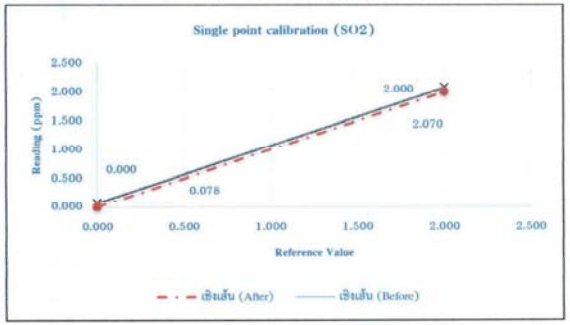
| | | | | |
|---|---|---|---|---|
| Gas Calibration | : | Thermo Environmental | Zero Air Generator | : API |
| Model | : | 146C | Model | : 701 |
| Serial No. | : | 514811458 | Serial No. | : 179 |

**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 :

(Mr. Tong Piima)

เอกสารการสอบเทียบเครื่องมือตรวจวัดความสั่นสะเทือน

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.

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 humdity 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)



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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

Certificate No.: CP20220309EA

## Calibration Report

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

| Frequency (Hz) | Nominal (mm/s) | Standard (mm/s) | UUC (mm/s) | Deviation (mm/s) | Uncertainty ± (%) | Direction |
|---|---|---|---|---|---|---|
| 4.0 | 10 | 9.984 | 9.671 | -0.313 | 1.5 | Transverse (T) |
| 5.0 | 10 | 10.024 | 9.876 | -0.148 | 1.5 | |
| 6.3 | 10 | 9.989 | 10.223 | 0.234 | 1.5 | |
| 8.0 | 10 | 9.996 | 10.049 | 0.053 | 1.5 | |
| 10.0 | 10 | 10.010 | 10.112 | 0.102 | 1.5 | |
| 12.5 | 10 | 10.003 | 10.057 | 0.054 | 1.5 | |
| 16.0 | 10 | 10.008 | 10.018 | 0.010 | 1.5 | |
| | 20 | 19.997 | 20.107 | 0.110 | 1.5 | |
| | 30 | 29.995 | 30.116 | 0.121 | 1.5 | |
| | 50 | 49.978 | 50.239 | 0.261 | 1.5 | |
| 20.0 | 10 | 9.997 | 9.978 | -0.019 | 1.5 | |
| 25.0 | 10 | 9.994 | 9.963 | -0.031 | 1.5 | |
| 31.5 | 10 | 9.996 | 9.900 | -0.096 | 1.5 | |
| 40.0 | 10 | 10.008 | 9.829 | -0.179 | 1.5 | |
| 50.0 | 10 | 10.013 | 9.750 | -0.263 | 1.5 | |
| 52.0 | 10 | 10.001 | 9.758 | -0.243 | 1.5 | |
| 63.0 | 10 | 9.997 | 9.734 | -0.263 | 1.5 | |
| 80.0 | 10 | 9.990 | 9.742 | -0.248 | 1.5 | |





Certificate No.: CP20220309EA

## Calibration Report

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

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

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

- - End of Report - -

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.





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) Humdity 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 ± (%) | 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 | |



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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 | 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 | |

ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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 - -



F-CAL-005 Ed.1

# 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

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Instantel

a part of StanleyBlack&Decker

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***« 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 choisi 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 pieces; si un moniteur ou un capteur est ramené à l'usine pour étalonnage jusqu'à un an après la date d'achat, la garantie sera automatiquement prolongée d'un an supplémentaire**

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เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพน้ำ

ภาคผนวกที่ 4

สรุปเอกสารสอบเทียบอุปกรณ์เครื่องมือ

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:** 22176-60018

Aquion Final Test

[x] Pump Calibration, Ripple and Accuracy
[x] Suppressor Current: Cal and Accuracy
[x] Column Heater: Cal and Check
[x] Detector Heater: Cal and Accuracy
[x] Conductivity Detector Cal, Noise and Linearity
[x] Degas Calibration
[x] Injection Valve Precision
[x] Relay and TTL I/O Test
[x] Injection Valve Functionality
[x] Leak Sensors
[x] Hi-Pot Test
[x] Eluent Generator Calibration

Tester's Signature: Angel Ruiz Date: 22 Dec 2022

60-069566 Rev B

ThermoFisher SCIENTIFIC

# 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

Print: Chromeleon 7.2.9.20010

Report Template: Aquion_FOQ_Pump: Summary_Results
Printed: 12/22/2022

Thermo SCIENTIFIC

# 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 µS | Measured | <=10.0 nS/hour | Measured | <=0.2 nS |
| Cell DI Water Noise and Drift | 0.090 µS | 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 | <=0.1min |
| Injector Precision: 50 ppm | 2.576 µS*min | 0.106% | Pass | 0.373 min | 0.0100 min | Pass |

Angel Ruiz
Test Technician

22 Dec 2022
Date

Print: Chromeleon 7.2.9.20010

Report Template: Aquion_FOQ_Detector: Summary_Result
Printed: 12/22/202

# Thermo SCIENTIFIC Aquion System Calibration Summary

| Instrument Name | Model | Serial Number | Moduleware | Calibration | Value |
|---|---|---|---|---|---|
| Module | Aquion | 221280114 | 3. 1. 0 | Column Calibration | 12/22/2022 |

| | | | | | |
|---|---|---|---|---|---|
| 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

Print: Chromeleon 7.2.9.20010

Report Template: Aquion_FOQ_Detector: Summary_Cal_Customer
Printed: 12/22/2022

HARIKUL SCIENCE

Harikul Science Co.,Ltd.
694 Soi Ratchadanivet 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
Submitted by : C.E.M TECHNOLOGY (THAILAND) Co., LTD.
219/43 Moo 12, Petchkasem Road, Omnoi, Krathumban,
Samutsakorn 74130

Avg Room Temp : 20 °C
Avg Water Temp : 20 °C
Air Pressure : 760.00 mmHg
Salinity : 0 ppt

Model : YSI 5000
S/N : 18L109487
Probe : YSI 5010
S/N : 22G100123
ID NO. :
Air Temp ref : S/N. E00522
Barometric ref : S/N. E00522
Water Temp ref : S/N. 11431

Technician : Kittipong M.

Calibration Details

| Calibration Point | 100% air sat. (@20 °C, DO = 9.09 mg/l) | (status) | | (status) |
|---|---|---|---|---|
| Measurement 1 (mg/l) | 9.09 | (PASS) | - | - |
| Measurement 2 (mg/l) | 9.09 | (PASS) | - | - |
| Measurement 3 (mg/l) | 9.09 | (PASS) | - | - |
| Measurement 4 (mg/l) | 9.09 | (PASS) | - | - |
| Measurement 5 (mg/l) | 9.09 | (PASS) | - | - |
| Measurement 6 (mg/l) | 9.08 | (PASS) | - | - |
| Measurement 7 (mg/l) | 9.09 | (PASS) | - | - |
| Measurement 8 (mg/l) | 9.09 | (PASS) | - | - |
| Measurement 9 (mg/l) | 9.09 | (PASS) | | - |
| Measurement 10 (mg/l) | 9.09 | (PASS) | - | - |
| Mean Measurement | 9.09 | mg/l | - | - |
| Inaccuracy | 0.00 | mg/l | - | - |
| Overall Status | (PASS) | | | |

*Manufacturer Specification*

Accuracy = +/- 0.02 mg/l

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

Technician Signature

Laboratory Manager

# CERTIFICATE OF System Validation

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

*Validation Package Number : TR2022001*
*Instruments : GC*
*Model : KONIK GC 4000B*
*Serial No : 4B1774*
*Location : C.E.M. Technology (Thailand) Co., Ltd.*

**Amani Corporation Limited**

*Service Engineer :* _____
*(Teerapon Tawonwong)*

***December** 21,2022*

**Amani Corporation Limited.**
201/220 MOO 6, PRAVATE, PRAVATE, BANGKOK 10250
TEL. 02-322 4421-3 FAX. 02-322 6705

## 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

**Amani Corporation Limited.**
201/220 MOO 6, PRAVATE, PRAVATE, BANGKOK 10250
TEL. 02-322 4421-3 FAX. 02-322 6705

## 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 | ☒ Passed ☐ Fail |
| **Detector Gases** | | | |
| Reference Gas | | | |
| Set point (mL/min) | Measured (mL/min) | Criteria (mL/min) | Status |
| Low 9 | 9.3 | 8.0-12.0 | ☒ Passed ☐ Fail |
| High 50 | 46.7 | 45.0-55.0 | ☒ Passed ☐ Fail |
| Make-up Gas | | | |
| Set point (mL/min) | Measured (mL/min) | Criteria (mL/min) | Status |
| Low 9 | 9.7 | 8.0-12.0 | ☒ Passed ☐ Fail |
| High 30 | 31.3 | 28.0-32.0 | ☒ Passed ☐ Fail |

Service Engineer Signature: .....
(Teerapon Tawonwong)

Date: 21.12.2022



**Amani Corporation Limited.**
201/220 MOO 6, PRAVATE, PRAVATE, BANGKOK 10250
TEL. 02-322 4421-3 FAX. 02-322 6705

## Temperature Validation Result

| Injector Temperature | | | |
|---|---|---|---|
| Set point (°C) | Measured (°C) | Status | Note |
| 60 +/- 1.0 | 60.0 | ☒ Passed ☐ Fail | |
| **Detector Temperature** | | | |
| Block Temp | | | |
| Set point (°C) | Measured (°C) | Status | Note |
| 60 +/- 1.0 | 60.0 | ☒ Passed ☐ Fail | |
| Transfer Temp | | | |
| Set point (°C) | Measured (°C) | Status | Note |
| 60 +/- 1.0 | 60.0 | ☒ Passed ☐ Fail | |
| **Column Oven** | | | |
| Set point (°C) | Measured (°C) | Status | Note |
| 40 +/- 1 | 40.0 | ☒ Passed ☐ Fail | RTD OFFSET = 6.2 |
| 120 +/- 1 | 120.0 | ☒ Passed ☐ Fail | |

Service Engineer Signature: .....
(Teerapon Tawonwong)

Date: 21.12.2022

**Amani Corporation Limited.**
201/220 MOO 6, PRAVATE, PRAVATE, BANGKOK 10250
TEL. 02-322 4421-3 FAX. 02-322 6705

## Parts Referenced

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

Service Engineer Signature: .....
(Teerapon Tawonwong)

Date: 27.12.2022



**Amani Corporation Limited.**
201/220 MOO 6, PRAVATE, PRAVATE, BANGKOK 10250
TEL. 02-322 4421-3 FAX. 02-322 6705

## Operating Condition

| Parameter | Condition |
|---|---|
| **Environmental** | Temperature 25.0 °C<br>Relative Humidity 45.7 °C |
| **Instrument Condition** | **Gases**<br>- Carrier Gas : Helium = 1ml/min<br>- Hydrogen = 35 ml/min<br>- Air = 350 ml/min<br>- Make-up Gas: Nitrogen = 30ml/min<br><br>**Oven**<br>- Initial Temperature = 50°C<br>- Initial Time = 1 minute<br>- Ramp 1 = 20 °C/minute<br>- Final Temperature = 200°C<br>- Final Time = 1 minute<br><br>**Injector**<br>- Operating Mode = Spilt<br>- Temperature = 230 °C<br>- Split Flow 40 ml/min<br>- Purge Flow rate = 5 ml/min<br><br>**Detector**<br>- Base Temperature = 250 °C<br>- Detector Signal Range = 10°<br><br>**Injected Volume**<br>- 1 µl + needle of Test Mixture |

Service Engineer Signature: .....
(Teerapon Tawonwong)

Date: 27.12.2022

# Certificate of Calibration

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

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

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

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

**Calibration By:** Mr. Suphanimit Khamnonphoem

**Calibration Date:** 15 February 2023

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

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

(Mr. Suphanimit Khamnonphoem)
Person in charge

(Mr. Udon Srichana)
Authorized signatory

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

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

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

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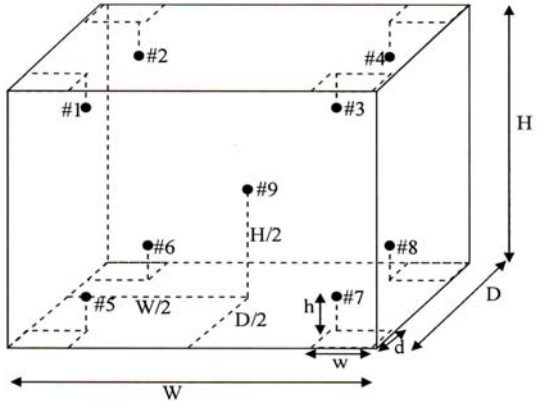


**Standard Installation Locations**

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.

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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**

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## 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**

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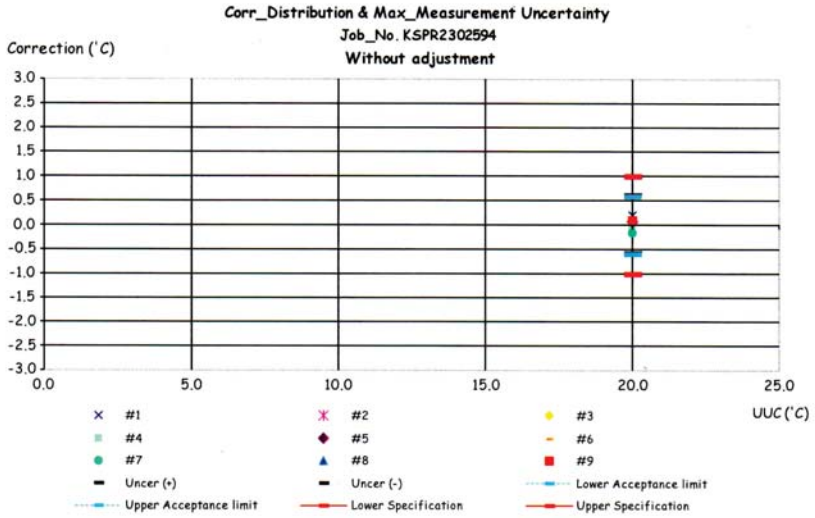
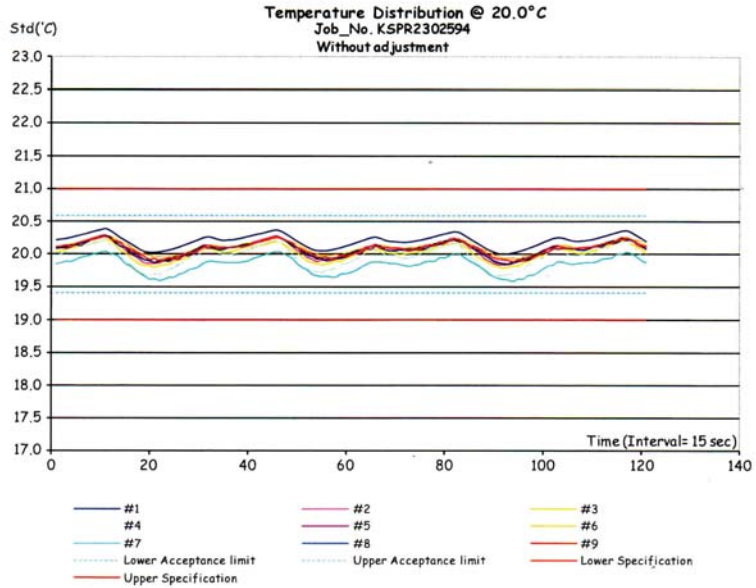
CAL-FM-C31-10: 12 Sep 2022




DKSH

# ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: KSPR2302594

ชนิดเครื่องมือ: Cooled Incubator รุ่น: KB 240

หมายเลขเครื่อง: 20180000012164 ( WW-16-001 )

| ตรวจสอบ (รับ) 15 Feb 2023 | | รายการตรวจเช็ค | ตรวจสอบ (ส่ง) 15 Feb 2023 | | หมายเหตุ |
|---|---|---|---|---|---|
| ปกติ | ไม่ปกติ | | ปกติ | ไม่ปกติ | |
| | | ***General*** | | | |
| ☑ | ☐ | 1. สายไฟ | ☑ | ☐ | |
| ☑ | ☐ | 2. การทำงาน Main Switch | ☑ | ☐ | |
| ☑ | ☐ | 3. การทำงาน Selector Key | ☑ | ☐ | |
| ☑ | ☐ | 4. การแสดงผล Display | ☑ | ☐ | |
| ☑ | ☐ | 5. การทำงาน พัดลม | ☑ | ☐ | |
| ☐ | ☐ | 6. สภาพ Lever of Ventilation valve | ☐ | ☐ | ไม่มี |
| ☑ | ☐ | 7. สภาพ Lever door open / close | ☑ | ☐ | |
| ☑ | ☐ | 8. สภาพ Door seal | ☑ | ☐ | |
| ☑ | ☐ | 9. การทำงานของระบบ Safety | ☑ | ☐ | |
| ☑ | ☐ | 10. การทำงานของระบบทำความเย็น | ☑ | ☐ | |
| ☐ | ☐ | 11. การทำงานของระบบทำความชื้น | ☐ | ☐ | ไม่มี |
| ☑ | ☐ | 12. สภาพตัวเครื่อง | ☑ | ☐ | |
| ☑ | ☐ | 13. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง | ☑ | ☐ | |

ข้อแนะนำ : _____

Mr. Suphanimit Khamnonphoem

Service Engineer

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# Certificate of Calibration

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

**Customer:** C.E.M Technology (Thailand) Co., Ltd.
31/8 Moo 13, Tambom 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.

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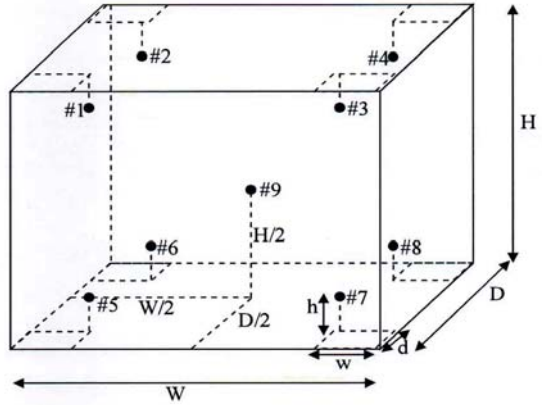


**Standard Installation Locations**

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.

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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.

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## 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

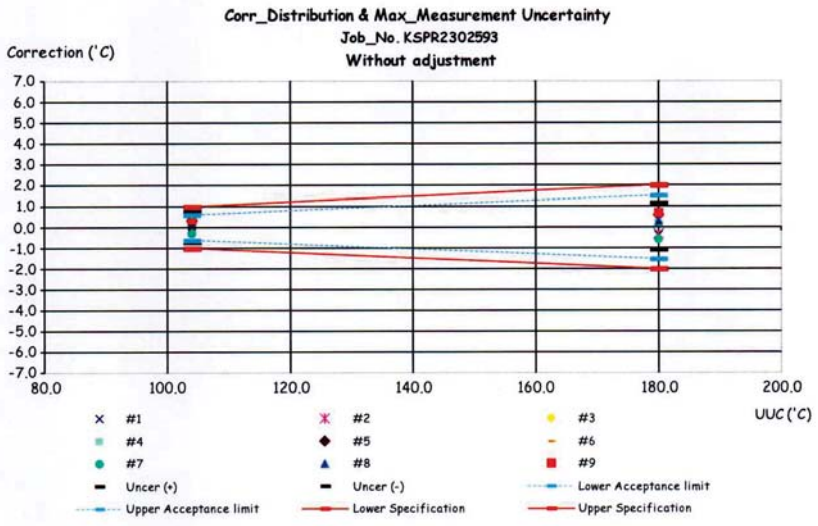
| Locations | Measured (°C) | Correction of UUC.* (°C) | Guard band (W) (± °C) | Tolerance (± °C) | Conformity |
|---|---|---|---|---|---|
| #1 | 179.63 | -0.37 | 0.46 | 2.0 | Pass |
| #2 | 179.69 | -0.31 | 0.45 | 2.0 | Pass |
| #3 | 180.34 | 0.34 | 0.45 | 2.0 | Pass |
| #4 | 180.23 | 0.23 | 0.45 | 2.0 | 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 |

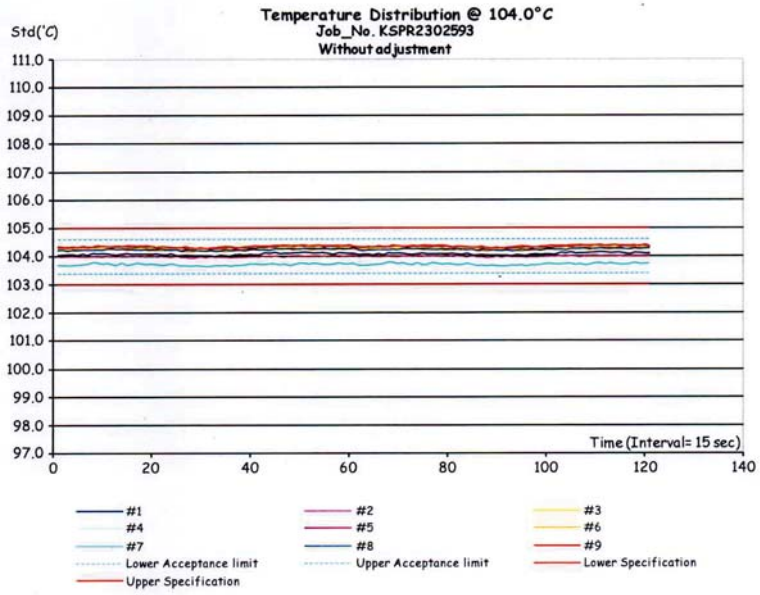
Correction of UUC.* = Measured Temperature - Desired Temperature

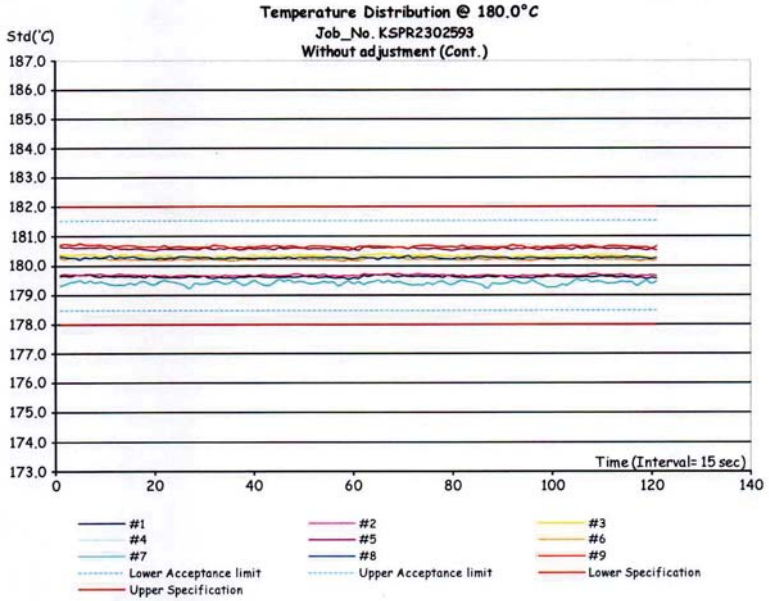
The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

**The End of Statements of Conformity**

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


Corr_Distribution & Max_Measurement Uncertainty
Job_No. KSPR2302593
Without adjustment
Correction (°C)
UUC (°C)
#1
#2
#3
#4
#5
#6
#7
#8
#9
Uncer (+)
Uncer (-)
Lower Acceptance limit
Upper Acceptance limit
Lower Specification
Upper Specification


Temperature Distribution @ 104.0°C
Job_No. KSPR2302593
Without adjustment
Std(°C)
Time (Interval= 15 sec)
#1
#2
#3
#4
#5
#6
#7
#8
#9
Lower Acceptance limit
Upper Acceptance limit
Lower Specification
Upper Specification


Temperature Distribution @ 180.0°C
Job_No. KSPR2302593
Without adjustment (Cont.)
Std(°C)
Time (Interval= 15 sec)
#1
#2
#3
#4
#5
#6
#7
#8
#9
Lower Acceptance limit
Upper Acceptance limit
Lower Specification
Upper Specification

DKSH

# ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: KSPR2302593

ชนิดเครื่องมือ: Hot Air Oven รุ่น: UF 55

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

| ตรวจสอบ (รับ) 15 Feb 2023 ปกติ | ตรวจสอบ (รับ) 15 Feb 2023 ไม่ปกติ | รายการตรวจเช็ค | ตรวจสอบ (ส่ง) 15 Feb 2023 ปกติ | ตรวจสอบ (ส่ง) 15 Feb 2023 ไม่ปกติ | หมายเหตุ |
|---|---|---|---|---|---|
| | | ***General*** | | | |
| ☑ | ☐ | 1. สายไฟ | ☑ | ☐ | |
| ☑ | ☐ | 2. การทำงาน Main Switch | ☑ | ☐ | |
| ☑ | ☐ | 3. การทำงาน Selector Key | ☑ | ☐ | |
| ☑ | ☐ | 4. การแสดงผล Display | ☑ | ☐ | |
| ☑ | ☐ | 5. การทำงาน พัดลม | ☑ | ☐ | |
| ☑ | ☐ | 6. สภาพ Lever of Ventilation valve | ☑ | ☐ | |
| ☑ | ☐ | 7. สภาพ Lever door open / close | ☑ | ☐ | |
| ☑ | ☐ | 8. สภาพ Door seal | ☑ | ☐ | |
| ☑ | ☐ | 9. การทำงานของระบบ Safety | ☑ | ☐ | |
| ☐ | ☐ | 10. การทำงานของระบบทำความเย็น | ☐ | ☐ | ไม่มี |
| ☐ | ☐ | 11. การทำงานของระบบทำความชื้น | ☐ | ☐ | ไม่มี |
| ☑ | ☐ | 12. สภาพตัวเครื่อง | ☑ | ☐ | |
| ☑ | ☐ | 13. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง | ☑ | ☐ | |

ข้อแนะนำ :

Mr. Apiwit Chaosap

Service Engineer

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
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ilac-MRA NSC-TISI-TIS17025 CALIBRATION 0030

# 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%

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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** 

**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 ( pH ) | UUC Reading ( mV ) | Correction ( mV ) | Uncertainty ( ± 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 measurment was based on a standard uncertainty multiplied by a coverage factor k = 2 , providing a level of confidence of approximately 95%

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NSC-TISI-TIS17025
CALIBRATION 0030

# Certificate of Calibration

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

**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%

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# Certificate of Calibration

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



**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 -



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NSC-TISI-TIS 17025
CALIBRATION 0366

# CERTIFICATE OF CALIBRATION

**Certificate No : S2022/168**
**Page : 1/5**
**Order No : 316/2022**

| | | |
|---|---|---|
| **Customer** | : | **C.E.M Technology (Thailand) Co., Ltd** |
| **Address** | : | **219/43 Moo 12 Phet Kasem Rd., Omnoi, Krathum Baen, Chachoengsao 24000** |
| **Instrument** | : | **UV/VIS spectrophotometer** |
| **Manufacture** | : | **MERCK** |
| **Model** | : | **Prove100** |
| **Serial Number** | : | **1714112078** |
| **Environment** | : | **Temperature (26.6 - 26.4)˚C** |
| | : | **Humidity (58 - 60) %RH** |
| **Received Date** | : | **September 29, 2022** |
| **Calibration Date** | : | **September 29, 2022** |
| **Issued Date** | : | **October 3, 2022** |
| **Calibrate Status** | : | **No Adjustment** |
| **Calibration Area** | : | **Customer area** |
| **Roomname** | : | **Laboratory Room of C.E.M Technology (Thailand) Co., Ltd** |

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

**Approved By** :
( Mr.Wanchai Meesiri )
**Manager**

Bangkok High Lab Co.,Ltd.
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## 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 |



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1.5 Reading scale at 590.0 nm

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

1.6 Reading scale at 635.0 nm

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

## 2. Photometric Accuracy

**CRMs:** Potassium Dichromate in Perchloric acid

**CRMs Serial Number: 15086** **Blank Serial Number: 15178**

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

**Spectral slit width :** 4.00 nm

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

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### 3. Wavelength Accuracy

**Spectral slit width :** 4.00 nm

**3.1 CRMs:** Holmium Glass Filter
**CRMs Serial Number: W184/H**
**Traceability:** Traceable to NIST Holmium oxide filter NIST SRM 2034, through Starna certificate report no. 108651

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

**3.2 CRMs:** Didymium Glass Filter
**CRMs Serial Number: W184/D**
**Traceability:** Traceable to NIST Holmium oxide filter NIST SRM 2034, through Starna certificate report no. 108652

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



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### 4. *Stray Light

**CRMs:** Potassium Chloride aqueous solution
**CRMs Serial Number: 5469** **Blank Serial Number: 8745**
**Traceability:** Traceable to NIST, U.S.A. potassium chloride NIST SRM2032, through Starna certificate report no. 88922

**Spectral slit width :** 4.00 nm

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

### 5. *Spectral Resolution

**CRMs:** Toluene in Hexane
**CRMs Serial Number: 8697** **Blank Serial Number: 8716**
**Traceability:** Traceable to toluene in hexane NIST SRM2034, through Starna certificate report no. 88923

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

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

**Remark:** Calibrate Method

1.1 Photometric and Wavelength accuracy: In-house method W-SER-001 based on ASTM E925-02 and ASTM E275-01
1.2 Stray light: Measuring the CRMs in both absorbance and transmittance unit at wavelength 201.23 nm. Base on European Pharmacopoeia V.6.19.3 1984
1.3 Spectral resolution: Measuring the CRMs.The maximum absorbance values were read at closest to 268.7nm and the minimum absorbance values were read at closest 267.0 nm. Refer to European Pharmacopoeia V.6.19.3 1984

2. N/A = not available.
3. Uncertainty of Measurement: The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.
4. This result of calibration was found accurate as shown on date and place of calibration only.
5. This report will certify of calibrated equipment only.

***- End of Report -***

DKSH

# Certificate of Calibration

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

**Customer:** C.E.M Technology (Thailand) Co., Ltd.
31/8 Moo 13, Tambom 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 comparision 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.

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



DKSH



**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**

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DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
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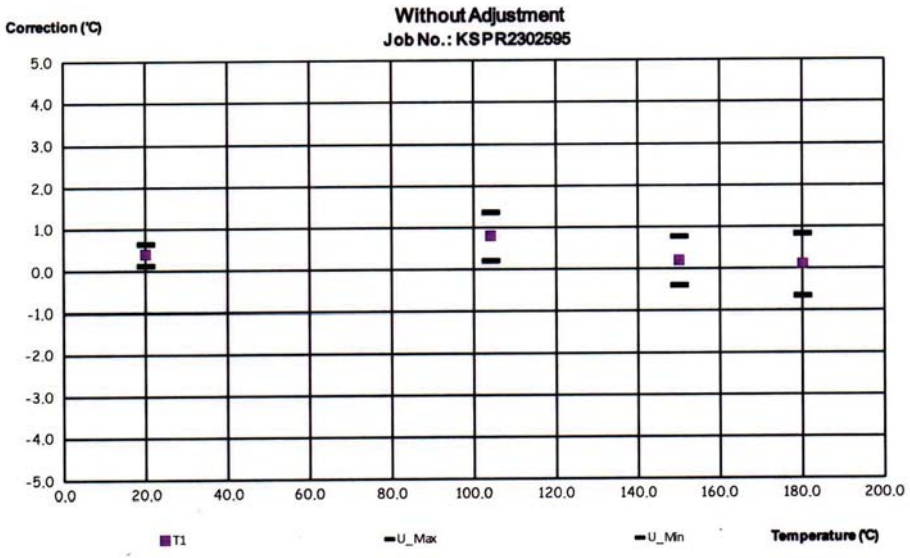
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand
Delivering Growth – in Asia and Beyond.
CAL-FM-C15-14: 06 Dec 2022




DKSH

# ใบตรวจสอบสภาพเครื่องมือวัดอุณหภูมิ

เลขที่ใบงาน: KSPR2302595

ชนิดเครื่องมือ: Digital Thermometer with Sensor

รุ่น: TK 61

หมายเลขเครื่อง: 1P181269184

| ตรวจสอบ (รับ) 16-Feb-2023 | | รายการตรวจเช็ค | ตรวจสอบ (ส่ง) 16-Feb-2023 | | หมายเหตุ |
|---|---|---|---|---|---|
| ปกติ | ไม่ปกติ | | ปกติ | ไม่ปกติ | |
| | | ***General*** | | | |
| ☐ | ☐ | 1. สายไฟ | ☐ | ☐ | ไม่มี |
| ☐ | ☐ | 2. Adapter / Power supply 220 / 110 VAC | ☐ | ☐ | ไม่มี |
| ☑ | ☐ | 3. การทำงาน Main Switch | ☑ | ☐ | |
| ☑ | ☐ | 4. การทำงาน Selector Key | ☑ | ☐ | |
| ☑ | ☐ | 5. การแสดงผล Display | ☑ | ☐ | |
| ☑ | ☐ | 6. Battery | ☑ | ☐ | |
| ☑ | ☐ | 7. สภาพตัวเครื่อง | ☑ | ☐ | |
| ☑ | ☐ | 8. สภาพ Sensor ( In / Ex ) | ☑ | ☐ | |

ข้อแนะนำ : _____

Mr. Anat Karapitak

Service Engineer

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

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THC Calibration Services
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
ilac-MRA ANAB ACCREDITED ISO/IEC 17025 CALIBRATION LABORATORY AC-2695

# 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** _____ **Approved by** _____

Act as Technical Manager — Representative of Managing Director

( ) ( Krisyosl K. ) ( ) ( Sakda Y. ) ( Dr. Ekachai Puttitwong )
( ) ( Patiphan K. ) ( ) ( Onnapa P. )
(√) ( Pongsak H. ) ( ) ( Nitiphong K. )
( ) ( Kanung C. ) ( ) ( Nonthachai K. )
( ) ( Pramong P. ) ( ) ( Noppol P. )

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



THC Calibration Services
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
ilac-MRA ANAB ACCREDITED ISO/IEC 17025 CALIBRATION LABORATORY AC-2695



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

Reference Standard Instruments:

| Type | Model | Serial No. | Cert. No. | Due Date | Traceability |
|---|---|---|---|---|---|
| Data Logger with Sensors | 34972A/ 34901A | MY57010717/ MY59004982 | I0-1308001/22 | Aug. 12, 2023 | THC |

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:
- THC, Thai Heart Calibration Co., Ltd.

Calibrated by Apisit

**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

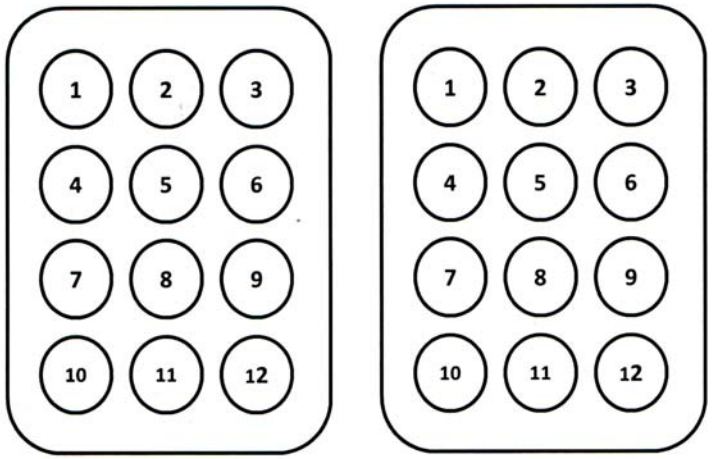
Calibrated by Apisit



THC Calibration Services
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
ilac-MRA ANAB ACCREDITED ISO/IEC 17025 CALIBRATION LABORATORY AC-2695

**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

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

NSC-TISI-TIS17025
CALIBRATION 0030

# Certificate of Calibration

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



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

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

**Equipment :** Digital Conductivity meter (Pocket)

Manufacturer : XS Instruments Model : PC 5

Serial No. : GB 0706/024 ID No. : WW-23-001

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

Ambient Temperature (22.0 to 22.6) ° C

Relative Humidity (55 to 58) %

**Date of Received :** 13 February 2023

**Date of Calibration :** 13 February 2023

**Date of Issue :** 18 February 2023

**Calibrated by :** Bunjerd Masri

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

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

Standard Buffer Solution

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

Approved by :

( Bunjerd Masri )
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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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



**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%

- o0o -

THAI CALIBRATION SERVICES CO., LTD.
19/8 Moo 9 Soi Raiking 30 Puttamonton 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

NSC-TISI-TIS 17025
CALIBRATION 0189

# CALIBRATION CERTIFICATE

Certificate No.S2303153S



**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

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Tel. 0-3439-7682-5 Fax: 0-3439-7687
www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com

NSC-TISI-TIS 17025
CALIBRATION 0189

# CALIBRATION CERTIFICATE

Certificate No.S2303153S

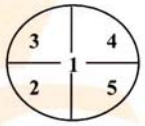


## The repeatability of indication

| 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--