

ภาคผนวกที่ 4

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สรุปเอกสารสอบเทียบอุปกรณ์เครื่องมือ

เอกสารการสอบเทียบเครื่องมือตรวจวัดระดับเสียงในบรรยากาศ

## CERTIFICATE OF CALIBRATION

Certificate No. : 66S1031-25

Job No. : 66S1031

Page : 1 of 2

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

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

Location : Laboratory

Equipment : Sound Level Meter

Ambient temperature : ( 20 ± 2 ) °C

Manufacturer : ACO

Relative humidity : ( 50 ± 15 ) %

Model : 6236

Atmospheric pressure : -

Serial No. : 222128

Date of received : 26-Oct-2023

Identity No. : NS-03-013

Date of calibration : 30-Oct-2023

Range : See to Data

Date of issued : 01-Nov-2023

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

### Reference Standard Instruments :

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

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

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

☐ Ms. Bhacharin Phanangkaew (MD)

Reviewed By : ☐ Mr. Sompong Srisert

☒ Mr. Boonyarit Auejirakarn

☒ Ms. Natthaparakarn Thammaphan

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

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

*UUC\* = Unit Under Calibration*

- The End -



## CERTIFICATE OF CALIBRATION

Certificate No. : 66S1031-24

Job No. : 66S1031

Page : 1 of 2

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

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

Location : Laboratory

Equipment : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 222129

Identity No. : NS-03-014

Range : See to Data

Ambient temperature : ( 20 ± 2 ) °C

Relative humidity : ( 50 ± 15 ) %

Atmospheric pressure : -

Date of received : 26-Oct-2023

Date of calibration : 30-Oct-2023

Date of issued : 01-Nov-2023

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

### Reference Standard Instruments :

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

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

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

[ ] Ms. Bhacharin Phanangkaew (MD)

Reviewed By : [ ] Mr. Sompong Srisert

[ ] Mr. Boonyarit Auejirakarn

[x] Ms. Natthaparakarn Thammaphan

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

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

*UUC\* = Unit Under Calibration*

- The End -

# G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 17 E 30064

PAGE : 1 OF 2

## *Certificate of Calibration*

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

**CALIBRATED BY** :   
**CALIBRATION DATE** : 25-April-24

**APPROVED BY** :   
DHUDIT P.

**ISSUED DATE** : 25-April-24

# G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 17 E 30064

PAGE : 2 OF 2

## Calibration Report

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

### CONDITION OF THIS RESULTS OF CALIBRATION

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

#### INSTRUMENT

#### MODEL

#### SERIAL No.

#### CERTIFICATTE No.

#### DUE DATE

1) MULTIFUNCTION SOUND CALIBRATOR. 1986 01827 EEL.BP.67/0974 10-Jan-25

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

UUC\* : UNIT UNDER CALIBRATION

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

**END OF CALIBRATION REPORT**

# G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 17 E 30063

PAGE : 1 OF 2

## *Certificate of Calibration*

**EQUIPMENT** : SOUND LEVEL METER  
**MANUFACTURER** : ACO  
**MODEL** : TYPE 6226  
**SERIAL No.** : 060210  
**ID No.** : CEM-SI-03  
  
**SUBMITTED BY** : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.  
219/43 MOO 12, PETCHKASEM RD., OMNOI,  
KRATHUMBAN SAMUTSAKORN 74130

**CALIBRATED BY** :   
**CALIBRATION DATE** : 25-April-24

**APPROVED BY** :   
PHUDIT P.

**ISSUED DATE** : 25-April-24

# G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 17 E 30063

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : SOUND LEVEL METER  
MANUFACTURER : ACO  
MODEL : TYPE 6226 SERIAL NUMBER : 060210  
ID No. : CEM-SI-03  
RECEIVED DATE : 23-April-24 CALIBRATION DATE : 25-April-24  
AMBIENT TEMPERATURE : 22 °C ± 3°C RELATIVE HUMIDITY : 50%RH ± 20%RH

### CONDITION OF THIS RESULTS OF CALIBRATION

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

| INSTRUMENT                            | MODEL | SERIAL No. | CERTIFICATTE No. | DUE DATE  |
|---------------------------------------|-------|------------|------------------|-----------|
| 1) MULTIFUNCTION<br>SOUND CALIBRATOR. | 1986  | 01827      | EEL.BP.67/0974   | 10-Jan-25 |

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

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

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

| FREQUENCY<br>(Hz) | STANDARD EXPECTED<br>READING (dB) | UUC READING (dB) | CORRECTION (dB) | UNCERTAINTY OF<br>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<br>(Hz) | STANDARD EXPECTED<br>READING (dB) | UUC READING (dB) | CORRECTION (dB) | UNCERTAINTY OF<br>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<br>MEASUREMENT (±dB) |
|-----------------------|------------------|-----------------|-------------------------------------|
| 74                    | 74.0             | 0.0             | 0.50                                |
| 84                    | 84.0             | 0.0             | 0.50                                |
| 94                    | 94.0             | 0.0             | 0.50                                |
| 104                   | 104.1            | -0.1            | 0.50                                |
| 114                   | 114.2            | -0.2            | 0.50                                |

UUC\* : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT



# G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 17 E 30067


PAGE : 1 OF 2

## *Certificate of Calibration*

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

**CALIBRATED BY** :   
SURAWIT K.

**CALIBRATION DATE** : 25-April-24

**APPROVED BY** :   
PHUDIT P.

**ISSUED DATE** : 25-April-24

# G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 17 E 30067

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : SOUND LEVEL METER  
MANUFACTURER : ACO  
MODEL : TYPE 6226 SERIAL NUMBER : 150007  
ID No. : CEM-SI-07  
RECEIVED DATE : 23-April-24 CALIBRATION DATE : 25-April-24  
AMBIENT TEMPERATURE : 22 °C ± 3°C RELATIVE HUMIDITY : 50%RH ± 20%RH

### CONDITION OF THIS RESULTS OF CALIBRATION

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

| INSTRUMENT                            | MODEL | SERIAL No. | CERTIFICATTE No. | DUE DATE  |
|---------------------------------------|-------|------------|------------------|-----------|
| 1) MULTIFUNCTION<br>SOUND CALIBRATOR. | 1986  | 01827      | EEL.BP.67/0974   | 10-Jan-25 |

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

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

- THIS CERTIFICATE IS TRACEABLE TO :-

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

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

### 1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

| FREQUENCY<br>(Hz) | STANDARD EXPECTED<br>READING (dB) | UUC READING (dB) | CORRECTION (dB) | UNCERTAINTY OF<br>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<br>(Hz) | STANDARD EXPECTED<br>READING (dB) | UUC READING (dB) | CORRECTION (dB) | UNCERTAINTY OF<br>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<br>MEASUREMENT (±dB) |
|-----------------------|------------------|-----------------|-------------------------------------|
| 74                    | 74.0             | 0.0             | 0.50                                |
| 84                    | 84.0             | 0.0             | 0.50                                |
| 94                    | 94.0             | 0.0             | 0.50                                |
| 104                   | 104.1            | -0.1            | 0.50                                |
| 114                   | 114.2            | -0.2            | 0.50                                |

UUC\* : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

# G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 17 E 30068


PAGE : 1 OF 2

## *Certificate of Calibration*

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

**CALIBRATED BY** :   
SURAWIT K.

**CALIBRATION DATE** : 25-April-24

**APPROVED BY** :   
PHUDIT P.

**ISSUED DATE** : 25-April-24

# G.Ruamkit Panich Co.,Ltd.

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

CERTIFICATE No : GR 17 E 30068

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : SOUND LEVEL METER  
MANUFACTURER : ACO  
MODEL : TYPE 6226 SERIAL NUMBER : 150008  
ID No. : CEM-SI-08  
RECEIVED DATE : 23-April-24 CALIBRATION DATE : 25-April-24  
AMBIENT TEMPERATURE : 22 °C ± 3°C RELATIVE HUMIDITY : 50%RH ± 20%RH

### CONDITION OF THIS RESULTS OF CALIBRATION

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

| INSTRUMENT                            | MODEL | SERIAL No. | CERTIFICATTE No. | DUE DATE  |
|---------------------------------------|-------|------------|------------------|-----------|
| 1) MULTIFUNCTION<br>SOUND CALIBRATOR. | 1986  | 01827      | EEL.BP.67/0974   | 10-Jan-25 |

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

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

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

| FREQUENCY<br>(Hz) | STANDARD EXPECTED<br>READING (dB) | UUC READING (dB) | CORRECTION (dB) | UNCERTAINTY OF<br>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<br>(Hz) | STANDARD EXPECTED<br>READING (dB) | UUC READING (dB) | CORRECTION (dB) | UNCERTAINTY OF<br>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

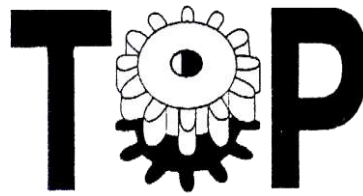
| STANDARD APPLIED (dB) | UUC READING (dB) | CORRECTION (dB) | UNCERTAINTY OF<br>MEASUREMENT (±dB) |
|-----------------------|------------------|-----------------|-------------------------------------|
| 74                    | 74.0             | 0.0             | 0.50                               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

UUC\* : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในบรรยากาศ



Trade & Engineering

## PM10 High Volume Sampler Verification

### Site Information

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

### Site Conditions

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

### Calibration Orifice

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

### Calibration Data

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

# of Observations: 5

### Calculations

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

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

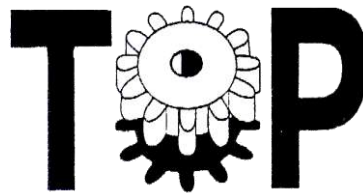
$SFR = 1.13(Ps/Pa)(Ta/Ts)$   
 $SSP = (m*SFR+b)(\text{Sqrt}(Pa/Ta))$   
SFR = sampler set point flow rate  
SSP = sampler chart set point  
m = sampler slope  
b = sampler intercept  
Ta = actual temperature (deg K)  
Pa = actual pressure (mm Hg)  
Ts = Average temperature (deg K)  
Ps = Average pressure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

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

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

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





Trade & Engineering

## PM10 High Volume Sampler Verification

### Site Information

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

### Site Conditions

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

### Calibration Orifice

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

### Calibration Data

| Plate or Test # | In H2O | Qa (m3/min) | I (chart) | IC (corrected) | Linear Regression  |
|-----------------|--------|-------------|-----------|----------------|--------------------|
| 1               | 9.35   | 1.269       | 60.0      | 39.12          | Slope 36.6800      |
| 2               | 7.65   | 1.149       | 55.4      | 36.12          | Intercept -6.6541  |
| 3               | 6.55   | 1.064       | 50.9      | 33.19          | Corr. Coeff 0.9908 |
| 4               | 5.70   | 0.993       | 45.5      | 29.67          | SFR 1.086          |
| 5               | 4.65   | 0.898       | 39.4      | 25.69          | SSP 50.91          |

# of Observations: 5

### Calculations

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

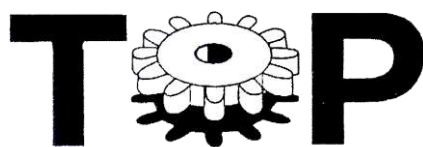
Qa = actual flow rate  
IC = corrected chart response  
m = calibrator slope  
b = calibrator intercept  
Ta = actual temperature (deg K)  
Pa = actual pressure (mm Hg)  
For subsequent calculation  
of sampler flow:

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

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

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

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



Trade & Engineering

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

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

**Site Conditions**

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

**Calibration Orifice**

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

**Calibration Information**

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

**Calculations**

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

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

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

m = sampler slope

b = sampler intercept

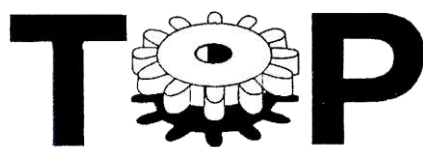
I = chart response

Tav = daily average temperature

Pav = daily average pressure

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

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



Trade & Engineering

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

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

**Site Conditions**

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

**Calibration Orifice**

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

**Calibration Information**

| Plate or Test # | H2O (in) | Qstd (m3/min) | I (chart) | IC (corrected) | Linear Regression           |
|-----------------|----------|---------------|-----------|----------------|-----------------------------|
| 1               | 7.80     | 1.705         | 60.1      | 57.76          | <b>Slope:</b> 28.1557       |
| 2               | 6.00     | 1.497         | 57.2      | 54.97          | <b>Intercept:</b> 11.0629   |
| 3               | 5.30     | 1.407         | 53.4      | 51.32          | <b>Corr. Coeff:</b> 0.9717  |
| 4               | 4.50     | 1.297         | 49.7      | 47.77          |                             |
| 5               | 3.90     | 1.209         | 45.6      | 43.83          |                             |
|                 |          |               |           |                | <b># of Observations:</b> 5 |

**Calculations**

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

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

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

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure

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

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

## 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

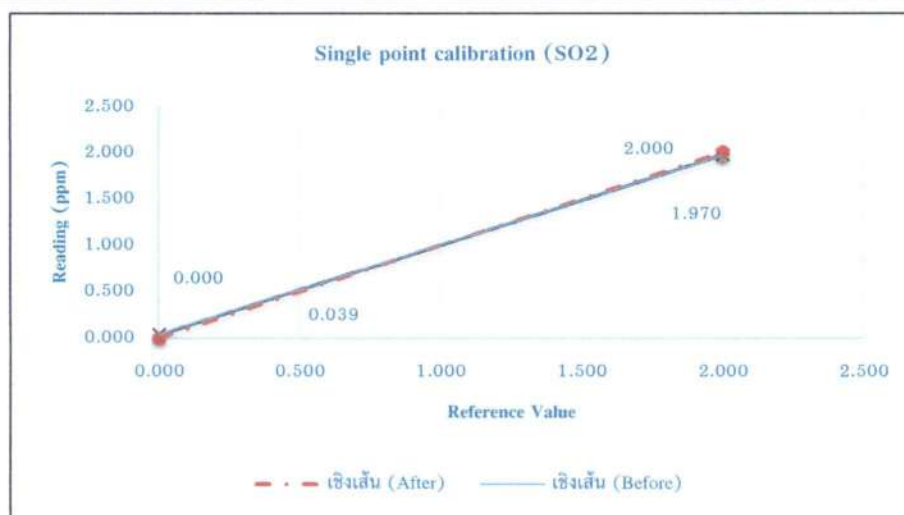
SO2 Conc. : 2 ppm

Expire Date : 21-Nov-23

CO Conc. : 50 ppm

### Calibration Check

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



Calibrated by :

  
 (Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 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

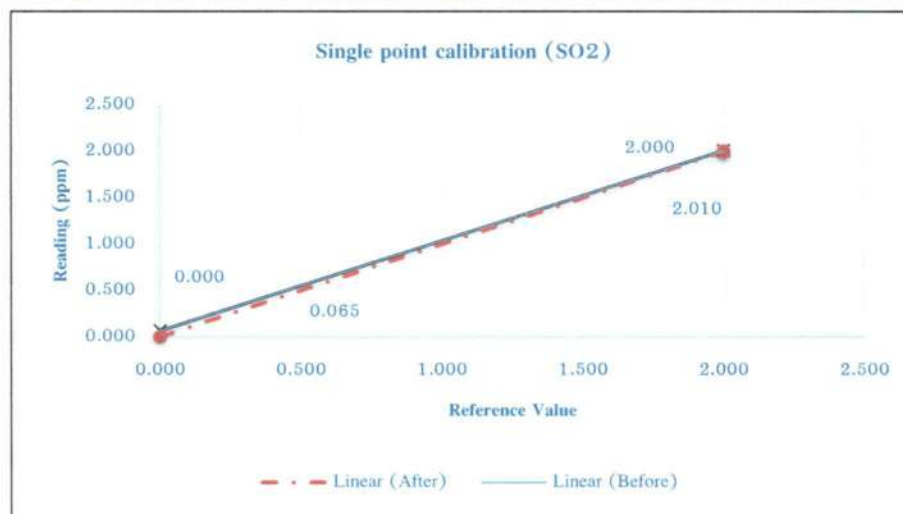
SO2 Conc. : 2 ppm

Expire Date : 21-Nov-23

CO Conc. : 50 ppm

### Calibration Check

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



Calibrated by :

*Tong Piima*  
(Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 31-Mar-24

Certificate No. : 0324-003

Page : 1/1

### Analyzer Instruments

Analyzer Type : SO2 Analyzer

Manufacturer : Thermo Environmental

Model : 43C

Serial No. : 69858-364

### Environmental

Temperature : 25.2 °C

Humidity : 52.3 %RH

### Calibration System

#### Calibrator Units

Gas Calibration : Thermo Environmental

Zero Air Generator : API

Model : 146C

Model : 701

Serial No. : 514811458

Serial No. : 179

#### Standard Gas

NO Conc. : 2 ppm

Cylinder No. : 307199

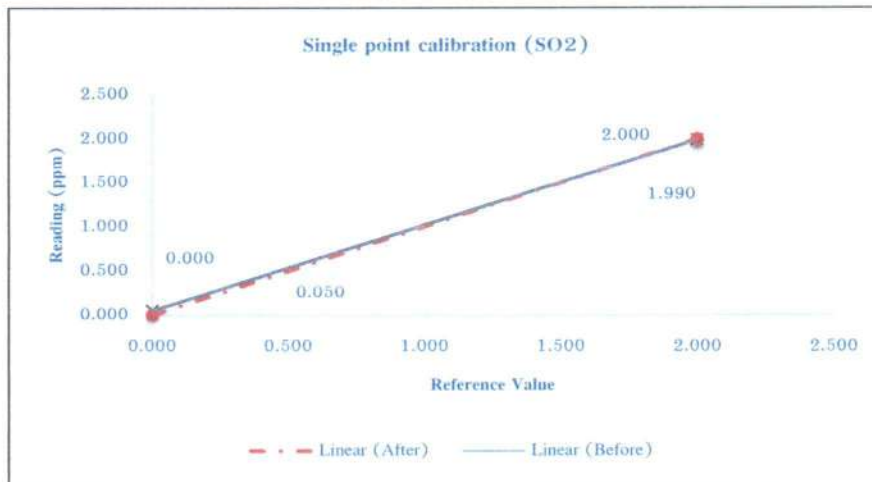
SO2 Conc. : 2 ppm

Expire Date : 10-Oct-25

CO Conc. : 50 ppm

### Calibration Check

| Gas    | Zero                   |                         |              | Span                   |                         |              |
|--------|------------------------|-------------------------|--------------|------------------------|-------------------------|--------------|
|        | Reading Value<br>(ppm) | Expected Value<br>(ppm) | Drift<br>(%) | Reading Value<br>(ppm) | Expected Value<br>(ppm) | Drift<br>(%) |
| Before |                        |                         |              |                        |                         |              |
| SO2    | 0.050                  | 0.000                   | 0.05         | 1.99                   | 2.000                   | -0.50        |
| After  |                        |                         |              |                        |                         |              |
| SO2    | 0.000                  | 0.000                   | 0.00         | 2.00                   | 2.000                   | 0.00         |



Calibrated by :

*Tong Piima*  
(Mr. Tong Piima)



## Certificate of Analyzer Performance Testing

Calibrated Date : 8-Mar-24

Certificate No. : 0324-006

Page : 1/1

### Analyzer Instruments

Analyzer Type : NO/NO/NOx Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial No. : 58926-320

### Environmental

Temperature : 25.7 °C

Humidity : 44.6 %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

NO Conc. : 2 ppm

Cylinder No. : 307199

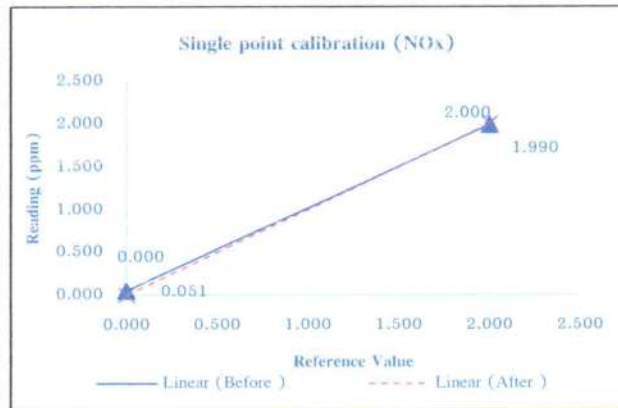
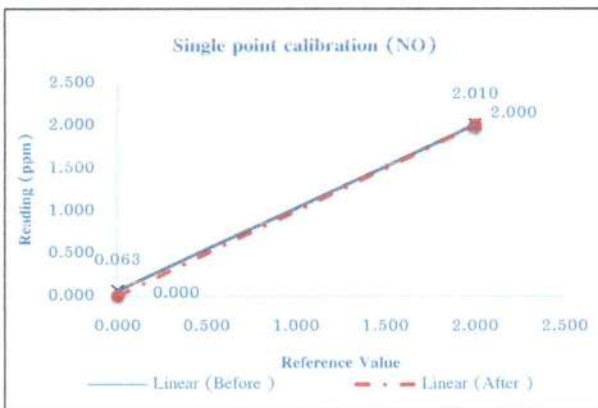
SO2 : 2 ppm

Expire Date : 10-Oct-25

CO Conc. : 50 ppm

### Calibration Check

| Gas    | Zero                   |                         |              | Span                   |                         |              |
|--------|------------------------|-------------------------|--------------|------------------------|-------------------------|--------------|
|        | Reading Value<br>(ppm) | Expected Value<br>(ppm) | Drift<br>(%) | Reading Value<br>(ppm) | Expected Value<br>(ppm) | Drift<br>(%) |
| Before |                        |                         |              |                        |                         |              |
| NO     | 0.063                  | 0.000                   | 0.06         | 2.01                   | 2.00                    | 0.50         |
| NOx    | 0.051                  | 0.000                   | 0.05         | 1.99                   | 2.00                    | -0.50        |
| After  |                        |                         |              |                        |                         |              |
| NO     | 0.000                  | 0.000                   | 0.00         | 2.00                   | 2.00                    | 0.00         |
| NOx    | 0.000                  | 0.000                   | 0.00         | 2.00                   | 2.00                    | 0.00         |



Calibrated by :

  
 (Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 28-Mar-23

Certificate No. : 0324-007

Page : 1/1

### Analyzer Instruments

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

Manufacturer : Thermo Environmental

Model : 42C

Serial No. : 72454-371

### Environmental

Temperature : 25.3 °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. : 307199

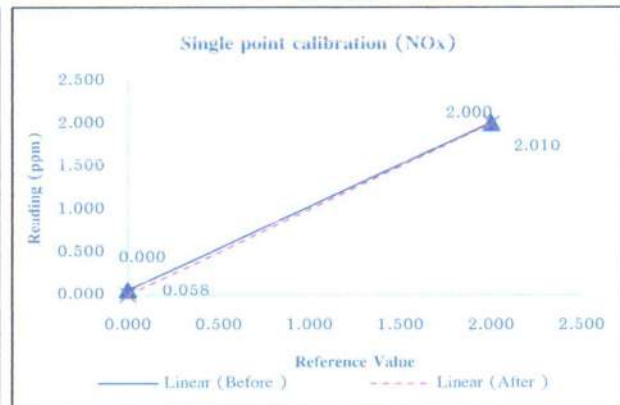
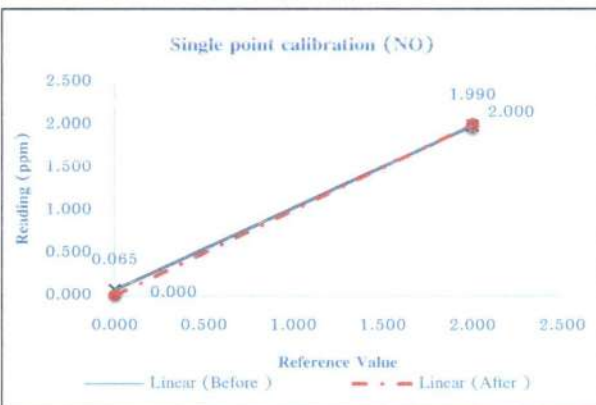
SO<sub>2</sub> : 2 ppm

Expire Date : 10-Oct-25

CO Conc. : 50 ppm

### Calibration Check

| Gas             | Zero                   |                         |              | Span                   |                         |              |
|-----------------|------------------------|-------------------------|--------------|------------------------|-------------------------|--------------|
|                 | Reading Value<br>(ppm) | Expected Value<br>(ppm) | Drift<br>(%) | Reading Value<br>(ppm) | Expected Value<br>(ppm) | Drift<br>(%) |
| Before          |                        |                         |              |                        |                         |              |
| NO              | 0.065                  | 0.000                   | 0.07         | 1.99                   | 2.00                    | -0.50        |
| NO <sub>x</sub> | 0.058                  | 0.000                   | 0.06         | 2.01                   | 2.00                    | 0.50         |
| After           |                        |                         |              |                        |                         |              |
| NO              | 0.000                  | 0.000                   | 0.00         | 2.00                   | 2.00                    | 0.00         |
| NO <sub>x</sub> | 0.000                  | 0.000                   | 0.00         | 2.00                   | 2.00                    | 0.00         |



Calibrated by :

  
(Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 2-Aug-24

Certificate No. : 0824-003

Page : 1/1

### Analyzer Instruments

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

Manufacturer : Thermo Environmental

Model : 42C

Serial No. : 59406-323

### Environmental

Temperature : 25.7 °C

Humidity : 46.6 %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

NO Conc. : 2 ppm

Cylinder No. : 307199

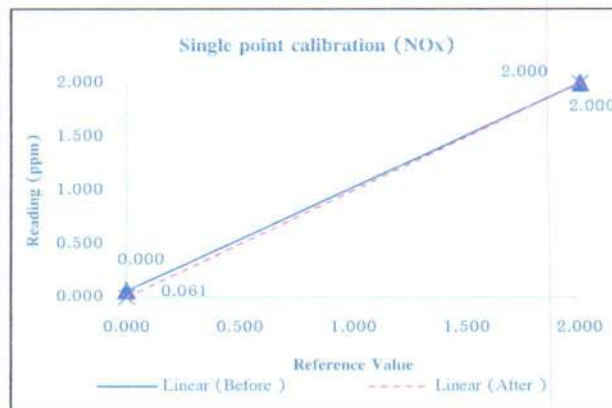
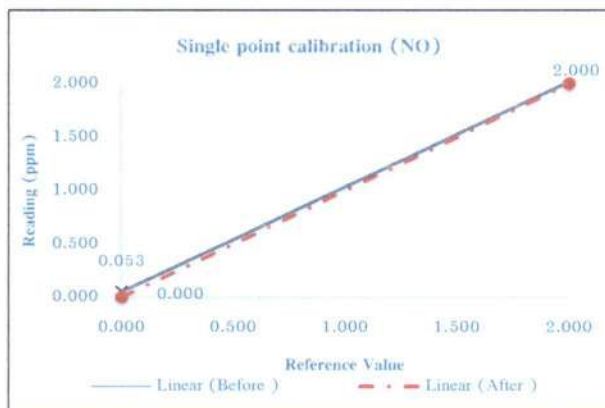
SO<sub>2</sub> : 2 ppm

Expire Date : 10-Oct-25

CO Conc. : 50 ppm

### Calibration Check

| Gas             | Zero                   |                         |              | Span                   |                         |              |
|-----------------|------------------------|-------------------------|--------------|------------------------|-------------------------|--------------|
|                 | Reading Value<br>(ppm) | Expected Value<br>(ppm) | Drift<br>(%) | Reading Value<br>(ppm) | Expected Value<br>(ppm) | Drift<br>(%) |
| Before          |                        |                         |              |                        |                         |              |
| NO              | 0.053                  | 0.000                   | 0.05         | 2.02                   | 2.00                    | 1.00         |
| NO <sub>x</sub> | 0.061                  | 0.000                   | 0.06         | 2.00                   | 2.00                    | 0.00         |
| After           |                        |                         |              |                        |                         |              |
| NO              | 0.000                  | 0.000                   | 0.00         | 2.00                   | 2.00                    | 0.00         |
| NO <sub>x</sub> | 0.000                  | 0.000                   | 0.00         | 2.00                   | 2.00                    | 0.00         |



Calibrated by :

  
 (Mr. Tong Piima)

### Certificate of Analyzer Performance Testing

Calibrated Date : 5-Mar-24

Certificate No. : 0324-002

Page : 1/1

#### Analyzer Instruments

Analyzer Type : CO Analyzer

Manufacturer : Thermo Environmental

Model : 48C

Serial No. : 65775350

#### Environmental

Temperature : 25.2 °C

Humidity : 44.6 %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

NO Conc. : 2 ppm

Cylinder No. : 307199

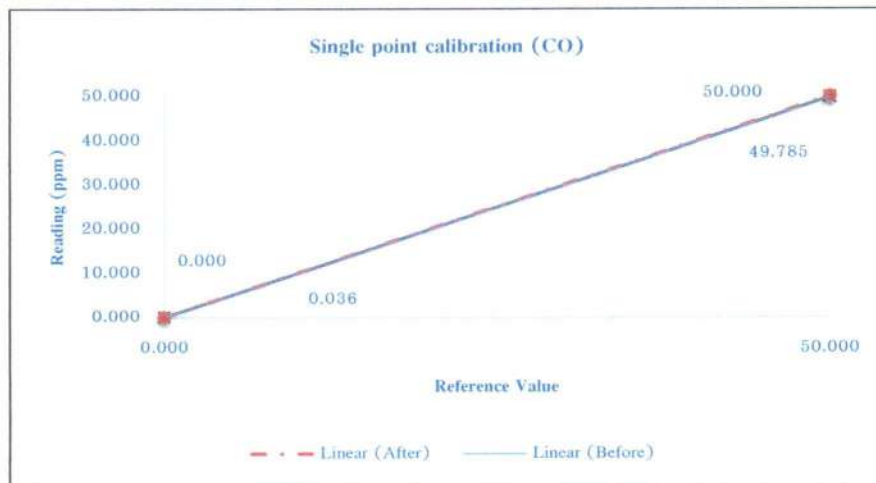
SO2 Conc. : 2 ppm

Expire Date : 10-Oct-25

CO Conc. : 50 ppm

#### Calibration Check

| Gas    | Zero                   |                         |              | Span                   |                         |              |
|--------|------------------------|-------------------------|--------------|------------------------|-------------------------|--------------|
|        | Reading Value<br>(ppm) | Expected Value<br>(ppm) | Drift<br>(%) | Reading Value<br>(ppm) | Expected Value<br>(ppm) | Drift<br>(%) |
| Before |                        |                         |              |                        |                         |              |
| CO     | 0.036                  | 0.000                   | 0.04         | 49.785                 | 50.000                  | -0.43        |
| After  |                        |                         |              |                        |                         |              |
| CO     | 0.000                  | 0.000                   | 0.00         | 50.000                 | 50.000                  | 0.00         |



Calibrated by :

*Tong Piima*  
(Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 28-Mar-24

Certificate No. : 0324-005

Page : 1/1

### Analyzer Instruments

Analyzer Type : CO Analyzer

Manufacturer : Thermo Environmental

Model : 48C

Serial No. : 401304261

### Environmental

Temperature : 25.1 °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. : 307199

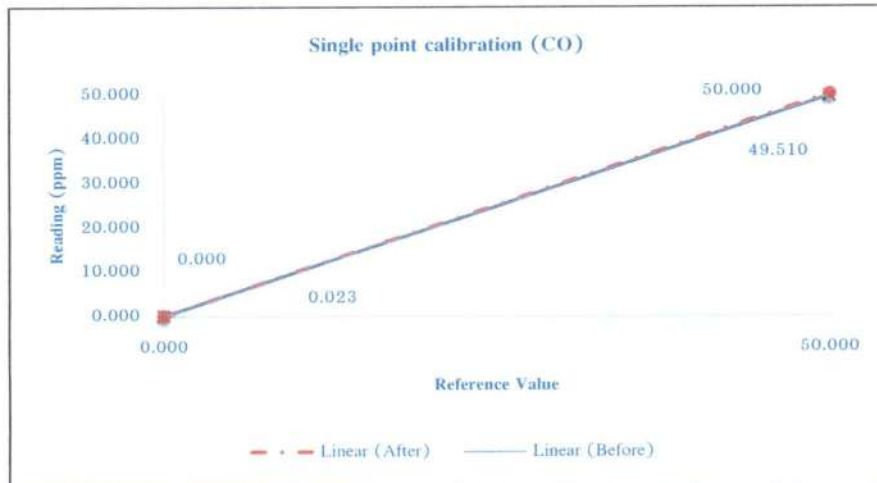
SO2 Conc. : 2 ppm

Expire Date : 10-Oct-25

CO Conc. : 50 ppm

### Calibration Check

| Gas    | Zero                   |                         |              | Span                   |                         |              |
|--------|------------------------|-------------------------|--------------|------------------------|-------------------------|--------------|
|        | Reading Value<br>(ppm) | Expected Value<br>(ppm) | Drift<br>(%) | Reading Value<br>(ppm) | Expected Value<br>(ppm) | Drift<br>(%) |
| Before |                        |                         |              |                        |                         |              |
| CO     | 0.023                  | 0.000                   | 0.02         | 49.510                 | 50.000                  | -0.98        |
| After  |                        |                         |              |                        |                         |              |
| CO     | 0.000                  | 0.000                   | 0.00         | 50.000                 | 50.000                  | 0.00         |



Calibrated by :

  
 (Mr. Tong Piima)



## Certificate of Analyzer Performance Testing

Calibrated Date : 15-Jan-24

Certificate No. : 0124-001

Page : 1/1

### Analyzer Instruments

Analyzer Type : THC Analyzer

Manufacturer : Thermo Environmental

Model : 51

Serial No. : 51HT-73244-373

### 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

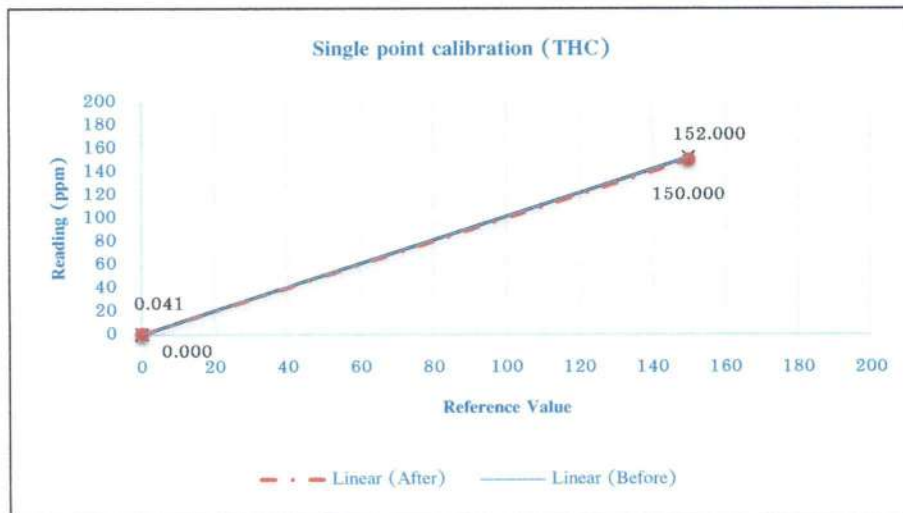
Propane Conc. : 150 ppm

Cylinder No. : 21W281046

Expire Date : 26-Sep-25

### Calibration Check

| Gas    | Zero                   |                         |              | Span                   |                         |              |
|--------|------------------------|-------------------------|--------------|------------------------|-------------------------|--------------|
|        | Reading Value<br>(ppm) | Expected Value<br>(ppm) | Drift<br>(%) | Reading Value<br>(ppm) | Expected Value<br>(ppm) | Drift<br>(%) |
| Before |                        |                         |              |                        |                         |              |
| THC    | 0.041                  | 0.000                   | 0.041        | 152                    | 150                     | 1.333        |
| After  |                        |                         |              |                        |                         |              |
| THC    | 0.000                  | 0.000                   | 0.000        | 150                    | 150                     | 0.000        |



Calibrated by :

  
(Mr. Tong Piima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 15-Jan-24

Certificate No. : 0124-002

Page : 1/1

### Analyzer Instruments

Analyzer Type : THC Analyzer

Manufacturer : Baseline

Model : Series 8800

Serial No. : 584

### Environmental

Temperature : 24.6 °C

Humidity : 45.1 %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

Propane Conc. : 150 ppm

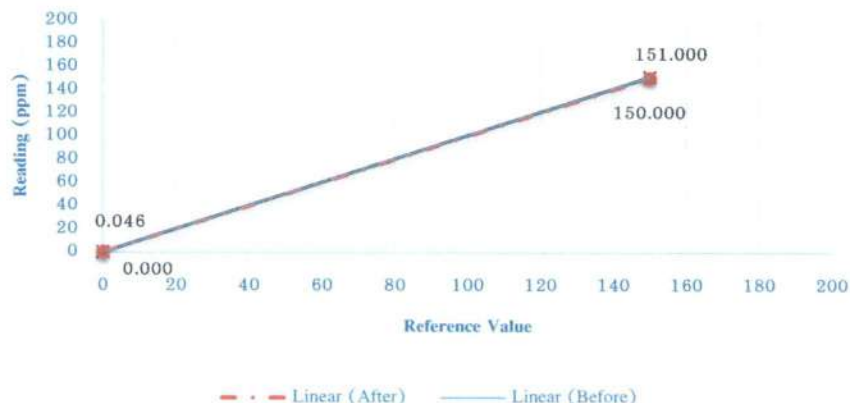
Cylinder No. : 21W281046

Expire Date : 26-Sep-25

### Calibration Check

| Gas    | Zero                   |                         |              | Span                   |                         |              |
|--------|------------------------|-------------------------|--------------|------------------------|-------------------------|--------------|
|        | Reading Value<br>(ppm) | Expected Value<br>(ppm) | Drift<br>(%) | Reading Value<br>(ppm) | Expected Value<br>(ppm) | Drift<br>(%) |
| Before |                        |                         |              |                        |                         |              |
| THC    | 0.046                  | 0.000                   | 0.046        | 151                    | 150                     | 0.667        |
| After  |                        |                         |              |                        |                         |              |
| THC    | 0.000                  | 0.000                   | 0.000        | 150                    | 150                     | 0.000        |

Single point calibration (THC)



Calibrated by :

  
(Mr. Tong Piima)



เอกสารการสอบเทียบเครื่องมือตรวจวัดความชื้นสะท้อน



**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.: CP20240388EA

Operation No.: CP2024100354

## 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: 16 October 2024

Calibrated Date: 7 - 15 November 2024

Issued Date: 20 November 2024

Calibrated by: Ms. Juntaporn Kunhakom

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

( Mr. Sittichai Swaksuriyawong )

Group Manager

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

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

Certificate No.: CP20240388EA

## Calibration Report

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

### Method of Calibration :-

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

### Condition of this result of calibration

1. Reference standards instrument :-

| <u>Instrument</u>                       | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|---|--------------|-------------------|------------------|-----------------|
| 1) Standard Accelerometer               | 8305         | 2708237           | AV-0040-24       | 19-Sep-2025     |
| 2) Measuring Amplifier                  | 2525         | 2685967           | AV-0034-24       | 7-Aug-2025      |
| 3) PULSE Multi-analyzer system          | 3560-C       | 2705645           | CQ20230026EA     | 25-Dec-2024     |
| 4) Humidity and Temperature Transmitter | HMT331       | K3810009          | CD20240141EA     | 12-Jun-2025     |

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; NSC Accredited Calibration No.0119

Certificate No.: CP20240388EA

### Calibration Report

**Result of Calibration:-**

**Function :** Frequency response and Linearity test at 16 Hz

| Frequency (Hz) | Nominal (mm/s) | Standard (mm/s) | UUC (mm/s) | Deviation (mm/s) | Uncertainty $\pm$ (%) | Direction        |
|----------------|----------------|-----------------|------------|------------------|-----------------------|------------------|
| 4.0            | 10.000         | 10.004          | 9.758      | -0.246           | 1.50                  | Longitudinal (L) |
| 5.0            | 10.000         | 10.004          | 9.805      | -0.199           | 1.50                  |                  |
| 6.3            | 10.000         | 10.011          | 9.953      | -0.058           | 1.60                  |                  |
| 8.0            | 10.000         | 10.006          | 9.718      | -0.288           | 1.50                  |                  |
| 10.0           | 10.000         | 10.002          | 9.710      | -0.292           | 1.50                  |                  |
| 12.5           | 10.000         | 10.006          | 9.734      | -0.272           | 1.50                  |                  |
| 16.0           | 10.000         | 9.997           | 9.813      | -0.184           | 1.50                  |                  |
|                | 20.000         | 19.997          | 19.517     | -0.480           | 1.50                  |                  |
|                | 30.000         | 29.995          | 29.210     | -0.785           | 1.50                  |                  |
|                | 50.000         | 49.992          | 48.732     | -1.260           | 1.50                  |                  |
| 20.0           | 10.000         | 10.001          | 9.805      | -0.196           | 1.50                  |                  |
| 25.0           | 10.000         | 9.997           | 9.837      | -0.160           | 1.50                  |                  |
| 31.5           | 10.000         | 10.004          | 9.907      | -0.097           | 1.50                  |                  |
| 40.0           | 10.000         | 10.004          | 9.955      | -0.049           | 1.50                  |                  |
| 52.0           | 10.000         | 10.004          | 10.041     | 0.037            | 1.50                  |                  |
| 63.0           | 10.000         | 10.008          | 10.270     | 0.262            | 1.50                  |                  |
| 80.0           | 10.000         | 9.991           | 10.467     | 0.476            | 1.50                  |                  |

Certificate No.: CP20240388EA

### Calibration Report

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

| Frequency | Nominal | Standard | UUC    | Deviation | Uncertainty | Direction      |
|-----------|---------|----------|--------|-----------|-------------|----------------|
| (Hz)      | (mm/s)  | (mm/s)   | (mm/s) | (mm/s)    | ± (%)       |                |
| 4.0       | 10.000  | 9.997    | 9.852  | -0.145    | 1.50        | Transverse (T) |
| 5.0       | 10.000  | 9.998    | 9.915  | -0.083    | 1.60        |                |
| 6.3       | 10.000  | 9.996    | 10.183 | 0.187     | 1.50        |                |
| 8.0       | 10.000  | 9.990    | 10.053 | 0.063     | 1.60        |                |
| 10.0      | 10.000  | 10.007   | 9.953  | -0.054    | 1.60        |                |
| 12.5      | 10.000  | 10.008   | 9.950  | -0.058    | 1.60        |                |
| 16.0      | 10.000  | 10.003   | 9.945  | -0.058    | 1.60        |                |
|           | 20.000  | 19.983   | 19.917 | -0.066    | 1.60        |                |
|           | 30.000  | 29.970   | 29.762 | -0.208    | 1.50        |                |
|           | 50.000  | 49.992   | 49.671 | -0.321    | 1.50        |                |
| 20.0      | 10.000  | 10.007   | 9.954  | -0.053    | 1.60        |                |
| 25.0      | 10.000  | 10.003   | 9.947  | -0.056    | 1.60        |                |
| 31.5      | 10.000  | 9.998    | 9.939  | -0.059    | 1.60        |                |
| 40.0      | 10.000  | 9.997    | 10.034 | 0.037     | 1.50        |                |
| 52.0      | 10.000  | 9.996    | 10.114 | 0.118     | 1.50        |                |
| 63.0      | 10.000  | 10.001   | 10.262 | 0.261     | 1.50        |                |
| 80.0      | 10.000  | 10.003   | 10.491 | 0.488     | 1.50        |                |

Certificate No.: CP20240388EA

### Calibration Report

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

| Frequency | Nominal | Standard | UUC    | Deviation | Uncertainty | Direction    |
|-----------|---------|----------|--------|-----------|-------------|--------------|
| (Hz)      | (mm/s)  | (mm/s)   | (mm/s) | (mm/s)    | ± (%)       |              |
| 4.0       | 10.000  | 10.004   | 9.923  | -0.081    | 1.50        | Vertical (V) |
| 5.0       | 10.000  | 10.010   | 10.183 | 0.173     | 1.50        |              |
| 6.3       | 10.000  | 9.983    | 10.420 | 0.437     | 1.50        |              |
| 8.0       | 10.000  | 10.006   | 10.286 | 0.280     | 1.50        |              |
| 10.0      | 10.000  | 9.984    | 10.207 | 0.223     | 1.50        |              |
| 12.5      | 10.000  | 9.987    | 10.160 | 0.173     | 1.50        |              |
| 16.0      | 10.000  | 10.003   | 10.191 | 0.188     | 1.50        |              |
|           | 20.000  | 20.011   | 20.402 | 0.390     | 1.60        |              |
|           | 30.000  | 29.995   | 30.589 | 0.594     | 1.50        |              |
|           | 50.000  | 49.992   | 51.011 | 1.019     | 1.50        |              |
| 20.0      | 10.000  | 10.011   | 10.215 | 0.204     | 1.50        |              |
| 25.0      | 10.000  | 9.983    | 10.120 | 0.137     | 1.50        |              |
| 31.5      | 10.000  | 9.983    | 10.047 | 0.064     | 1.60        |              |
| 40.0      | 10.000  | 9.990    | 10.081 | 0.091     | 1.50        |              |
| 52.0      | 10.000  | 9.998    | 10.294 | 0.296     | 1.50        |              |
| 63.0      | 10.000  | 10.010   | 10.404 | 0.394     | 1.50        |              |
| 80.0      | 10.000  | 10.004   | 10.696 | 0.692     | 1.50        |              |

**Remark**

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

-- End of Report --

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพน้ำ



## Certificate of Calibration

**Certificate No. :** 67-420018-1

**Page : 1 of 2**

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

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

**Equipment :** pH Meter with electrode

pH meter

Manufacturer : Thermo Scientific Model : VERSA STAR PRO

Range : N/A pH Resolution : 0.01 pH

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

Electrode

Model : 9156BNWP Serial No. : VV1-15843

ID No. : WW-03-001

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

Ambient Temperature : (23.0 to 24.0)°C

Relative Humidity : (50 to 55) %

**Date of Received :** 10 February 2024

**Date of Calibration :** 10 February 2024

**Date of Issue :** 15 February 2024

**Calibrated by :** Permpoon Chanpu

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

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

### 1. Multiproduct Calibrator

| ID No. | Cert. No.     | Due Date    | Traceability                                    |
|--------|---------------|-------------|---|
| 400005 | SG-E-00307/66 | 23 Aug 2025 | National Institute of Metrology Thailand (NIMT) |

### 2. Standard Buffer Solution

| pH    | Cert. No. | Lot No. | Exp. Date   | Traceability  |
|-------|-----------|---------|-------------|---|
| 4.008 | 61293328  | 944535  | 27 Nov 2025 | CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025 |
| 6.986 | 61281486  | 944537  | 17 Nov 2024 | CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025 |
| 9.997 | 61281073  | 944536  | 17 Nov 2024 | CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025 |

Approved by :

( Surachai Promthong )

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. :** 67-420018-1

**Page :** 2 of 2

**Result of Calibration :**

**UUC Condition As-Received :** Good

**Function :** Electrical measurement  
pH meter

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

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

**Function :** pH meter with electrode

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

| Adjustment Curve<br>at nominal pH | Standard Buffer<br>( pH ) | UUC Reading<br>( pH ) | Correction<br>( pH ) | Uncertainty<br>( ± pH ) |
|-----------------------------------|---------------------------|-----------------------|----------------------|-------------------------|
| 4, 7, 10                          | 4.008                     | 4.01                  | 0.00                 | 0.0097                  |
|                                   | 6.986                     | 7.00                  | -0.01                | 0.011                   |
|                                   | 9.997                     | 10.01                 | -0.01                | 0.014                   |

Remark

UUC : Unit Under Calibration

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

This reported uncertainty of 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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## Certificate of Calibration

**Certificate No. :** 67-400074-1

**Page : 1 of 2**

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

**Equipment :** Digital Thermometer with Thermistor probe  
Temperature Indicator

Manufacturer : Thermo Scientific Model : VERSA STAR PRO

Range : N/A °C Resolution : 0.1 °C

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

Thermistor probe

Model : N/A Sheath Material : Stainless

Diameter : 6.5 mm. Length : 120 mm.

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

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

Ambient Temperature : (23.0 to 24.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (224.5 to 226.0) VAC

**Date of Received :** 10 February 2024

**Date of Calibration :** 10 February 2024

**Date of Issue :** 15 February 2024

**Calibrated by :** Permpon Chanpu

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

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

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

2. Standard Digital Thermometer

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

Approved by :



( Surachai Promthong )

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. :** 67-400074-1

**Page :** 2 of 2

**Result of Calibration :** Without Adjustment

**UUC Condition As-Received :** Good

**Function :** Temperature measurement

| Immersion Depth<br>( mm. ) | Standard Reading<br>( °C ) | UUC Reading<br>( °C ) | Correction<br>( °C ) | Uncertainty<br>( ± °C ) |
|----------------------------|----------------------------|-----------------------|----------------------|-------------------------|
| 120                        | 25.002                     | 25.0                  | 0.0                  | 0.19                    |

Remark

UUC : Unit Under Calibration

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

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

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AD



## Certificate of Calibration

**Certificate No. :** 67-420018-3

**Page : 1 of 2**

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

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

**Equipment :** pH Meter with electrode

pH meter

Manufacturer : Apera

Model : PC 910

Range : N/A

pH

Resolution : 0.01 pH

Serial No. : PC910X1220811001

ID No. : WW-03-002

Electrode

Model : LabSen 211

Serial No. : 2110009/213

ID No. : WW-03-002

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

Ambient Temperature : (23.0 to 24.0)°C

Relative Humidity : (50 to 55) %

**Date of Received :** 10 February 2024

**Date of Calibration :** 10 February 2024

**Date of Issue :** 15 February 2024

**Calibrated by :** Permpon Chanpu

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

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

### 1. Multiproduct Calibrator

| ID No. | Cert. No.     | Due Date    | Traceability                                    |
|--------|---------------|-------------|---|
| 400005 | SG-E-00307/66 | 23 Aug 2025 | National Institute of Metrology Thailand (NIMT) |

### 2. Standard Buffer Solution

| pH    | Cert. No. | Lot No. | Exp. Date   | Traceability  |
|-------|-----------|---------|-------------|---|
| 4.008 | 61293328  | 944535  | 27 Nov 2025 | CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025 |
| 6.986 | 61281486  | 944537  | 17 Nov 2024 | CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025 |
| 9.997 | 61281073  | 944536  | 17 Nov 2024 | CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025 |

Approved by :

( Surachai Promthong )

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. :** 67-420018-3

**Page :** 2 of 2

**Result of Calibration :**

**UUC Condition As-Received :** Good

**Function :** Electrical measurement

pH meter

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

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

**Function :** pH meter with electrode

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

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

Remark

UUC : Unit Under Calibration

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

This reported uncertainty of 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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## Certificate of Calibration

**Certificate No. :** 67-400074-2

**Page : 1 of 2**

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

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

**Equipment :** Digital Thermometer with Thermistor probe  
Temperature Indicator

Manufacturer : Apera Model : PC 910  
Range : N/A °C Resolution : 0.1 °C  
Serial No. : PC910X1220811001 ID No. : WW-03-002

Thermistor probe

Model : N/A Sheath Material : Stainless  
Diameter : 4.8 mm. Length : 100 mm.  
Serial No. : N/A ID No. : WW-03-002

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

Ambient Temperature : (23.0 to 24.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (224.5 to 226.0) VAC

**Date of Received :** 10 February 2024

**Date of Calibration :** 10 February 2024

**Date of Issue :** 15 February 2024

**Calibrated by :** Permpon Chanpu

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

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

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

2. Standard Digital Thermometer

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

Approved by :

( Surachai Promthong )

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. :** 67-400074-2

**Page : 2 of 2**

**Result of Calibration :** Without Adjustment

**UUC Condition As-Received :** Good

**Function :** Temperature measurement

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

Remark

UUC : Unit Under Calibration

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

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

- o0o -





# Certificate of Calibration

|                           |                           |                           |                  |
|---------------------------|---------------------------|---------------------------|------------------|
| <b>Equipment:</b>         | Cooled Incubator          | <b>Certificate No.:</b>   | C31240373        |
| <b>Model:</b>             | KB 240                    | <b>Issued Date:</b>       | 16 February 2024 |
| <b>Serial No.(or ID):</b> | 20180000012164(WW-16-001) | <b>Job No.:</b>           | WO-00017098      |
| <b>Manufacturer:</b>      | Binder                    | <b>Page:</b>              | 1 of 3           |
| <b>Condition:</b>         | In Condition              | <b>Ventilation Valve:</b> | None             |
| <b>Shelves(pc.):</b>      | 3                         |                           |                  |

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

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

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

**Calibration By:** Mr. Ampol Srisumphan

**Calibration Date:** 14 February 2024

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

**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.  
Certificate No. C10240001



(Mr. Ampol Srisumphan)

Person in charge



(Mr. Udon Srichana)

Authorized signatory

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

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

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



## 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**

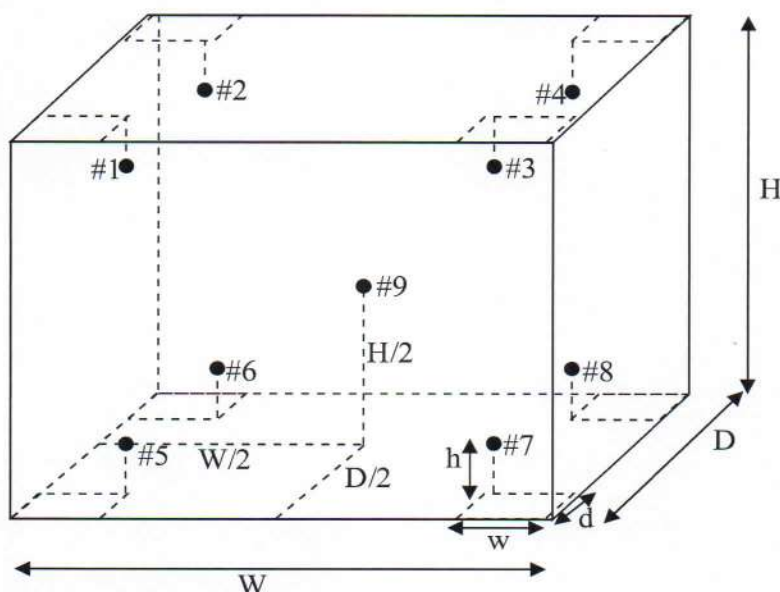
Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 20.0 °C

| Locations | Measured<br>(°C) | Correction*<br>(°C) | Guard band<br>(W)<br>(± °C) | Tolerance<br>(± °C) | Conformity |
|-----------|------------------|---------------------|-----------------------------|---------------------|------------|
| #1        | 20.17            | 0.17                | 0.49                        | 1.0                 | Pass       |
| #2        | 20.13            | 0.13                | 0.49                        | 1.0                 | Pass       |
| #3        | 19.99            | -0.01               | 0.56                        | 1.0                 | Pass       |
| #4        | 19.98            | -0.02               | 0.60                        | 1.0                 | Pass       |
| #5        | 20.21            | 0.21                | 0.51                        | 1.0                 | Pass       |
| #6        | 20.17            | 0.17                | 0.46                        | 1.0                 | Pass       |
| #7        | 19.97            | -0.03               | 0.57                        | 1.0                 | Pass       |
| #8        | 20.07            | 0.07                | 0.47                        | 1.0                 | Pass       |
| #9        | 20.13            | 0.13                | 0.43                        | 1.0                 | Pass       |

Correction\* = Measured Temperature - Desired Temperature

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

### The End of Statements of Conformity



### Standard Installation Locations

Volume (Calibration Zone)= 122 (Liters)

Inside chamber:  $W = 65$  (cm)  $D = 50$  (cm)  $H = 76$  (cm)

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

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

#9: Geometric center of the chamber

| Position of Std   | #1  | #2  | #3  | #4  | #5  | #6  | #7  | #8  | #9  |
|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Channel of Logger | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 |

### Definitions

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

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

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

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

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

## Calibration Results:

### Without adjustment

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

| Locations | Measured Temperature<br>(°C) | Correction of UUC.<br>(°C) | Uncertainty<br>(± °C) |
|-----------|------------------------------|----------------------------|-----------------------|
| #1        | 20.17                        | 0.17                       | 0.49                  |
| #2        | 20.13                        | 0.13                       | 0.49                  |
| #3        | 19.99                        | -0.01                      | 0.56                  |
| #4        | 19.98                        | -0.02                      | 0.60                  |
| #5        | 20.21                        | 0.21                       | 0.51                  |
| #6        | 20.17                        | 0.17                       | 0.46                  |
| #7        | 19.97                        | -0.03                      | 0.57                  |
| #8        | 20.07                        | 0.07                       | 0.47                  |
| #9        | 20.13                        | 0.13                       | 0.43                  |

### Temperature Distribution

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

### Chamber Characterization

| Indicating<br>(°C) | Measured Uniformity<br>(°C) | Measured Stability<br>(± °C) | Overall Variation<br>(°C) |
|--------------------|-----------------------------|------------------------------|---------------------------|
| 20.0               | 0.47                        | 0.48                         | 1.13                      |

Note: \* Maximum uncertainty of the each position

## The End of Certificate

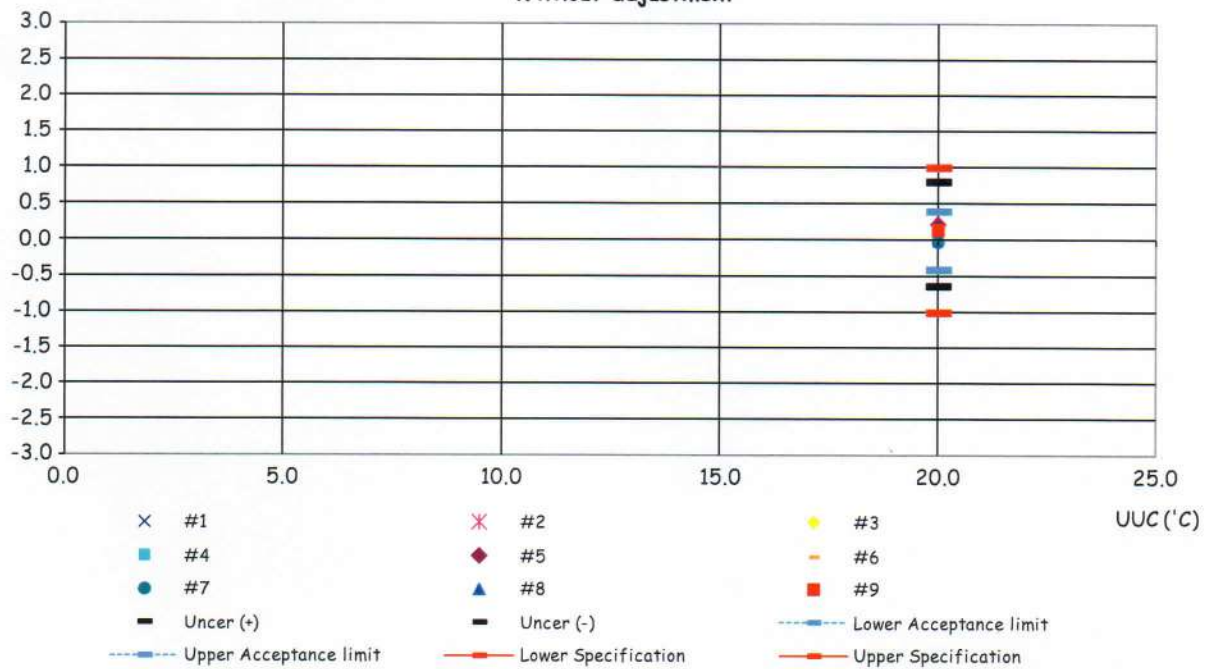


# Corr\_Distribution & Max\_Measurement Uncertainty

Job\_No. WO-00017098

Without adjustment

Correction ('C)

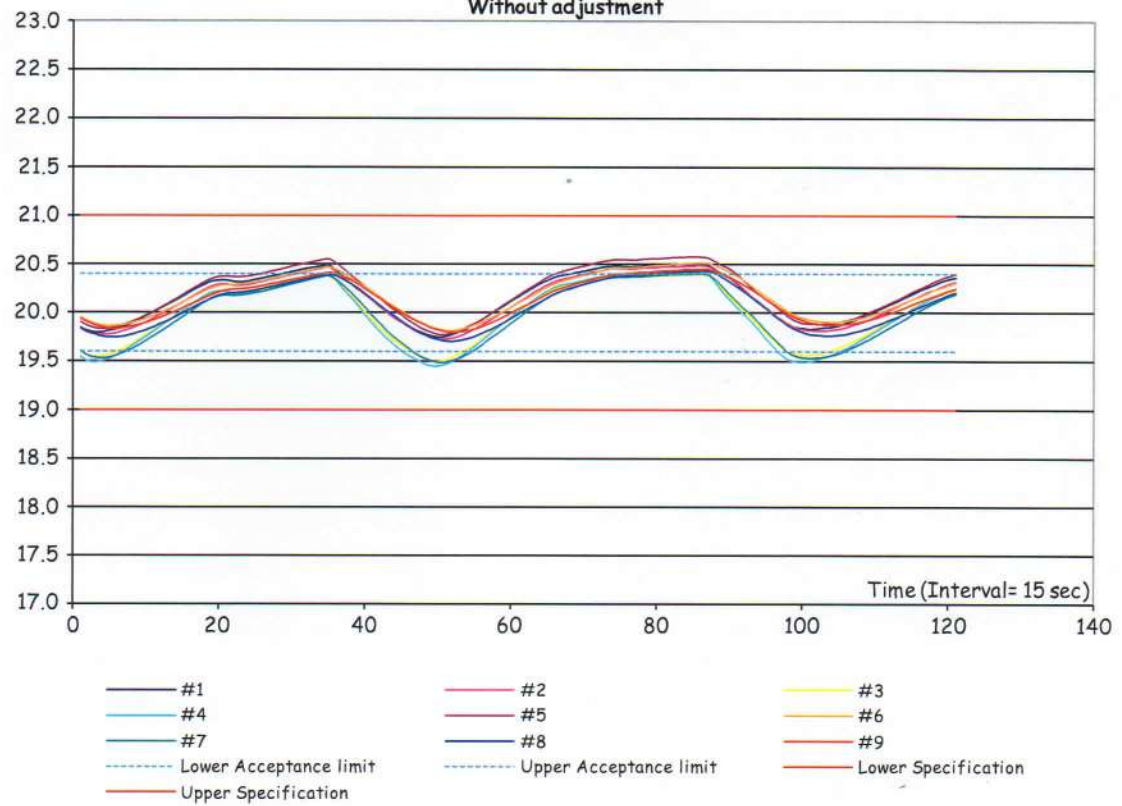


## Temperature Distribution @ 20.0°C

Job\_No. WO-00017098

Without adjustment

Std('C)



## ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00017098

ชนิดเครื่องมือ: Cooled Incubator

รุ่น: KB 240

หมายเลขเครื่อง: 20180000012164(WW-16-001)

| ตรวจสอบ (รับ)                       |                          | รายการตรวจเช็ค                           | ตรวจสอบ (ส่ง)                       |                          | หมายเหตุ |
|-------------------------------------|--------------------------|--|-------------------------------------|--------------------------|----------|
| 14 Feb 2024                         |                          |  | 14 Feb 2024                         |                          |          |
| ปกติ                                | ไม่ปกติ                  |  | ปกติ                                | ไม่ปกติ                  |          |
|                                     |                          | General                                  |                                     |                          |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 1. สายไฟ                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 2. การทำงาน Main Switch                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 3. การทำงาน Selector Key                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 4. การแสดงผล Display                     | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 5. การทำงาน พัดลม                        | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input type="checkbox"/>            | <input type="checkbox"/> | 6. สภาพ Lever of Ventilation valve       | <input type="checkbox"/>            | <input type="checkbox"/> | ไม่มี    |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 7. สภาพ Lever door open / close          | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 8. สภาพ Door seal                        | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 9. การทำงานของระบบ Safety                | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 10. การทำงานของระบบทำความเย็น            | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input type="checkbox"/>            | <input type="checkbox"/> | 11. การทำงานของระบบทำความร้อน            | <input type="checkbox"/>            | <input type="checkbox"/> | ไม่มี    |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 12. สภาพตัวเครื่อง                       | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 13. สภาพอะไหล่และ วัสดุที่ติดตั้งเครื่อง | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |

ข้อเสนอแนะ :

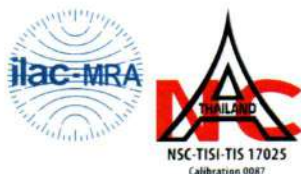
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Mr. Ampol Srisumphan

Service Engineer



# Certificate of Calibration

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

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

**Environment Condition:** Temperature: 29 °C ± 0.6 °C  
Humidity: 61 %RH ± 5.3 %RH  
Voltage: 230 VAC ± 1.5 VAC

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

**Calibration By:** Mr. Ampol Srisumphan

**Calibration Date:** 14 February 2024

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

**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.  
Certificate No. C10240001



(Mr. Ampol Srisumphan)

Person in charge



(Mr. Udon Srichana)

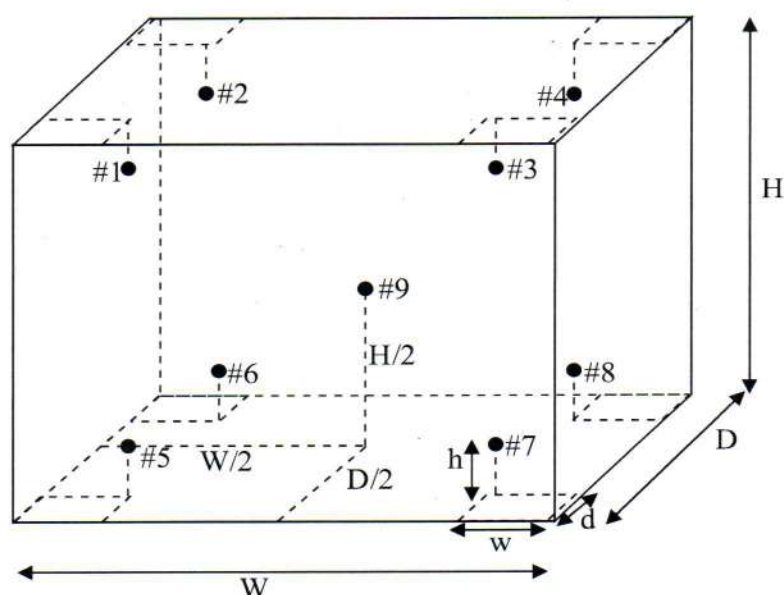
Authorized signatory

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

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

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





### Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

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

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

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

#9: Geometric center of the chamber

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

### Definitions

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

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

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

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

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

## Calibration Results:

### Without adjustment

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

| Locations | Measured Temperature<br>(°C) | Correction of UUC.<br>(°C) | Uncertainty<br>(± °C) |
|-----------|------------------------------|----------------------------|-----------------------|
| #1        | 104.38                       | 0.38                       | 0.39                  |
| #2        | 104.15                       | 0.15                       | 0.39                  |
| #3        | 104.39                       | 0.39                       | 0.39                  |
| #4        | 104.26                       | 0.26                       | 0.39                  |
| #5        | 103.88                       | -0.12                      | 0.39                  |
| #6        | 104.13                       | 0.13                       | 0.39                  |
| #7        | 104.47                       | 0.47                       | 0.39                  |
| #8        | 104.41                       | 0.41                       | 0.39                  |
| #9        | 104.65                       | 0.65                       | 0.39                  |

### Temperature Distribution

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

### Chamber Characterization

| Indicating<br>(°C) | Measured Uniformity<br>(°C) | Measured Stability<br>(± °C) | Overall Variation<br>(°C) |
|--------------------|-----------------------------|------------------------------|---------------------------|
| 104.0              | 0.83                        | 0.12                         | 0.96                      |

Note: \* Maximum uncertainty of the each position

**Without adjustment (Cont.)**

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

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

**Temperature Distribution**

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

**Chamber Characterization**

| Indicating<br>(°C) | Measured Uniformity<br>(°C) | Measured Stability<br>(± °C) | Overall Variation<br>(°C) |
|--------------------|-----------------------------|------------------------------|---------------------------|
| 180.0              | 1.59                        | 0.08                         | 1.66                      |

Note: \* Maximum uncertainty of the each position

**The End of Certificate**



**Without adjustment (Cont.)**

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

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

**Temperature Distribution**

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

**Chamber Characterization**

| Indicating<br>(°C) | Measured Uniformity<br>(°C) | Measured Stability<br>(± °C) | Overall Variation<br>(°C) |
|--------------------|-----------------------------|------------------------------|---------------------------|
| 110.0              | 0.71                        | 0.11                         | 0.86                      |

Note: \* Maximum uncertainty of the each position

## Statements of conformity:

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

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

### Tolerance and Decision rules:

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

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



(Mr. Udon Srichana)

Authorized signatory

### Without adjustment

**Desired Temperature : 104.0°C Tolerances : 1.0 °C**

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

| Locations | Measured<br>(°C) | Correction*<br>(°C) | Guard band<br>(W)<br>(± °C) | Tolerance<br>(± °C) | Conformity     |
|-----------|------------------|---------------------|-----------------------------|---------------------|----------------|
| #1        | 104.38           | 0.38                | 0.39                        | 1.0                 | Pass           |
| #2        | 104.15           | 0.15                | 0.39                        | 1.0                 | Pass           |
| #3        | 104.39           | 0.39                | 0.39                        | 1.0                 | Pass           |
| #4        | 104.26           | 0.26                | 0.39                        | 1.0                 | Pass           |
| #5        | 103.88           | -0.12               | 0.39                        | 1.0                 | Pass           |
| #6        | 104.13           | 0.13                | 0.39                        | 1.0                 | Pass           |
| #7        | 104.47           | 0.47                | 0.39                        | 1.0                 | Pass           |
| #8        | 104.41           | 0.41                | 0.39                        | 1.0                 | Pass           |
| #9        | 104.65           | 0.65                | 0.39                        | 1.0                 | Condition Pass |

Correction\* = Measured Temperature - Desired Temperature

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

## Statements of conformity:(Cont.)

### Without adjustment (Cont.)

**Desired Temperature : 110.0°C Tolerances : 5.0 °C**

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

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

Correction\* = Measured Temperature - Desired Temperature

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

### Without adjustment

**Desired Temperature : 180.0°C Tolerances : 2.0 °C**

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

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

Correction\* = Measured Temperature - Desired Temperature

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

## The End of Statements of Conformity

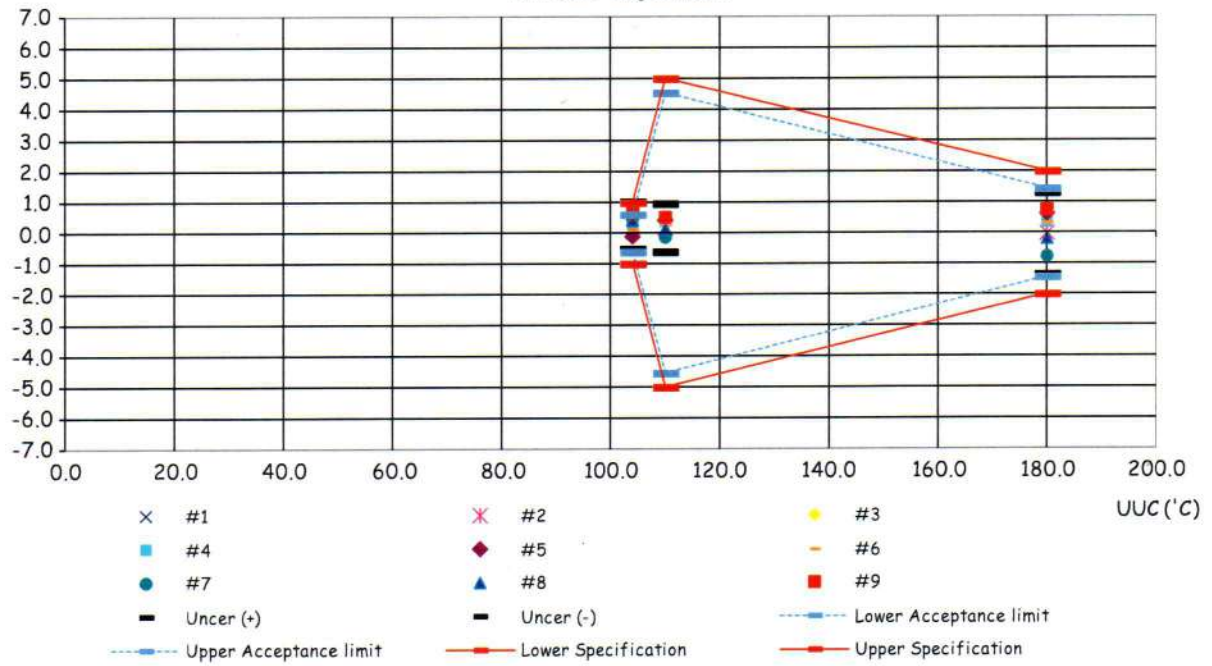


### Corr\_Distribution & Max\_Measurement Uncertainty

Job\_No. WO-00017098

Without adjustment

Correction ('C)

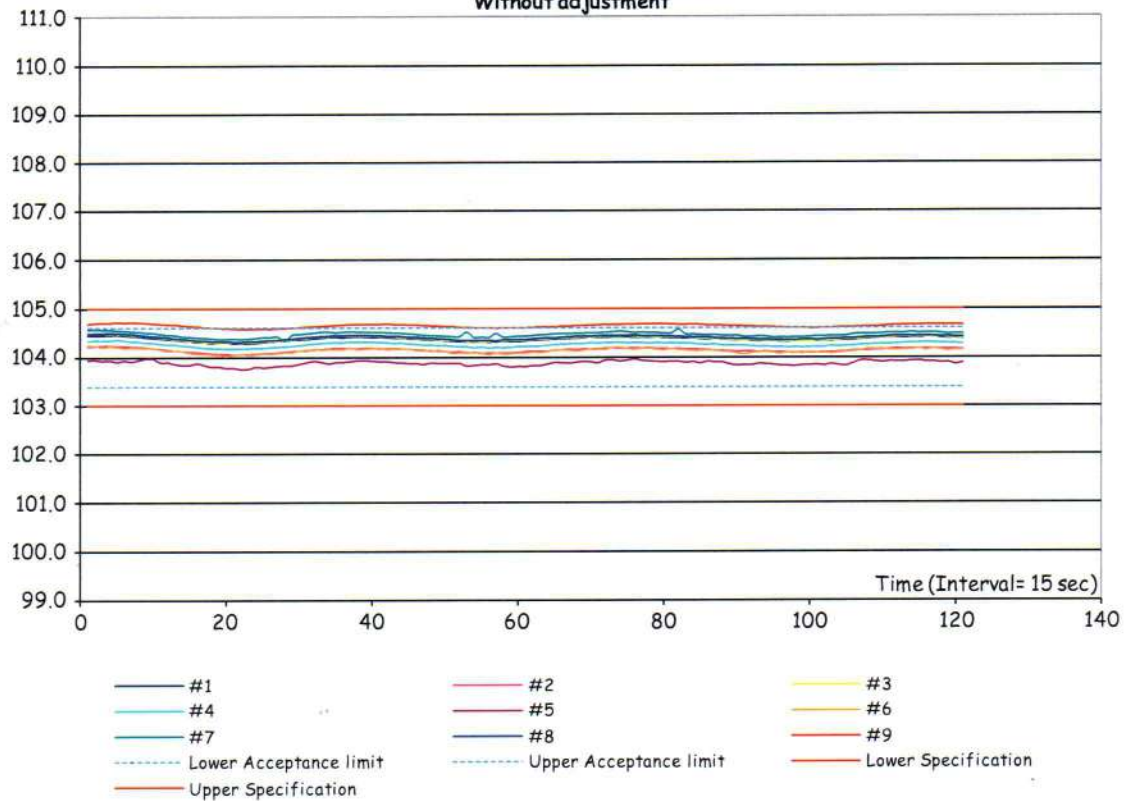


### Temperature Distribution @ 104.0°C

Job\_No. WO-00017098

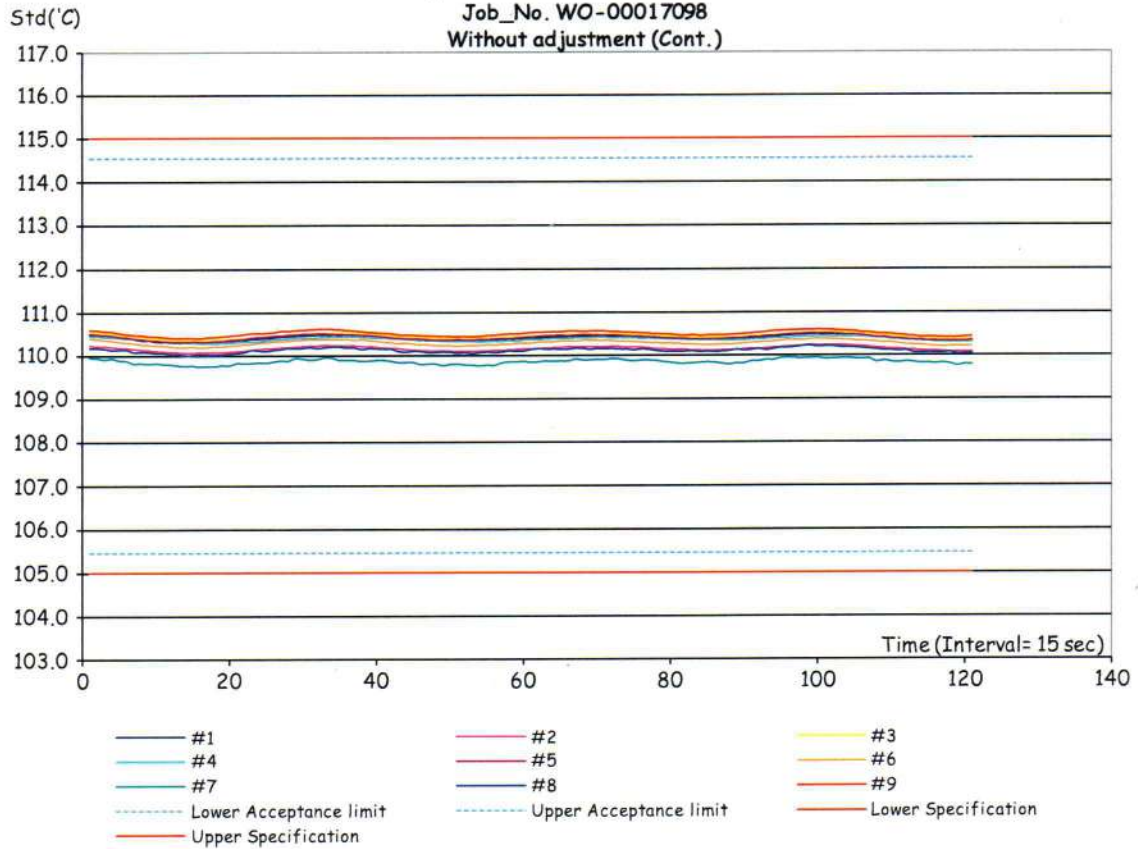
Without adjustment

Std('C)



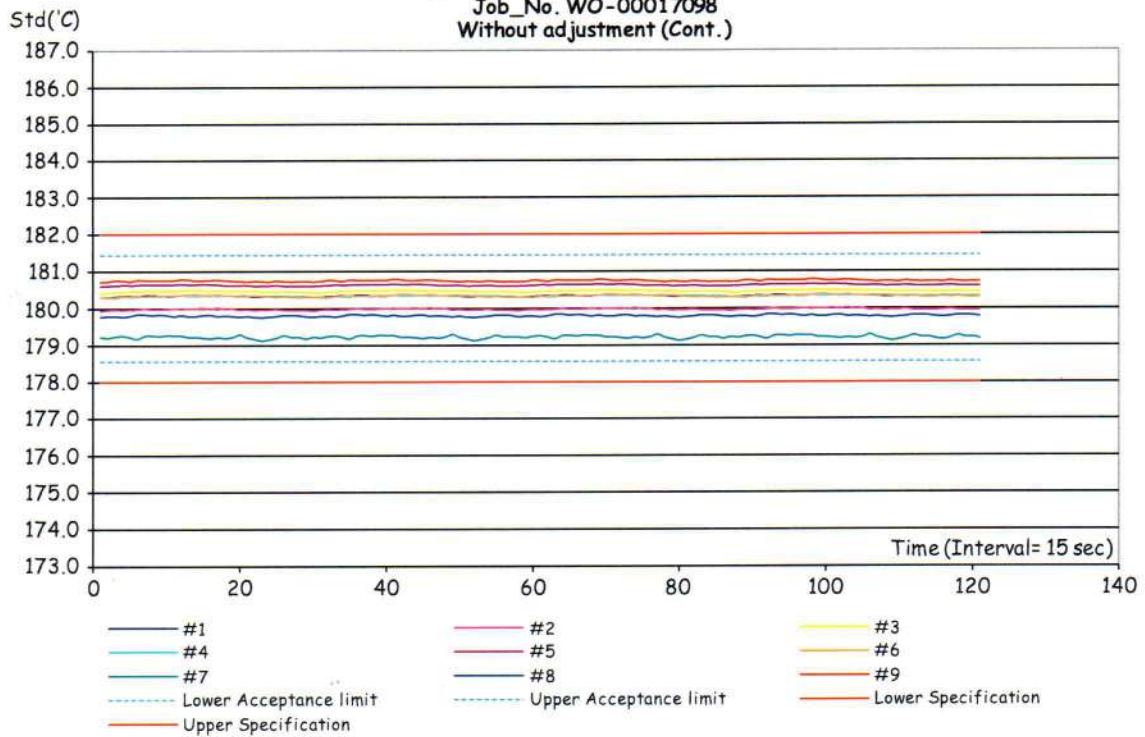
# Temperature Distribution @ 110.0°C

Job\_No. WO-00017098  
Without adjustment (Cont.)



# Temperature Distribution @ 180.0°C

Job\_No. WO-00017098  
Without adjustment (Cont.)



## ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00017098

ชนิดเครื่องมือ: Hot Air Oven

รุ่น: UF 55

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

| ตรวจสอบ (รับ)                       |                          | รายการตรวจเช็ค                         | ตรวจสอบ (ส่ง)                       |                          | หมายเหตุ |
|-------------------------------------|--------------------------|--|-------------------------------------|--------------------------|----------|
| 14 Feb 2024                         |                          |  | 14 Feb 2024                         |                          |          |
| ปกติ                                | ไม่ปกติ                  |  | ปกติ                                | ไม่ปกติ                  |          |
|                                     |                          | General                                |                                     |                          |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 1. สายไฟ                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 2. การทำงาน Main Switch                | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 3. การทำงาน Selector Key               | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 4. การแสดงผล Display                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 5. การทำงาน พัดลม                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 6. สภาพ Lever of Ventilation valve     | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 7. สภาพ Lever door open / close        | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 8. สภาพ Door seal                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 9. การทำงานของระบบ Safety              | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input type="checkbox"/>            | <input type="checkbox"/> | 10. การทำงานของระบบทำความเย็น          | <input type="checkbox"/>            | <input type="checkbox"/> | ไม่มี    |
| <input type="checkbox"/>            | <input type="checkbox"/> | 11. การทำงานของระบบทำความชื้น          | <input type="checkbox"/>            | <input type="checkbox"/> | ไม่มี    |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 12. สภาพตัวเครื่อง                     | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 13. สภาพอะแดคชั่น ณ สถานที่ตั้งเครื่อง | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |

ข้อเสนอแนะ :

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Mr. Ampol Srisumphan  
Service Engineer



CERT.No.: HS-V057H

Calibration Date : 16 Aug 24

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

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

Samutsakom 74130

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 760.00 mmHg

Salinity : 0 ppt

Model : YSI 5000

S/N : 18L109487

Probe : YSI 5010

S/N : 22G100123

ID NO. : -

Air Temp ref : S/N. F8065C26

Barometric ref : S/N. F8065C26

Water Temp ref : -

ID NO. HS001

Technician : Kittipong M.

**Calibration Details**

| Calibration Point     | 100% air sat.<br>(@20 °C, DO = 9.09 mg/l) | (status) | (status) |
|-----------------------|---|----------|----------|
| Measurement 1 (mg/l)  | 9.08                                      | (PASS)   | -        |
| Measurement 2 (mg/l)  | 9.08                                      | (PASS)   | -        |
| Measurement 3 (mg/l)  | 9.09                                      | (PASS)   | -        |
| Measurement 4 (mg/l)  | 9.08                                      | (PASS)   | -        |
| Measurement 5 (mg/l)  | 9.08                                      | (PASS)   | -        |
| Measurement 6 (mg/l)  | 9.08                                      | (PASS)   | -        |
| Measurement 7 (mg/l)  | 9.08                                      | (PASS)   | -        |
| Measurement 8 (mg/l)  | 9.07                                      | (PASS)   | -        |
| Measurement 9 (mg/l)  | 9.07                                      | (PASS)   | -        |
| Measurement 10 (mg/l) | 9.07                                      | (PASS)   | -        |

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

Overall Status (PASS)

**Manufacturer Specification**

Accuracy = +/- 0.02 mg/l

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



Technician Signature

(Kittipong Maekwong)



Laboratory Manager

(Supreecha Sumaritam)



## CERTIFICATE OF CALIBRATION

**Certificate No.:** T1-2009013/24

**Page** 1 **of total** 5 **pages**

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

|                     |                          |               |           |
|---------------------|--------------------------|---------------|-----------|
| <b>Equipment</b>    | Thermo Reactor           |               |           |
| <b>Manufacturer</b> | Merck                    | <b>Model</b>  | TR 420    |
| <b>Serial No.</b>   | 23290802                 | <b>ID No.</b> | WW-07-003 |
| <b>Description</b>  | Resolution of UUC : 1 °C |               |           |

**Environmental Conditions** Ambient Temperature: 26.3 °C  
Relative Humidity: 46 %  
Atmospheric Pressure: -

**Calibration Location** Lab room

**Received Date** 20 September 2024

**Calibration Date** 20 September 2024

**Date of Issue** 23 September 2024

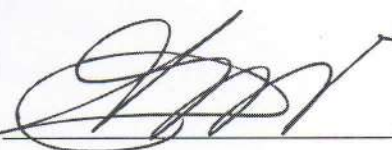
**Condition of Artifacts** Used conditions but can be calibrated

**Checked by**



Act as Technical Manager

**Approved by**



Representative of Managing Director

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

( Dr. Ekachai Puttitwong )

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

**Certificate No.:** T1-2009013/24

**Page 2 of total 5 pages**

**Reference Method :**

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

**Reference Standard Instruments:**

| Type                     | Serial No.                | Cert. No.     | Due Date     | Traceability |
|--------------------------|---------------------------|---------------|--------------|--------------|
| Data Logger with Sensors | MY57010605/<br>MY59005437 | IO-0108003/24 | Aug. 1, 2025 | THC          |

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

- THC, Thai Heart Calibration Co., Ltd.

**Measurement Results:**

# L

| Hole No. | UUC Setting<br>(°C) | Standard Reading<br>(°C) | UUC Reading<br>(°C) | Correction<br>(°C) | Stability of UUC<br>(± °C) | Uncertainty<br>(± °C) |
|----------|---------------------|--------------------------|---------------------|--------------------|----------------------------|-----------------------|
| # 1      | 60                  | 59.9                     | 60                  | -0.1               | 0.10                       | 0.68                  |
| # 2      | 60                  | 60.1                     | 60                  | 0.1                | 0.13                       |                       |
| # 3      | 60                  | 60.1                     | 60                  | 0.1                | 0.12                       |                       |
| # 4      | 60                  | 60.1                     | 60                  | 0.1                | 0.13                       |                       |
| # 5      | 60                  | 60.1                     | 60                  | 0.1                | 0.11                       |                       |
| # 6      | 60                  | 60.2                     | 60                  | 0.2                | 0.09                       |                       |
| # 7      | 60                  | 60.2                     | 60                  | 0.2                | 0.13                       |                       |
| # 8      | 60                  | 60.0                     | 60                  | 0.0                | 0.11                       |                       |
| # 9      | 60                  | 60.0                     | 60                  | 0.0                | 0.09                       |                       |
| # 10     | 60                  | 60.1                     | 60                  | 0.1                | 0.09                       |                       |
| # 11     | 60                  | 60.1                     | 60                  | 0.1                | 0.10                       |                       |
| # 12     | 60                  | 60.1                     | 60                  | 0.1                | 0.12                       |                       |

Calibrated by Pongsak



Certificate No.: T1-2009013/24

Page 3 of total 5 pages

Measurement Results (Cont.):

# L

| Hole No. | UUC Setting<br>(°C) | Standard Reading<br>(°C) | UUC Reading<br>(°C) | Correction<br>(°C) | Stability of UUC<br>(± °C) | Uncertainty<br>(± °C) |
|----------|---------------------|--------------------------|---------------------|--------------------|----------------------------|-----------------------|
| # 1      | 150                 | 148.7                    | 150                 | -1.3               | 0.12                       | 0.68                  |
| # 2      | 150                 | 148.1                    | 150                 | -1.9               | 0.10                       |                       |
| # 3      | 150                 | 148.2                    | 150                 | -1.8               | 0.09                       |                       |
| # 4      | 150                 | 148.5                    | 150                 | -1.5               | 0.11                       |                       |
| # 5      | 150                 | 149.0                    | 150                 | -1.0               | 0.11                       |                       |
| # 6      | 150                 | 148.7                    | 150                 | -1.3               | 0.08                       |                       |
| # 7      | 150                 | 149.7                    | 150                 | -0.3               | 0.14                       |                       |
| # 8      | 150                 | 149.0                    | 150                 | -1.0               | 0.09                       |                       |
| # 9      | 150                 | 148.8                    | 150                 | -1.2               | 0.08                       |                       |
| # 10     | 150                 | 148.8                    | 150                 | -1.2               | 0.09                       |                       |
| # 11     | 150                 | 148.2                    | 150                 | -1.8               | 0.09                       |                       |
| # 12     | 150                 | 148.4                    | 150                 | -1.6               | 0.11                       |                       |

# R

| Hole No. | UUC Setting<br>(°C) | Standard Reading<br>(°C) | UUC Reading<br>(°C) | Correction<br>(°C) | Stability of UUC<br>(± °C) | Uncertainty<br>(± °C) |
|----------|---------------------|--------------------------|---------------------|--------------------|----------------------------|-----------------------|
| # 1      | 60                  | 60.2                     | 60                  | 0.2                | 0.11                       | 0.68                  |
| # 2      | 60                  | 60.2                     | 60                  | 0.2                | 0.12                       |                       |
| # 3      | 60                  | 60.4                     | 60                  | 0.4                | 0.11                       |                       |
| # 4      | 60                  | 60.3                     | 60                  | 0.3                | 0.09                       |                       |
| # 5      | 60                  | 60.4                     | 60                  | 0.4                | 0.10                       |                       |
| # 6      | 60                  | 60.0                     | 60                  | 0.0                | 0.09                       |                       |
| # 7      | 60                  | 60.2                     | 60                  | 0.2                | 0.12                       |                       |
| # 8      | 60                  | 60.3                     | 60                  | 0.3                | 0.10                       |                       |
| # 9      | 60                  | 60.1                     | 60                  | 0.1                | 0.07                       |                       |
| # 10     | 60                  | 60.5                     | 60                  | 0.5                | 0.10                       |                       |
| # 11     | 60                  | 60.4                     | 60                  | 0.4                | 0.09                       |                       |
| # 12     | 60                  | 60.3                     | 60                  | 0.3                | 0.11                       |                       |

Calibrated by, Pongsak

Certificate No.: T1-2009013/24

Page 4 of total 5 pages

Measurement Results (Cont.):

# R

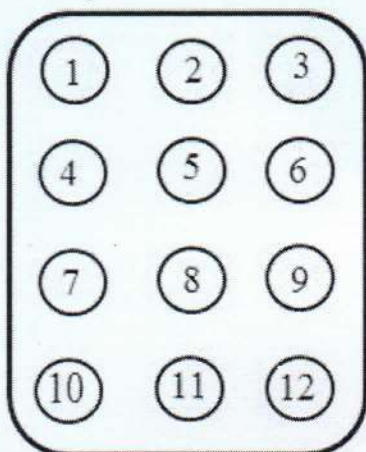
| Hole No. | UUC Setting<br>(°C) | Standard Reading<br>(°C) | UUC Reading<br>(°C) | Correction<br>(°C) | Stability of UUC<br>(± °C) | Uncertainty<br>(± °C) |
|----------|---------------------|--------------------------|---------------------|--------------------|----------------------------|-----------------------|
| # 1      | 150                 | 149.4                    | 150                 | -0.6               | 0.10                       | 0.68                  |
| # 2      | 150                 | 148.4                    | 150                 | -1.6               | 0.10                       |                       |
| # 3      | 150                 | 149.2                    | 150                 | -0.8               | 0.12                       |                       |
| # 4      | 150                 | 149.0                    | 150                 | -1.0               | 0.11                       |                       |
| # 5      | 150                 | 149.4                    | 150                 | -0.6               | 0.07                       |                       |
| # 6      | 150                 | 148.7                    | 150                 | -1.3               | 0.07                       |                       |
| # 7      | 150                 | 149.4                    | 150                 | -0.6               | 0.10                       |                       |
| # 8      | 150                 | 148.8                    | 150                 | -1.2               | 0.07                       |                       |
| # 9      | 150                 | 148.8                    | 150                 | -1.2               | 0.11                       |                       |
| # 10     | 150                 | 150.1                    | 150                 | 0.1                | 0.14                       |                       |
| # 11     | 150                 | 149.8                    | 150                 | -0.2               | 0.11                       |                       |
| # 12     | 150                 | 149.0                    | 150                 | -1.0               | 0.10                       |                       |



Certificate No.: T1-2009013/24

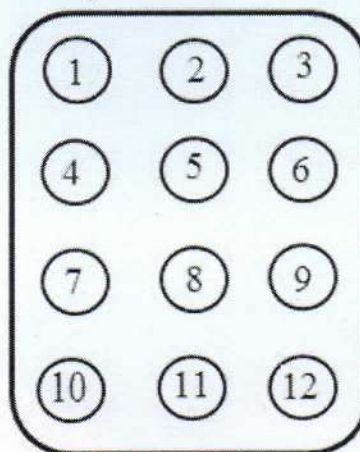
Page 5 of total 5 pages

Measurement Results (Cont.):



Front View

L



Front View

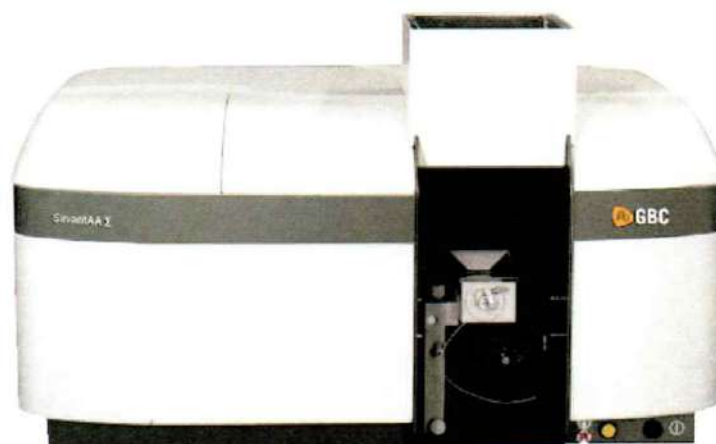
R

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 -



## PREVENTIVE MAINTENANCE Atomic Absorption Spectrometer



### Instrument List is System

| Equipment |               |
|-----------|---------------|
| Model     | Serial Number |
| SavantAA  | A7310         |

|                         |  |
|-------------------------|--|
| Date :                  | 18/06/2024   |
| Contact person :        | คุณอัจฉรา ทองสี / 081-351-0828   |
| Place of installation : | บริษัท ซี.อี.เอ็ม เทคโนโลยี (ไทยแลนด์) จำกัด                                     |
| Customer :              | บริษัท ซี.อี.เอ็ม เทคโนโลยี (ไทยแลนด์) จำกัด                                     |
| Address :               | 219/43 หมู่ 12 ถนนเพชรเกษม ตำบลอ้อมน้อย อำเภอกะทู้ม้วน<br>จังหวัดสมุทรสาคร 74130 |

## PREVENTIVE MAINTENANCE AND PERFORMANCE VERIFICATION REPORT

### ATOMIC ABSORPTION SPECTROPHOTOMETER (AAS)

Issued Date: 17/06/24

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

**Manufacturer :** GBC Scientific Equipment Pty Ltd.

**Address :** 219/43 หมู่ 12 ถนนเพชรเกษม ตำบลอ้อมน้อย  
 อำเภอกระทุ่มแบน จังหวัดสมุทรสาคร 74130

**Model :** SavantAA

**Serial No :** A7310

**Contract :**

**Location :**

#### Power on switch and initial status

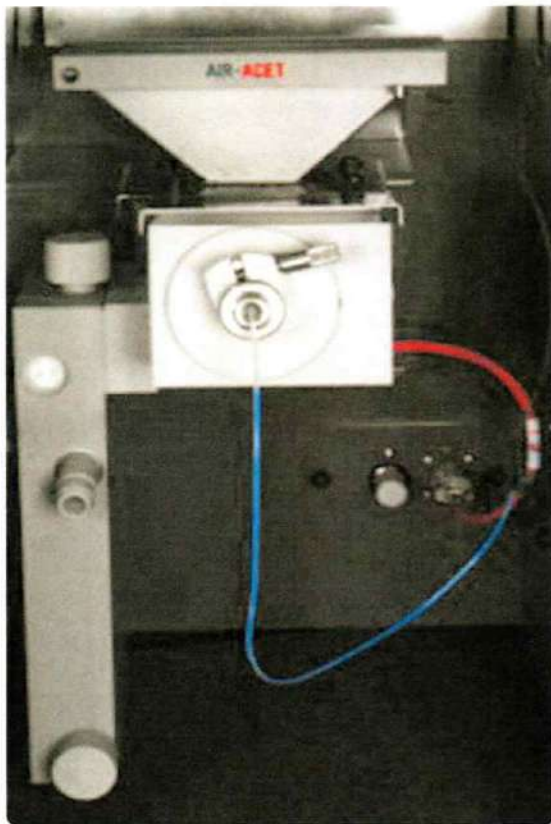
*Instrument Ready for operation*

| Preventive Maintenance   | Pass                                | Fail                     | Remarks       |
|--|-------------------------------------|--------------------------|---------------|
| <b>Electrical Voltage</b>  |                                     |                          |               |
| - Main voltage ( power supply check 220V $\pm$ 10V ).                                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 220.1VAC      |
| - Power indicator light (Replace if faulty).   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | N/A           |
| - Power core (Clean or replace as appropriate).  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | N/A           |
| - Fan (Clean or replace filter element as appropriate).                                | <input checked="" type="checkbox"/> | <input type="checkbox"/> | N/A           |
| <b>Environment</b>   |                                     |                          |               |
| - Temperature (10 to 35 deg.C)   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 27.2C         |
| - Humidity (8 to 80%).   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 47 %          |
| - Air Quality (No Dust)  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | N/A           |
| - No corrosive vapours present from laboratory sample preparation or external sources. | <input checked="" type="checkbox"/> | <input type="checkbox"/> | N/A           |
| <b>Optics</b>  |                                     |                          |               |
| - Windows lens (Clean or replace as appropriate).                                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Ready         |
| - Light Source (Check operation. Replace if required).                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Ready         |
| - D2 Lamp (Check operation. Replace if required).                                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Ready         |
| <b>Gas system</b>  |                                     |                          |               |
| - General (Tube and Fitting /Check for leaks).   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Ready         |
| - Air Zero (Inlet pressure range 300-400 kPa).   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 4 bar         |
| - Acetylene (Inlet pressure range 55-96 kPa).  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 0.9 bar       |
| - Nitrous oxide (Inlet pressure range 300-400 kPa).                                    | <input type="checkbox"/>            | <input type="checkbox"/> |               |
| <b>Computer</b>  |                                     |                          |               |
| - Operating system   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Windows 7 Pro |
| - Software Version   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Ver. 3.11a    |
| - Verify that all computer links and installed software operate correctly              | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Ready         |

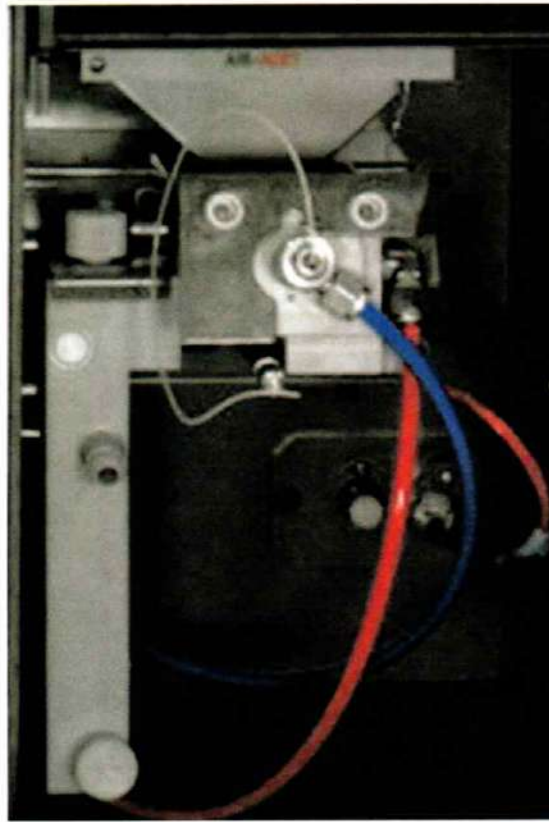


## Spray Chamber Type

☐ ABR Spray Chamber



☒ Standard Spray Chamber

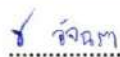



| Preventive Maintenance   | Pass                                | Fail                     | Remark |
|--|-------------------------------------|--------------------------|--------|
| <b>Flame system</b>  |                                     |                          |        |
| - <b>Burner head</b>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

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

**Note:**

Before PM immersion Cu ppm, = 0.1XX Abs  
 - นำหัววัดไปจุ่มใน Sample Tube (ในกรณีที่ไม่ใช่ 2)

| Signature   |  |
|---|--|
| <b>Customer :</b><br><br>( นางสาวอัสมา ทอสี )            | <b>Date :</b><br>18/06/67                |
| <b>Service Engineer :</b><br><br>( Mr. NIWAT SUPATANIT ) | <b>Maintenance Date :</b><br>18/Jun/2024 |

| Performance Verification   | Specification                          | Actual Value  | Pas<br>s                            | Failed                   | Remarks  |
|--|--|---|-------------------------------------|--------------------------|----------|
| 1. Wavelength accuracy<br>(optic calibration check).   | Cu 324.75 nm $\pm$ 0.2 nm              | 324.68 nm   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | N/A      |
|  | Cs 852.10 nm $\pm$ 0.2 nm              | 852.10 nm   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | N/A      |
| 2. Slit width accuracy<br>(0.2 nm ,0.5 nm,1.0 nm)  | 0.2 nm $\pm$ 0.02 nm                   | 324.58, 44 / 324.797, 44<br>Nimrat S.<br>596                              | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 0.211 nm |
|  | 0.5 nm $\pm$ 0.05 nm                   | 324.42, 45 / 324.95, 45   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 0.53 nm  |
|  | 1.0 nm $\pm$ 0.10 nm                   | 324.17, 43 / 325.19, 43   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 1.02 nm  |
| 3. EHT   | <350V                                  | 336 V   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | N/A      |
| 4. Absorbance accuracy<br>(absorbance calibration check).<br>➤ Gauze 0.49 A.U.   | Reading $\pm$ 10% of calibrated value. | 0.4897 Abs  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | N/A      |
| 5. Background correction<br>(optics alignment check).<br>difference between measurement with and without 0.49 A.U. gauze for 10 samples. | SavantAA <1%<br>SensAA/XplorAA <2%     | BC on with gauze:<br>- 0.0017 Abs<br>BC on without gauze:<br>- 0.0007 Abs | <input checked="" type="checkbox"/> | <input type="checkbox"/> | N/A      |
| 6. Sensitivity /noise flame test<br>(aqueous Cu solution test under air-acetylene flame).  | Cu 5 ppm<br>>0.7 A.U.                  | 0.7650 Abs.   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | N/A      |
|  | <0.5% RSD                              | 0.39 % RSD  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | N/A      |

Note:

| Signature  |                                       |
|--|---------------------------------------|
| Customer :<br>.....<br>( นพจวิทย์ จอจนา )              | Date :<br>18 / 06 / 67                |
| Service Engineer :<br>.....<br>( Mr. NIWAT SUPATANIT ) | Maintenance Date :<br>18 / Jun / 2024 |



|              |  |
|--------------|--|
| Results File | K:\PM AAS\2567\Cu 5ppm_Service.res             |
| Analysis     |  |
| Filename     | C:\Users\Administrator\Documents\Analysis1.anl |
| Date         | Tue Jun 18 11:30:11 2024                       |
| Method       |  |

Instrument Parameters

|                 |             |
|-----------------|-------------|
| System Type     | Flame       |
| Element         | Cu          |
| Matrix          |             |
| Lamp Current    | 4.00 mA     |
| Wavelength      | 324.70 nm   |
| Slit Width      | 0.50 nm     |
| Slit Height     | Normal      |
| Instrument Mode | Abs. BC Off |

Sample Measurement Parameters

|                     |             |
|---------------------|-------------|
| Measurement Mode    | Integration |
| Sample Introduction | Manual      |
| Read Time           | 3.00 s      |
| Time Constant       | 0.00        |
| Replicates          | 10          |

Calibration Parameters

|                                 |                    |
|---------------------------------|--------------------|
| Calibration Mode                | Conc Least Squares |
| Overrange Sample Action         | None               |
| Conc. Units                     | µg/ml              |
| Conc. Decimal Places            | 3                  |
| Calibration Failure On          | None               |
| Calibration Failure Action      | Stop               |
| Measure Sample Blank After Cal. | Yes                |
| Auto Save Method After Cal.     | No                 |

### Quality Parameters

|                          |              |
|--------------------------|--------------|
| Second Fail Action       | Stop         |
| Range Checking           | Off          |
| Check Sample Conc        | 1.0000 µg/ml |
| Check Sample Lower Range | 80.00 %      |
| Check Sample Upper Range | 120.00 %     |
| Check Sample Fail Action | Stop         |
| Check Sample Flag        | *            |

### Flame Control Parameters

|                 |               |
|-----------------|---------------|
| Flame Type      | Air-Acetylene |
| Fuel Flow       | 2.000 l/min   |
| Oxidant Flow    | 10.00 l/min   |
| Burner Angle    | 0.00°         |
| Workhead Height | 15.00 mm      |

### Full Calibration

|                  |                    |                    |                         |            |
|------------------|--------------------|--------------------|-------------------------|------------|
| Calibration Mode | Conc Least Squares | Max Error : 0.0000 | R <sup>2</sup> : 1.0000 | R : 1.0000 |
|------------------|--------------------|--------------------|-------------------------|------------|

Error Calibration has zero gradient

| Sample         | Conc.   | %RSD  | Mean   | Replicates |        |        |
|----------------|---------|-------|--------|------------|--------|--------|
| Label          | (µg/ml) |       | Abs.   |            |        |        |
| Table Blank    | -----   | ----- | 0.0000 |            |        |        |
| Standard 1     | 5.000   | ----- | 0.0000 |            |        |        |
| STD Gauze 0.49 | -----   | 0.09  | 0.4897 | 0.4897     | 0.4905 | 0.4897 |
|                |         |       |        | 0.4898     | 0.4902 | 0.4892 |
|                |         |       |        | 0.4896     | 0.4894 | 0.4890 |
|                |         |       |        | 0.4897     |        |        |

### Analysis

|          |  |
|----------|--|
| Filename | C:\Users\Administrator\Documents\Analysis1.anl |
| Date     | Tue Jun 18 11:34:16 2024                       |

## Method

### Instrument Parameters

|                 |            |
|-----------------|------------|
| System Type     | Flame      |
| Element         | Cu         |
| Matrix          |            |
| Lamp Current    | 4.00 mA    |
| Wavelength      | 324.70 nm  |
| Slit Width      | 0.50 nm    |
| Slit Height     | Normal     |
| Instrument Mode | Abs. BC On |

### Sample Measurement Parameters

|                     |             |
|---------------------|-------------|
| Measurement Mode    | Integration |
| Sample Introduction | Manual      |
| Read Time           | 3.00 s      |
| Time Constant       | 0.00        |
| Replicates          | 10          |

### Calibration Parameters

|                                 |                    |
|---------------------------------|--------------------|
| Calibration Mode                | Conc Least Squares |
| Overrange Sample Action         | None               |
| Conc. Units                     | µg/ml              |
| Conc. Decimal Places            | 3                  |
| Calibration Failure On          | None               |
| Calibration Failure Action      | Stop               |
| Measure Sample Blank After Cal. | Yes                |
| Auto Save Method After Cal.     | No                 |

### Quality Parameters

|                    |              |
|--------------------|--------------|
| Second Fail Action | Stop         |
| Range Checking     | Off          |
| Check Sample Conc  | 1.0000 µg/ml |

### Quality Parameters

Check Sample Lower Range 80.00 %  
Check Sample Upper Range 120.00 %  
Check Sample Fail Action Stop  
Check Sample Flag \*

### Flame Control Parameters

Flame Type Air-Acetylene  
Fuel Flow 2.000 l/min  
Oxidant Flow 10.00 l/min  
Burner Angle 0.00°  
Workhead Height 15.00 mm

### Full Calibration

Calibration Mode Conc Least Squares Max Error : 0.0000 R<sup>2</sup> : 1.0000 R : 1.0000

Error Calibration has zero gradient

| Sample<br>Label     | Conc.<br>(µg/ml) | %RSD | Mean<br>Abs. | Replicates |         |         |
|---------------------|------------------|------|--------------|------------|---------|---------|
| Table Blank         | ----             | ---- | 0.0000       |            |         |         |
| Standard 1          | 5.000            | ---- | 0.0000       |            |         |         |
| BC on with Gauze    | ----             | HIGH | -0.0017      | -0.0016    | -0.0010 | -0.0020 |
|                     |                  |      |              | -0.0019    | -0.0026 | -0.0034 |
|                     |                  |      |              | -0.0013    | -0.0008 | -0.0017 |
|                     |                  |      |              | -0.0011    |         |         |
| BC on without Gauze | ----             | HIGH | -0.0007      | 0.0000     | -0.0013 | -0.0012 |
|                     |                  |      |              | -0.0011    | -0.0004 | -0.0007 |
|                     |                  |      |              | -0.0008    | -0.0009 | -0.0007 |
|                     |                  |      |              | -0.0000    |         |         |

### Analysis

Filename C:\Users\Administrator\Documents\Analysis1.anl

## Analysis

Date Tue Jun 18 11:51:31 2024

## Method

### Instrument Parameters

|                 |             |
|-----------------|-------------|
| System Type     | Flame       |
| Element         | Cu          |
| Matrix          |             |
| Lamp Current    | 3.00 mA     |
| Wavelength      | 324.70 nm   |
| Slit Width      | 0.50 nm     |
| Slit Height     | Normal      |
| Instrument Mode | Abs. BC Off |

### Sample Measurement Parameters

|                     |             |
|---------------------|-------------|
| Measurement Mode    | Integration |
| Sample Introduction | Manual      |
| Read Time           | 3.00 s      |
| Time Constant       | 0.00        |
| Replicates          | 10          |

### Calibration Parameters

|                                 |                    |
|---------------------------------|--------------------|
| Calibration Mode                | Conc Least Squares |
| Overrange Sample Action         | None               |
| Conc. Units                     | µg/ml              |
| Conc. Decimal Places            | 3                  |
| Calibration Failure On          | None               |
| Calibration Failure Action      | Stop               |
| Measure Sample Blank After Cal. | No                 |
| Auto Save Method After Cal.     | Yes                |

### Quality Parameters

|                    |      |
|--------------------|------|
| Second Fail Action | Stop |
|--------------------|------|



### Quality Parameters

|                          |              |
|--------------------------|--------------|
| Range Checking           | Off          |
| Check Sample Conc        | 1.0000 µg/ml |
| Check Sample Lower Range | 80.00 %      |
| Check Sample Upper Range | 120.00 %     |
| Check Sample Fail Action | Stop         |
| Check Sample Flag        | *            |

### Flame Control Parameters

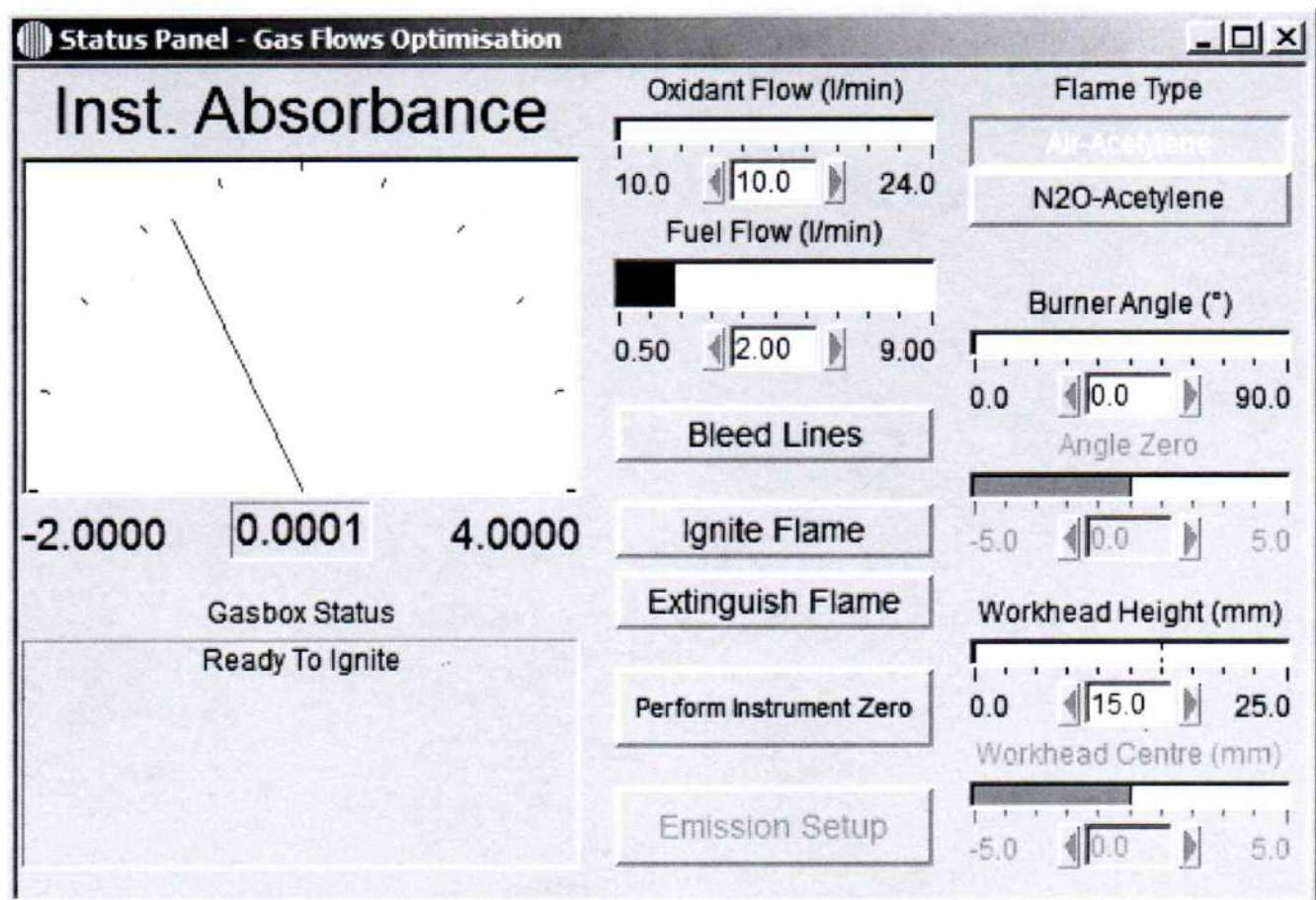
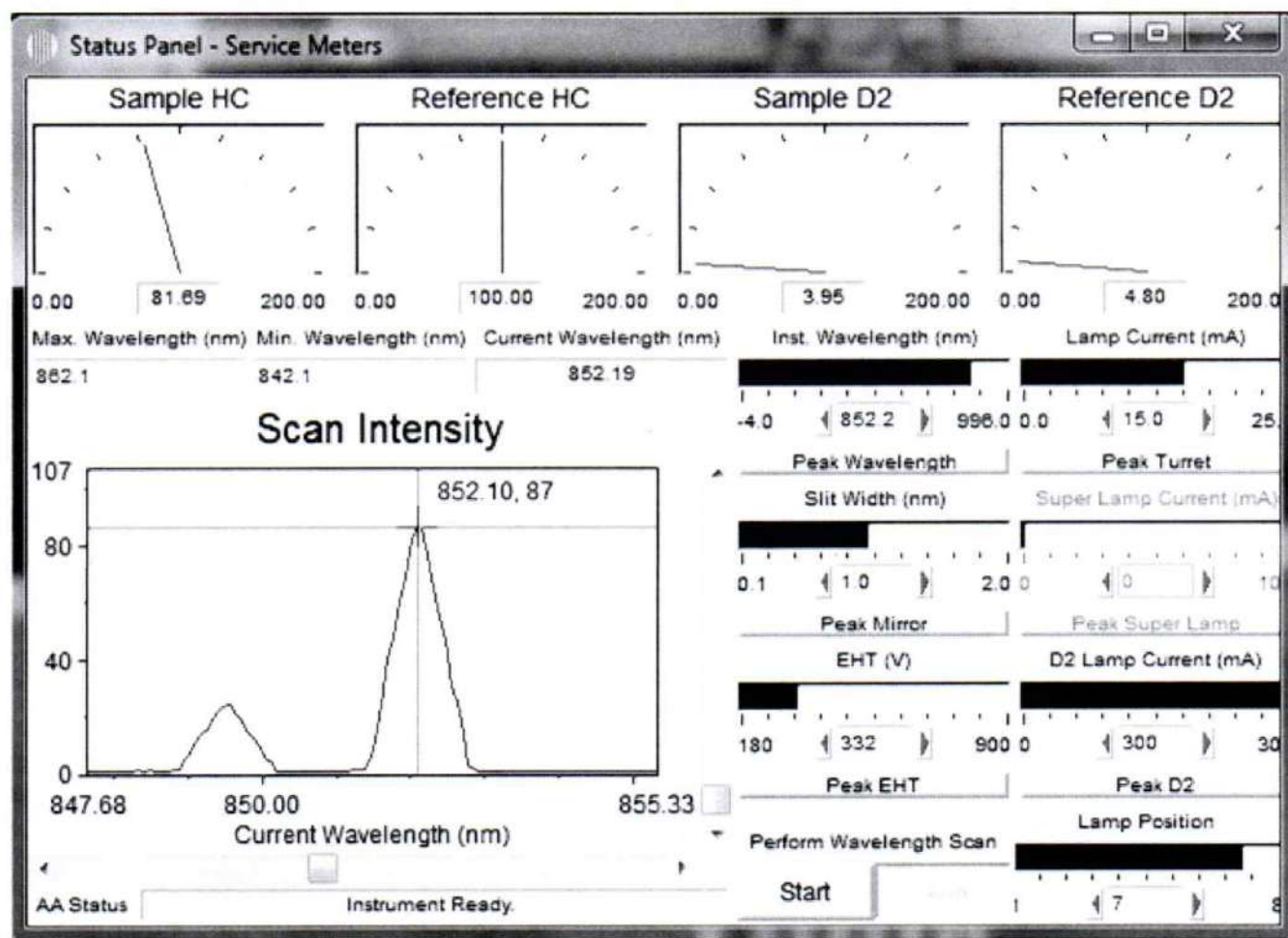
|                 |               |
|-----------------|---------------|
| Flame Type      | Air-Acetylene |
| Fuel Flow       | 2.000 l/min   |
| Oxidant Flow    | 10.00 l/min   |
| Burner Angle    | 0.00°         |
| Workhead Height | 15.00 mm      |

### Full Calibration

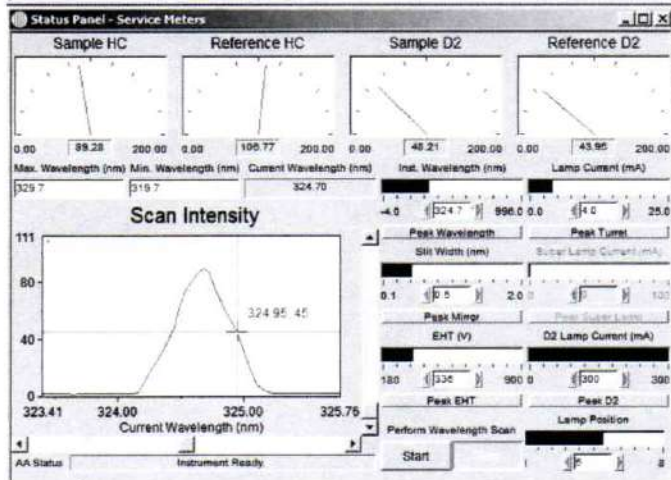
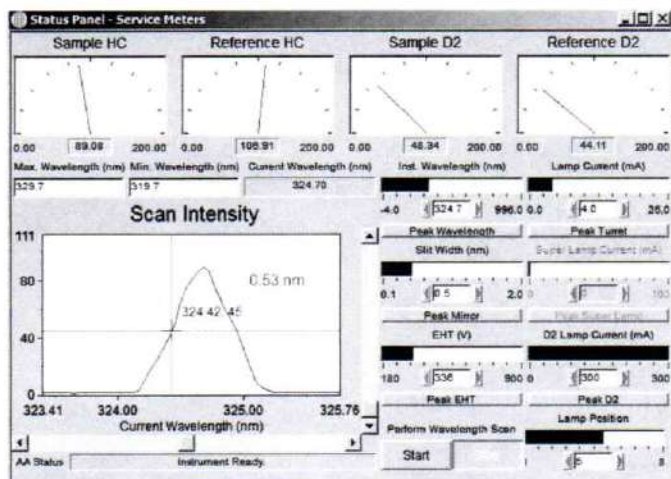
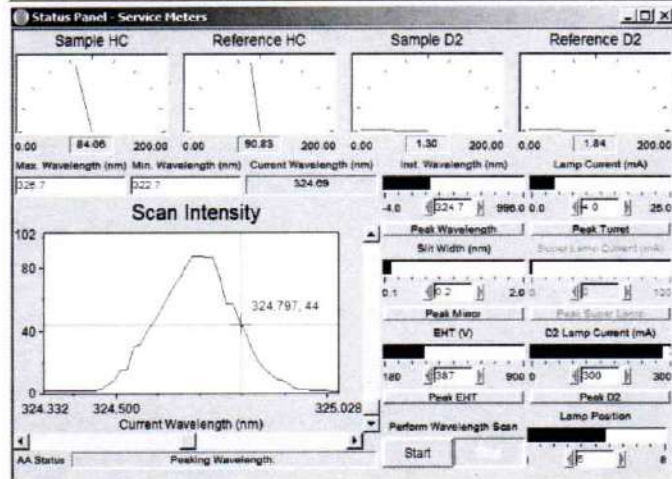
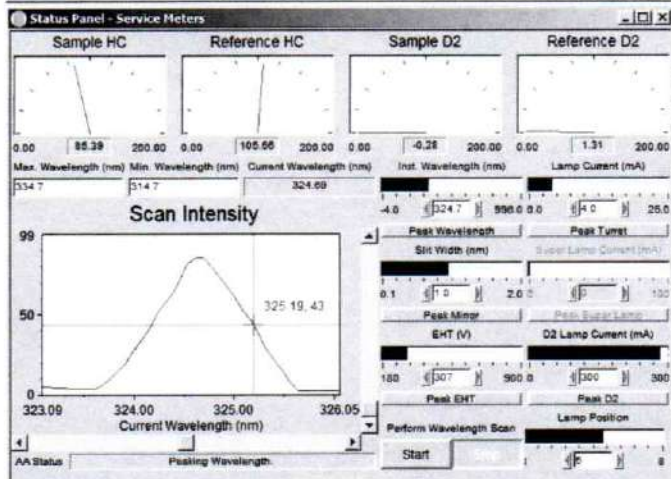
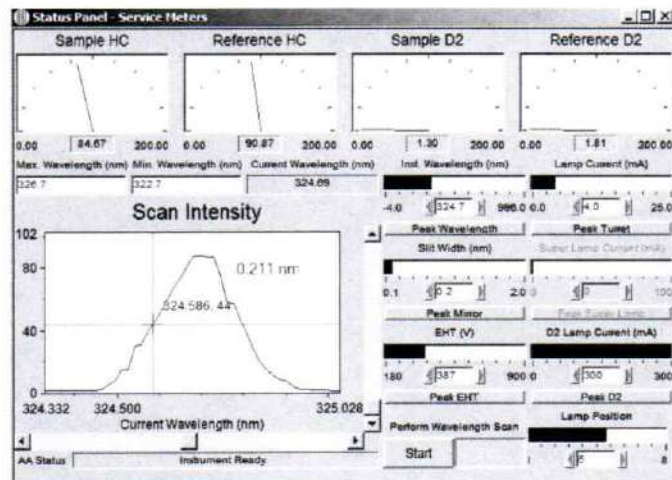
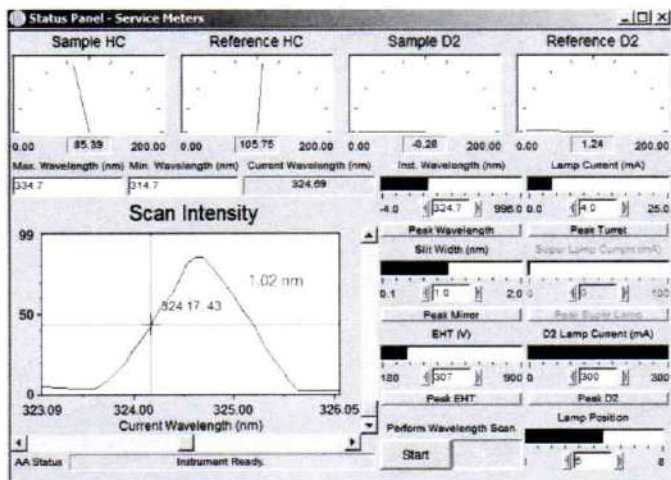
|  |                    |                    |                         |            |
|--|--------------------|--------------------|-------------------------|------------|
| Calibration Mode                       | Conc Least Squares | Max Error : 0.0000 | R <sup>2</sup> : 1.0000 | R : 1.0000 |
| Conc = Abs / ( 0.1530 + 0.0000 * Abs ) |                    |                    |                         |            |

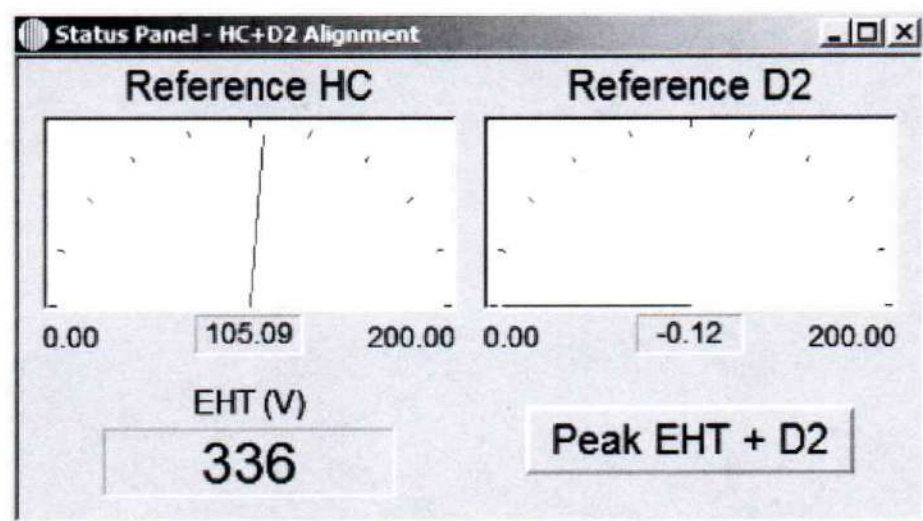
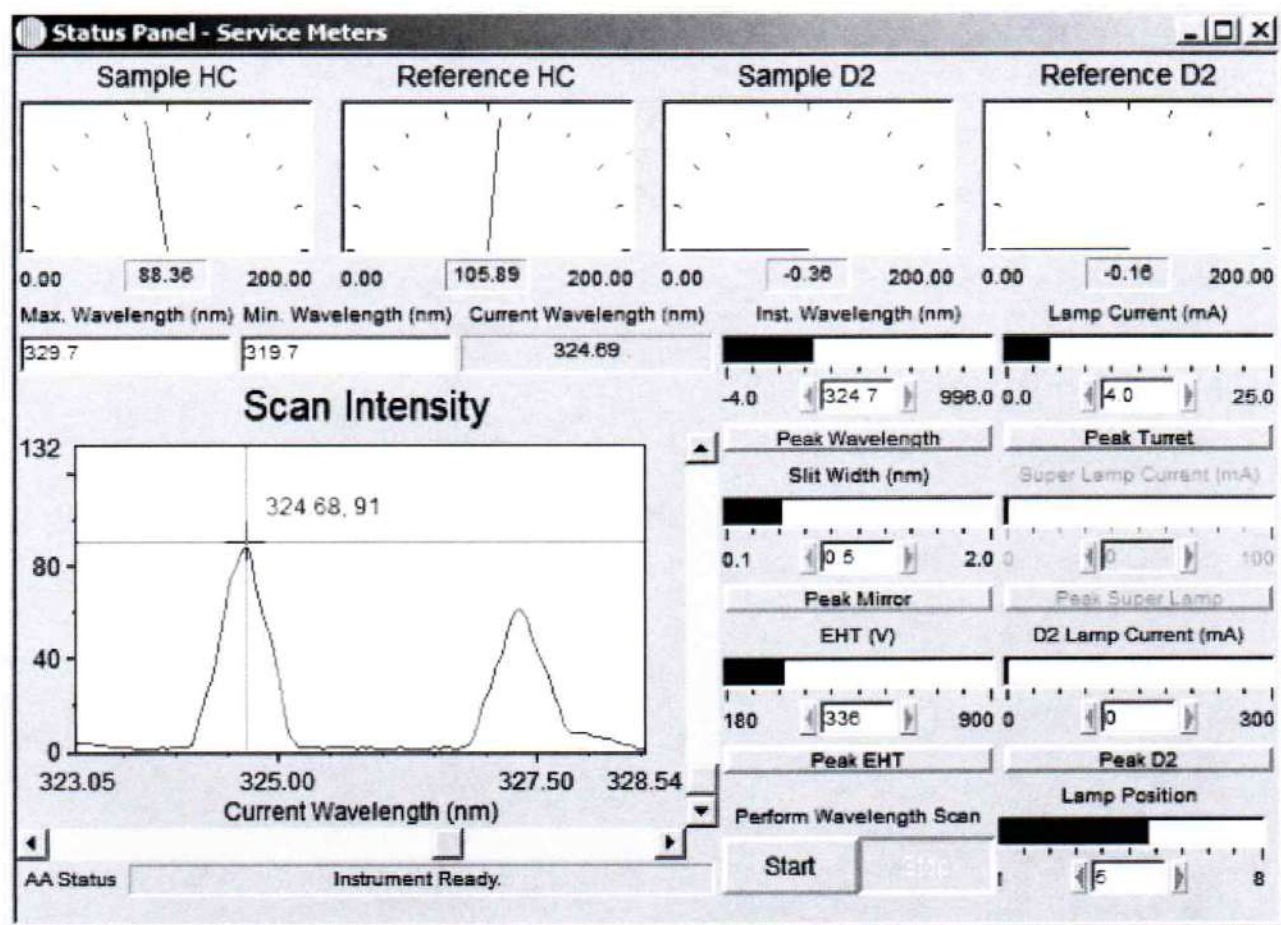
| Sample<br>Label | Conc.<br>(µg/ml) | %RSD | Mean<br>Abs. | Replicates |         |         |
|-----------------|------------------|------|--------------|------------|---------|---------|
| Cal Blank       | -----            | HIGH | -0.0007      | -0.0003    | -0.0005 | -0.0011 |
|                 |                  |      |              | -0.0007    | -0.0007 | -0.0011 |
|                 |                  |      |              | -0.0003    | -0.0010 | -0.0004 |
|                 |                  |      |              | -0.0005    |         |         |
| Standard 1      | 5.000            | 0.39 | 0.7650       | 0.7626     | 0.7674  | 0.7625  |
|                 |                  |      |              | 0.7674     | 0.7684  | 0.7661  |
|                 |                  |      |              | 0.7585     | 0.7657  | 0.7648  |
|                 |                  |      |              | 0.7668     |         |         |

| Sample<br>Label | Conc.<br>(µg/ml) | %RSD | Mean<br>Abs. | Replicates |        |        |
|-----------------|------------------|------|--------------|------------|--------|--------|
| Cu1             | 5.007            | 0.35 | 0.7661       | 0.7630     | 0.7673 | 0.7683 |
|                 |                  |      |              | 0.7617     | 0.7651 | 0.7635 |
|                 |                  |      |              | 0.7693     | 0.7674 | 0.7665 |
|                 |                  |      |              | 0.7691     |        |        |
| Cu2             | 5.009            | 0.43 | 0.7664       | 0.7670     | 0.7640 | 0.7671 |
|                 |                  |      |              | 0.7736     | 0.7644 | 0.7683 |
|                 |                  |      |              | 0.7650     | 0.7626 | 0.7634 |
|                 |                  |      |              | 0.7689     |        |        |
| Cu3             | 5.010            | 0.33 | 0.7666       | 0.7668     | 0.7681 | 0.7677 |
|                 |                  |      |              | 0.7670     | 0.7622 | 0.7714 |
|                 |                  |      |              | 0.7649     | 0.7652 | 0.7683 |
|                 |                  |      |              | 0.7648     |        |        |











# GBC Scientific Equipment Pty Ltd

## Certificate of Conformance

This is to certify that the gauze membrane serial number: F104

Reads a value of: 0.49 A.U. at a wavelength of **440 nm**, using a

GBC Cintra serial number V 4331 referenced to a NIST neutral density filter: 8661/SRM 930D (1210).

Valid for 12 months from date of issue.

Date: 22/03/2024

Operator: NIWAT SUPATANIT

GBC Scientific  
Equipment Pty Ltd  
A.C.N. 005 472 686  
A.B.N. 30 005 472 686

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PO Box 1135  
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Visionary Technology  
[www.gbcscl.com](http://www.gbcscl.com)  
[gbc@gbcscl.com](mailto:gbc@gbcscl.com)



This is to certify that

**Niwat Supatanit**

From

**DKSH Technology Limited  
Thailand**

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

AAS Instruments and Accessories

UV-Vis Instruments and Accessories

ICP-OES Quantima and Accessories

Introduction to:

ICP-TOFMS OptiMass

High Performance Liquid Chromatography

X-ray Equipment Emma

Training conducted in Penang, Malaysia

From 22 July to 2 August 2019



Geoff Condick  
CEO



**Certified Reference Material**  
**Reference material certificate****Copper Standard for AAS****TraceCERT®**  
Traceable Certified Reference Material

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

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

|               |  |   |
|---------------|--|---|
| <b>Copper</b> | <b>989 mg kg<sup>-1</sup> ± 4 mg kg<sup>-1</sup></b> | <b>1000 mg L<sup>-1</sup> ± 4 mg L<sup>-1</sup></b> |
|---------------|--|---|

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

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

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

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

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

**Packaging:** 250 mL HDPE bottle

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

**Certificate issue date:** 29 JUL 2022

ISO 17034  
SRMS 0001

S. Matt – CRM Operations

Dr. P. Zell – Approving Officer





### Certification process details:

To guarantee top reliability of the values for this *TraceCERT*<sup>®</sup> certified reference material, three independent procedures were followed. The values have to agree in the range of their uncertainties, but the value from the gravimetric preparation has been chosen as certified value [3]:

1. Gravimetric preparation using pure materials is a practical realization of concentration units, through conversion of mass to amount of substance [3]. If the purity of the materials is demonstrated and if contamination and loss of material is strictly prevented this approach allows highest accuracy and small uncertainties. The certified value of this *TraceCERT*<sup>®</sup> reference material is based on this approach and directly traceable to the SI unit kilogram. Therefore comprehensively characterized materials of high purity are used. All balances are calibrated annually by an ISO/IEC 17025 accredited laboratory and certified according to DKD guidelines. Calibration is checked daily with OIML Class E2 or F2 weights.
2. The starting material is measured against a certified reference material (i.e. NIST or BAM) followed by gravimetric preparation using balances calibrated with SI-traceable weights. Consequently the value calculated by this unbroken chain of comparisons is traceable to the reference to which the starting material is compared.
3. Whenever applicable the bottled *TraceCERT*<sup>®</sup> calibration solution is compared to a second reference which is independent from the first reference.

### Details on metrological traceability:

Only internationally accepted reference materials e.g. from NIST (USA) or BAM (Germany) have been carefully selected to provide the basis for traceability to the SI unit mole. When no such reference is available, an elemental metal or an adequate salt of highest available purity is used to confirm traceability to this pure material (and therefore to the SI unit kg).

To underpin the certified gravimetric value all traceability measurements are performed with the most accurate and precise analytical technique available. Therefore titrimetry measurement series are applied whenever possible (corrected for trace impurities). When no titrimetric technique is available, the traceability measurements are performed with another analytical technique, e.g. ICP-OES or AAS.

Reference and applied technique used for traceability measurements of the

starting material: NIST SRM 728 / complexometric titration

bottled solution: BAM 365 / complexometric titration

### Details on starting materials:

For high purity materials ( $P > 99.9\%$ ) the most appropriate way of purity determination is to quantify the impurities ( $w_i$ ) and to subtract the sum from 100%. Impurities below the detection limit are considered with a contribution of half of the detection limit ( $DL_j$ ).

$$P = 100\% - \sum_i w_i - \sum_j \left( \frac{DL_j}{2} \right)$$

Water containing materials were dried to absolute dryness by individual drying conditions (up to 600°C). When drying is impossible due to decomposition water was determined by high-precision KF-titration.

### Homogeneity assessment:

Due to the production process, a homogeneous solution derives. Nevertheless a small homogeneity contribution is included into the calculation of content uncertainty of this CRM.

### Density Measurement:

The density measurement is carried out in accordance with ISO/IEC 17025<sup>[4]</sup> and ISO 15212-1<sup>[6]</sup> using the digital density meter DMA 4500M from Anton Paar with an oscillating U-tube installed. The measurement uncertainty is calculated according to Eurachem/CITAC Guide and reported as combined expanded uncertainty at the 95% confidence level, using a coverage factor of  $k = 2$ .

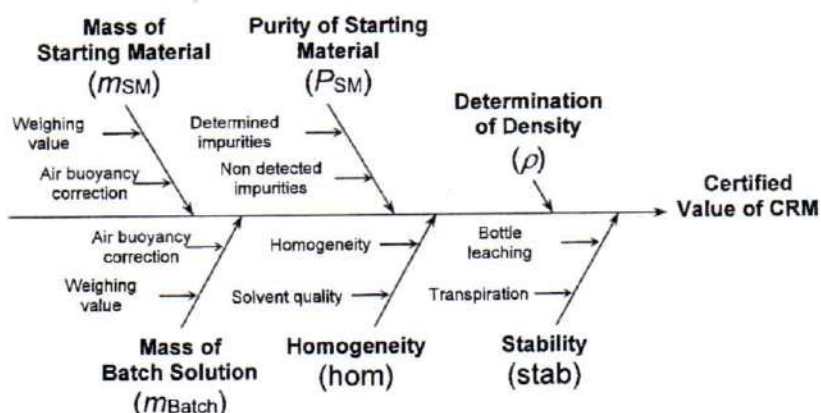


### Uncertainty evaluation:

The uncertainty contributions are illustrated by the following cause-effect diagram [7]:

Typical relative contributions are:

|                |          |
|----------------|----------|
| $u(m_{SM})$    | < 0.01 % |
| $u(m_{Batch})$ | < 0.01 % |
| $u(P_{SM})$    | < 0.05 % |
| $u_{hom}$      | < 0.03 % |
| $u_{stab}$     | < 0.17 % |
| $u(\rho)$      | < 0.05 % |



The combined standard uncertainty is calculated by combination of the standard uncertainties of the input estimates according to Eurachem/CITAC Guide "Quantifying Uncertainty in Analytical Measurement" and ISO 17034.[2][5]

Expanded uncertainty is then calculated to a confidence level of 95%, typically by multiplying with a confidence level factor of  $k=2$ .

### References:

- [1] ISO Guide 35:2017, "Reference materials - Guidance for characterization and assessment of homogeneity and stability"
- [2] Eurachem/CITAC Guide, 3<sup>rd</sup> Ed. (2012), "Quantifying uncertainty in analytical measurement"
- [3] Eurachem/CITAC Guide, 2<sup>nd</sup> Ed. (2019), "Metrological Traceability in chemical measurement"
- [4] The accredited testing laboratory STS 0490 performs the measurements and weighing steps for the certification of this CRM under ISO/IEC 17025:2017, "General requirements for the competence of testing and calibration laboratories"
- [5] ISO 17034:2016, "General requirements for the competence of reference material producers"
- [6] DIN EN ISO 15212-1:1998, Oscillation-type density meters - Part 1: Laboratory instruments
- [7] Reichmuth, A., Wunderli, S., Weber, M., Meyer, V. R. (2004), "The uncertainty of weighing data obtained with electronic analytical balances", Microchimica Acta 148: 133-141.

### Certificate of analysis revision history:

| Certificate version | Certificate issue date | Reason for version |
|---------------------|------------------------|--------------------|
| 01                  | 29 JUL 2022            | Initial version    |

### Disclaimer:

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## Certificate of Calibration

### Aqion RFIC: Anion (ID#1084)

This certificate is to verify that instrument below are calibrated  
by Archemica Lab Co., Ltd.

Aqion S/N: 221280114

AS-DV S/N: 22005880126

For

C.E.M Technology (Thailand) CDo., Ltd.



Operator Signature: Nutdanai

Date: Jul 25 ,2024

(Mr.Nutdanai Laekhwan)

Applications Chemist

# **Qualification Report**

**PM Check list, CM\_OQ and PQ**

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

**(1<sup>st</sup> Warranty Year 2) For**

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

# PM

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## **Preventive Maintenance Check List**





## Dionex Ion Chromatography Preventive Maintenance Report

| Customer Organization                 | Name/ Department |
|---------------------------------------|------------------|
| C.E.M Technology (Thailand) Co., Ltd. | -                |
| Engineer                              | Date             |
| Nutdanai Laekhwan                     | 25-Jul-24        |

### Instrument Detail

| Instrument Model            | Application   |
|-----------------------------|---------------|
| Aqion RFIC: Anion (ID#1084) | Anion         |
| Instrument components       | Serial Number |
| Aqion                       | 221280114     |
| AS-DV                       | 2205880126    |
|                             |               |
|                             |               |
|                             |               |

### Consumable Detail

| Columns        | Guard Columns | Suppressors | Concentrators | Etc.    |
|----------------|---------------|-------------|---------------|---------|
| AS18           | AG18          | ADRS600     | -             | CR-ATC  |
|                |               |             |               | EGC KOH |
|                |               |             |               |         |
| <b>Remark:</b> |               |             |               |         |



Perform By Archemica

Archemica

Date

Nutdanai

25/7/24

Customer

Date

## General ICS Maintenance Checklist

| No.  | Description                                     | Result                              |   |                          |                                     |
|--|---|-------------------------------------|---|--------------------------|-------------------------------------|
| Power on & Connection                          |   | Checked                             | Cleaned   | Replaced                 | N.A.                                |
| 1  | Instrument power on                             | <input checked="" type="checkbox"/> | -   | -                        | <input type="checkbox"/>            |
| 2  | Instrument connection                           | <input checked="" type="checkbox"/> | -   | -                        | <input type="checkbox"/>            |
| Injection Valve Rebuild                        |   | Checked                             | Cleaned   | Replaced                 | N.A.                                |
| 3  | Rebuilt injection valve 6 port                  | <input type="checkbox"/>            | <input checked="" type="checkbox"/>               | <input type="checkbox"/> | <input type="checkbox"/>            |
| 4  | - Rotor seal                                    | <input type="checkbox"/>            | <input checked="" type="checkbox"/>               | <input type="checkbox"/> | <input type="checkbox"/>            |
| 5  | - Stator face                                   | <input type="checkbox"/>            | <input checked="" type="checkbox"/>               | <input type="checkbox"/> | <input type="checkbox"/>            |
| (Optional) Auxiliary Valve Rebuild             |   | Checked                             | Cleaned   | Replaced                 | N.A.                                |
| 6  | Rebuilt auxiliary valve - port                  | <input type="checkbox"/>            | <input type="checkbox"/>                          | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 7  | - Rotor seal                                    | <input type="checkbox"/>            | <input type="checkbox"/>                          | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 8  | - Stator face                                   | <input type="checkbox"/>            | <input type="checkbox"/>                          | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Check Valve Cartridge                          |   | Checked                             | Cleaned   | Replaced                 | N.A.                                |
| 9  | Inlet check valve assembly                      | <input checked="" type="checkbox"/> | <input type="checkbox"/>                          | <input type="checkbox"/> | <input type="checkbox"/>            |
| 10   | Outlet check valve assembly                     | <input checked="" type="checkbox"/> | <input type="checkbox"/>                          | <input type="checkbox"/> | <input type="checkbox"/>            |
| 11   | Verified correct flow orientation               | <input checked="" type="checkbox"/> | -   | -                        | <input type="checkbox"/>            |
| Pump Piston Rinse Seal, Piston Seal and Piston |   | Checked                             | Cleaned   | Replaced                 | N.A.                                |
| 12   | Piston rinse seal in <i>primary</i> pump head   | <input checked="" type="checkbox"/> | <input type="checkbox"/>                          | <input type="checkbox"/> | <input type="checkbox"/>            |
| 13   | Piston seal in <i>primary</i> pump head         | <input checked="" type="checkbox"/> | <input type="checkbox"/>                          | <input type="checkbox"/> | <input type="checkbox"/>            |
| 14   | Piston in <i>primary</i> pump head              | <input checked="" type="checkbox"/> | <input type="checkbox"/>                          | <input type="checkbox"/> | <input type="checkbox"/>            |
| 15   | Piston rinse seal in <i>secondary</i> pump head | <input checked="" type="checkbox"/> | <input type="checkbox"/>                          | <input type="checkbox"/> | <input type="checkbox"/>            |
| 16   | Piston seal in <i>secondary</i> pump head       | <input checked="" type="checkbox"/> | <input type="checkbox"/>                          | <input type="checkbox"/> | <input type="checkbox"/>            |
| 17   | Piston in <i>secondary</i> pump head            | <input checked="" type="checkbox"/> | <input type="checkbox"/>                          | <input type="checkbox"/> | <input type="checkbox"/>            |
| Waste Valve and Priming Valve                  |   | Checked                             | Cleaned   | Replaced                 | N.A.                                |
| 18   | Waste valve                                     | <input checked="" type="checkbox"/> | <input type="checkbox"/>                          | <input type="checkbox"/> | <input type="checkbox"/>            |
| 19   | Priming valve                                   | <input checked="" type="checkbox"/> | <input type="checkbox"/>                          | <input type="checkbox"/> | <input type="checkbox"/>            |
| Cell Detector                                  |   | Checked                             | Cleaned   | Replaced                 | N.A.                                |
| 20   | Check conductivity cell                         | <input checked="" type="checkbox"/> | <input type="checkbox"/>                          | <input type="checkbox"/> | <input type="checkbox"/>            |
| 21   | Check electrochemical cell                      | <input type="checkbox"/>            | <input type="checkbox"/>                          | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 22   | - Working electrode                             | <input type="checkbox"/>            | <input type="checkbox"/>                          | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 23   | - Reference electrode                           | <input type="checkbox"/>            | <input type="checkbox"/>                          | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 24   | - Gasket  | <input type="checkbox"/>            | <input type="checkbox"/>                          | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 25   | - Cell body                                     | <input type="checkbox"/>            | <input type="checkbox"/>                          | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Other  |   | Checked                             | Cleaned   | Replaced                 | N.A.                                |
| 26   | Sample Loop      Size 25 ul                     | <input type="checkbox"/>            | <input checked="" type="checkbox"/>               | <input type="checkbox"/> | <input type="checkbox"/>            |
| 27   | End-line filter                                 | <input checked="" type="checkbox"/> | -   | <input type="checkbox"/> | <input type="checkbox"/>            |
| 28   | Leak sensor                                     | <input checked="" type="checkbox"/> | <input type="checkbox"/>                          | <input type="checkbox"/> | <input type="checkbox"/>            |
| 29   | Lubricate pump mechanic                         | <input type="checkbox"/>            | <input checked="" type="checkbox"/><br>Lubricated | -                        | <input type="checkbox"/>            |
| 30   | Reconnected liquid lines to the valve           | <input checked="" type="checkbox"/> | -   | -                        | <input type="checkbox"/>            |
| 31   | Reconnected liquid lines to pump heads          | <input checked="" type="checkbox"/> | -   | -                        | <input type="checkbox"/>            |
| 32   | Primed pump                                     | <input checked="" type="checkbox"/> | -   | -                        | <input type="checkbox"/>            |
| 33   | Checked pump for leaks                          | <input checked="" type="checkbox"/> | -   | -                        | <input type="checkbox"/>            |
| 34   | Checked gas for leaks                           | <input checked="" type="checkbox"/> | -   | -                        | <input type="checkbox"/>            |



## AS-DV Autosampler Preventive Maintenance Checklist

| Model                                     | Serial number | Firmware Version |
|---|---------------|------------------|
| <input checked="" type="checkbox"/> AS-DV | 2205880126    | 1.6.0            |

| No.                                   | Description                            | Result                              |  |                          |                                     |
|---------------------------------------|--|-------------------------------------|--|--------------------------|-------------------------------------|
| <b>Power on &amp; Connection</b>      |  | <b>Checked</b>                      | <b>Cleaned</b>                         | <b>Replaced</b>          | <b>N.A.</b>                         |
| 1.                                    | AS-DV power on                         | <input checked="" type="checkbox"/> | -                                      | -                        | <input type="checkbox"/>            |
| 2.                                    | AS-DV connection                       | <input checked="" type="checkbox"/> | -                                      | -                        | <input type="checkbox"/>            |
| <b>Sampling Tip</b>                   |  | <b>Checked</b>                      | <b>Cleaned</b>                         | <b>Replaced</b>          | <b>N.A.</b>                         |
| 3.                                    | Sampling needle                        | <input type="checkbox"/>            | <input checked="" type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>            |
| 4.                                    | Sampling tubing (Transfer line)        | <input type="checkbox"/>            | <input checked="" type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/>            |
| 5.                                    | Reconnect sampling needle & tubing     | <input checked="" type="checkbox"/> | -                                      | -                        | <input type="checkbox"/>            |
| <b>Other</b>                          |  | <b>Checked</b>                      | <b>Cleaned</b>                         | <b>Replaced</b>          | <b>N.A.</b>                         |
| 6.                                    | Check carousel movement                | <input checked="" type="checkbox"/> | -                                      | -                        | <input type="checkbox"/>            |
| 7.                                    | Check needle movement                  | <input checked="" type="checkbox"/> | -                                      | -                        | <input type="checkbox"/>            |
| 8.                                    | Lubricate needle drive                 | <input checked="" type="checkbox"/> | <input type="checkbox"/><br>Lubricated | -                        | <input type="checkbox"/>            |
| 9.                                    | AS-DV cover                            | <input checked="" type="checkbox"/> | <input type="checkbox"/>               | <input type="checkbox"/> | <input type="checkbox"/>            |
| <b>(Optional) High Pressure Valve</b> |  | <b>Checked</b>                      | <b>Cleaned</b>                         | <b>Replaced</b>          | <b>N.A.</b>                         |
| 10.                                   | High pressure valve Port               | <input type="checkbox"/>            | <input type="checkbox"/>               | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 11.                                   | - Rotor seal                           | <input type="checkbox"/>            | <input type="checkbox"/>               | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 12.                                   | - Stator face                          | <input type="checkbox"/>            | <input type="checkbox"/>               | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 13.                                   | - Reconnected liquid line to the valve | <input type="checkbox"/>            | <input type="checkbox"/>               | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

|                          |
|--------------------------|
| <b>Others / comments</b> |
|                          |

# CM OQ

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**Chromeleon**

**Operation Qualification**



**ThermoFisher**  
S C I E N T I F I C  
**Chromeleon Operational Qualification**

**General Information**

|                               | <b>Computer Name</b> | <b>Version Number:</b> |
|-------------------------------|----------------------|------------------------|
| <b>Instrument Controller:</b> | DESKTOP-32T6H3B      | 7.3.1 Build 6535       |
| <b>Client:</b>                | DESKTOP-32T6H3B      | 7.3.1.6535             |
| <b>Operator:</b>              | Mr.Nutdanai Laekhwan |                        |
| <b>Overall Test Result:</b>   | <b>Passed</b>        |                        |

**Comparison Format:**

|                 |                     |    |
|-----------------|---------------------|----|
| All Parameters: | Significant Digits: | 10 |
|-----------------|---------------------|----|

\_\_\_\_\_  
Reviewer's Signature // Date

  
**ARCHEMICA**  
บริษัท อัครเคมี อินเตอร์เนชั่นแนล จำกัด  
ARCHEMICA INTERNATIONAL CO.,LTD.  
*Nutdanai 25/7/24*  
\_\_\_\_\_  
Operator's Signature // Date

# ThermoFisher SCIENTIFIC

## Chromeleon Operational Qualification, Part 1

### Verification of Selected Results

Detection Algorithm: Cobra  
Calibration Type: Lin, WithOffset  
Evaluation Type: Area  
Standard Method: External  
Calibration Mode: Total

| <b>Report Variable</b>     | <b>Peak Name</b> | <b>Status</b> |
|----------------------------|------------------|---------------|
| <b>Offset (c0)</b>         | Acetanilide      | ok            |
|                            | Acetophenone     | ok            |
|                            | Propiophenone    | ok            |
| <b>Slope (c1)</b>          | Acetanilide      | ok            |
|                            | Acetophenone     | ok            |
|                            | Propiophenone    | ok            |
| <b>Correlation Coeffi.</b> | Acetanilide      | ok            |
|                            | Acetophenone     | ok            |
|                            | Propiophenone    | ok            |
| <b>Variance</b>            | Acetanilide      | ok            |
|                            | Acetophenone     | ok            |
|                            | Propiophenone    | ok            |
| <b>Std. Deviation</b>      | Acetanilide      | ok            |
|                            | Acetophenone     | ok            |
|                            | Propiophenone    | ok            |
| <b>Rel. Std. Dev.</b>      | Acetanilide      | ok            |
|                            | Acetophenone     | ok            |
|                            | Propiophenone    | ok            |
| <b>Variance Coeff.</b>     | Acetanilide      | ok            |
|                            | Acetophenone     | ok            |
|                            | Propiophenone    | ok            |

# ThermoFisher SCIENTIFIC

## Chromeleon Operational Qualification, Part 1

### Verification of Selected Results

| <i>Report Variable</i>     | <i>Peak Name</i> | <i>Status</i> |
|----------------------------|------------------|---------------|
| Calibration Point X        | Acetanilide      | ok            |
|                            | Acetophenone     | ok            |
|                            | Propiophenone    | ok            |
| Calibration Point Y        | Acetanilide      | ok            |
|                            | Acetophenone     | ok            |
|                            | Propiophenone    | ok            |
| Amount [ng]                | Acetanilide      | ok            |
|                            | Acetophenone     | ok            |
|                            | Propiophenone    | ok            |
| Resolution (EP)            | Acetanilide      | ok            |
|                            | Acetophenone     | ok            |
| Resolution (USP)           | Acetanilide      | ok            |
|                            | Acetophenone     | ok            |
| Peak Asymmetry<br>(EP/USP) | Acetanilide      | ok            |
|                            | Acetophenone     | ok            |
|                            | Propiophenone    | ok            |
| Peak Asymmetry<br>(AIA)    | Acetanilide      | ok            |
|                            | Acetophenone     | ok            |
|                            | Propiophenone    | ok            |

# ThermoFisher S C I E N T I F I C

## Chromeleon Operational Qualification, Part 1

### Verification of Selected Results

| <i>Report Variable</i>      | <i>Peak Name</i> | <i>Status</i> |
|-----------------------------|------------------|---------------|
| Theoretical Plates<br>(EP)  | Acetanilide      | ok            |
|                             | Acetophenone     | ok            |
|                             | Propiophenone    | ok            |
| Theoretical Plates<br>(USP) | Acetanilide      | ok            |
|                             | Acetophenone     | ok            |
|                             | Propiophenone    | ok            |
| Theoretical Plates<br>(JP)  | Acetanilide      | ok            |
|                             | Acetophenone     | ok            |
|                             | Propiophenone    | ok            |

**Test Result:**      **Passed**





## Chromeleon Operational Qualification, Part 2

### Most Frequently Used Parameters: Comparison with Expected Results

Detection Algorithm: Cobra  
Calibration Type: Lin, WithOffset  
Evaluation Type: Area  
Standard Method: External  
Calibration Mode: Total

| <b>Variable Category</b> | <b>Report Variable</b>  | <b>Peak Name</b> | <b>Status</b> |
|--------------------------|-------------------------|------------------|---------------|
| Injection                | No.                     |                  | ok            |
|                          | Name                    |                  | ok            |
|                          | Type                    |                  | ok            |
|                          | Position                |                  | ok            |
|                          | Status                  |                  | ok            |
|                          | Volume                  |                  | ok            |
|                          | Dilution Factor         |                  | ok            |
|                          | Weight                  |                  | ok            |
|                          | IntStd                  |                  | ok            |
|                          | InstrumentMethod        |                  | ok            |
|                          | ProcessingMethod        |                  | ok            |
| Chromatogram             | Channel                 |                  | ok            |
|                          | No. of Peaks            |                  | ok            |
|                          | Chromatogram Start Time |                  | ok            |
|                          | Signal Min.             |                  | ok            |
|                          | Signal Max.             |                  | ok            |
|                          | Unit                    |                  | ok            |
|                          | Noise                   |                  | ok            |
| Peak Results             | No.                     | Acetanilide      | ok            |
|                          | No.                     | Acetophenone     | ok            |
|                          | No.                     | Propiophenone    | ok            |
|                          | Peak Name               | Acetanilide      | ok            |
|                          | Peak Name               | Acetophenone     | ok            |
|                          | Peak Name               | Propiophenone    | ok            |
|                          | Ret.Time                | Acetanilide      | ok            |
|                          | Ret.Time                | Acetophenone     | ok            |
|                          | Ret.Time                | Propiophenone    | ok            |

# ThermoFisher SCIENTIFIC

## Chromeleon Operational Qualification, Part 2

### Most Frequently Used Parameters: Comparison with Expected Results

| <i>Variable Category</i> | <i>Report Variable</i> | <i>Peak Name</i> | <i>Status</i> |
|--------------------------|------------------------|------------------|---------------|
| Peak Results             | Abs.Ret.Dev.           | Acetanilide      | ok            |
|                          | Ret.Dev.(abs)          | Acetophenone     | ok            |
|                          | Ret.Dev.(abs)          | Propiophenone    | ok            |
|                          | Rel.Ret.Dev.           | Acetanilide      | ok            |
|                          | Ret.Dev.(rel)          | Acetophenone     | ok            |
|                          | Ret.Dev.(rel)          | Propiophenone    | ok            |
|                          | Area                   | Acetanilide      | ok            |
|                          | Area                   | Acetophenone     | ok            |
|                          | Area                   | Propiophenone    | ok            |
|                          | Rel.Area               | Acetanilide      | ok            |
|                          | Rel.Area (Total)       | Acetophenone     | ok            |
|                          | Rel.Area (Total)       | Propiophenone    | ok            |
|                          | Height                 | Acetanilide      | ok            |
|                          | Height                 | Acetophenone     | ok            |
|                          | Height                 | Propiophenone    | ok            |
|                          | Rel.Height (Total)     | Acetanilide      | ok            |
|                          | Rel.Height (Total)     | Acetophenone     | ok            |
|                          | Rel.Height (Total)     | Propiophenone    | ok            |
|                          | Amount                 | Acetanilide      | ok            |
|                          | Amount                 | Acetophenone     | ok            |
|                          | Amount                 | Propiophenone    | ok            |
|                          | Concentration          | Acetanilide      | ok            |
|                          | Concentration          | Acetophenone     | ok            |
|                          | Concentration          | Propiophenone    | ok            |
|                          | Rel.Amount             | Acetanilide      | ok            |
|                          | Rel.Amount             | Acetophenone     | ok            |
|                          | Rel.Amount             | Propiophenone    | ok            |
|                          | Peak Width (0%)        | Acetanilide      | ok            |
|                          | Peak Width (0%)        | Acetophenone     | ok            |
|                          | Peak Width (0%)        | Propiophenone    | ok            |
|                          | Peak Width (5%)        | Acetanilide      | ok            |
|                          | Peak Width (5%)        | Acetophenone     | ok            |
|                          | Peak Width (5%)        | Propiophenone    | ok            |
|                          | Peak Width (10%)       | Acetanilide      | ok            |
|                          | Peak Width (10%)       | Acetophenone     | ok            |
|                          | Peak Width (10%)       | Propiophenone    | ok            |

# ThermoFisher SCIENTIFIC

## Chromeleon Operational Qualification, Part 2

### Most Frequently Used Parameters: Comparison with Expected Results

| <u>Variable Category</u> | <u>Report Variable</u> | <u>Peak Name</u> | <u>Status</u> |
|--------------------------|------------------------|------------------|---------------|
| Peak Results             | Peak Width (50%)       | Acetanilide      | ok            |
|                          | Peak Width (50%)       | Acetophenone     | ok            |
|                          | Peak Width (50%)       | Propiophenone    | ok            |
|                          | Left Width (0%)        | Acetanilide      | ok            |
|                          | Left Width (0%)        | Acetophenone     | ok            |
|                          | Left Width (0%)        | Propiophenone    | ok            |
|                          | Right Width (0%)       | Acetanilide      | ok            |
|                          | Right Width (0%)       | Acetophenone     | ok            |
|                          | Right Width (0%)       | Propiophenone    | ok            |
|                          | Peak Start             | Acetanilide      | ok            |
|                          | Peak Start             | Acetophenone     | ok            |
|                          | Peak Start             | Propiophenone    | ok            |
|                          | Peak Stop              | Acetanilide      | ok            |
|                          | Peak Stop              | Acetophenone     | ok            |
|                          | Peak Stop              | Propiophenone    | ok            |
|                          | Peak Start Value       | Acetanilide      | ok            |
|                          | Peak Start Value       | Acetophenone     | ok            |
|                          | Peak Start Value       | Propiophenone    | ok            |
|                          | Peak Stop Value        | Acetanilide      | ok            |
|                          | Peak Stop Value        | Acetophenone     | ok            |
|                          | Peak Stop Value        | Propiophenone    | ok            |
|                          | BL-Value Peak Start    | Acetanilide      | ok            |
|                          | BL-Value Peak Start    | Acetophenone     | ok            |
|                          | BL-Value Peak Start    | Propiophenone    | ok            |
|                          | BL-Value Peak Stop     | Acetanilide      | ok            |
|                          | BL-Value Peak Stop     | Acetophenone     | ok            |
|                          | BL-Value Peak Stop     | Propiophenone    | ok            |
|                          | Type                   | Acetanilide      | ok            |
|                          | Type                   | Acetophenone     | ok            |
|                          | Type                   | Propiophenone    | ok            |
|                          | Resolution (EP)        | Acetanilide      | ok            |
|                          | Resolution(EP)         | Acetophenone     | ok            |
|                          | Resolution(USP)        | Acetanilide      | ok            |
|                          | Resolution(USP)        | Acetophenone     | ok            |
|                          | Asymmetry(EP)          | Acetanilide      | ok            |
|                          | Asymmetry(EP)          | Acetophenone     | ok            |
|                          | Asymmetry(EP)          | Propiophenone    | ok            |

# ThermoFisher SCIENTIFIC

## Chromeleon Operational Qualification, Part 2

### Most Frequently Used Parameters: Comparison with Expected Results

| <i>Variable Category</i> | <i>Report Variable</i> | <i>Peak Name</i> | <i>Status</i> |
|--------------------------|------------------------|------------------|---------------|
| Peak Results             | Asymmetry(AIA)         | Acetanilide      | ok            |
|                          | Asymmetry(AIA)         | Acetophenone     | ok            |
|                          | Asymmetry(AIA)         | Propiophenone    | ok            |
|                          | Theor. Plates(EP)      | Acetanilide      | ok            |
|                          | Theor. Plates(EP)      | Acetophenone     | ok            |
|                          | Theor. Plates(EP)      | Propiophenone    | ok            |
|                          | Theor. Plates(USP)     | Acetanilide      | ok            |
|                          | Theor. Plates(USP)     | Acetophenone     | ok            |
|                          | Theor. Plates(USP)     | Propiophenone    | ok            |
|                          | Theor. Plates (JP)     | Acetanilide      | ok            |
|                          | Theor. Plates(JP)      | Acetophenone     | ok            |
|                          | Theor. Plates(JP)      | Propiophenone    | ok            |
| Peak Calibration         | Cal.Mode               | Acetanilide      | ok            |
|                          | Cal.Mode               | Acetophenone     | ok            |
|                          | Cal.Mode               | Propiophenone    | ok            |
|                          | Cal.Type               | Acetanilide      | ok            |
|                          | Cal.Type               | Acetophenone     | ok            |
|                          | Cal.Type               | Propiophenone    | ok            |
|                          | Weights                | Acetanilide      | ok            |
|                          | Weights                | Acetophenone     | ok            |
|                          | Weights                | Propiophenone    | ok            |
|                          | Calibr. Coefficient C0 | Acetanilide      | ok            |
|                          | Calibr. Coefficient C0 | Acetophenone     | ok            |
|                          | Calibr. Coefficient C0 | Propiophenone    | ok            |
|                          | Calibr. Coefficient C1 | Acetanilide      | ok            |
|                          | Calibr. Coefficient C1 | Acetophenone     | ok            |
|                          | Calibr. Coefficient C1 | Propiophenone    | ok            |
|                          | RF-Value               | Acetanilide      | ok            |
|                          | RF-Value               | Acetophenone     | ok            |
|                          | RF-Value               | Propiophenone    | ok            |
|                          | No. of Points          | Acetanilide      | ok            |
|                          | No. of Points          | Acetophenone     | ok            |



# ThermoFisher S C I E N T I F I C

## Chromeleon Operational Qualification, Part 2

### Most Frequently Used Parameters: Comparison with Expected Results

| <i>Variable Category</i> | <i>Report Variable</i>  | <i>Peak Name</i> | <i>Status</i> |
|--------------------------|-------------------------|------------------|---------------|
| Peak Calibration         | No. of Points           | Propiophenone    | ok            |
|                          | No. of Points(disabled) | Acetanilide      | ok            |
|                          | No. of Points(disabled) | Acetophenone     | ok            |
|                          | No. of Points(disabled) | Propiophenone    | ok            |
|                          | Variance                | Acetanilide      | ok            |
|                          | Variance                | Acetophenone     | ok            |
|                          | Variance                | Propiophenone    | ok            |
|                          | Var.Coeff               | Acetanilide      | ok            |
|                          | Var.Coeff               | Acetophenone     | ok            |
|                          | Var.Coeff               | Propiophenone    | ok            |
|                          | Std.Dev.                | Acetanilide      | ok            |
|                          | Std.Dev.                | Acetophenone     | ok            |
|                          | Std.Dev.                | Propiophenone    | ok            |
|                          | Rel.Std.Dev.            | Acetanilide      | ok            |
|                          | Rel.Std.Dev.            | Acetophenone     | ok            |
|                          | Rel.Std.Dev.            | Propiophenone    | ok            |
|                          | Corr.Coeff.             | Acetanilide      | ok            |
|                          | Corr.Coeff.             | Acetophenone     | ok            |
|                          | Corr.Coeff.             | Propiophenone    | ok            |
|                          | R-Square                | Acetanilide      | ok            |
|                          | R-Square                | Acetophenone     | ok            |
|                          | R-Square                | Propiophenone    | ok            |
|                          | Adj. R-Square           | Acetanilide      | ok            |
|                          | Adj. R-Square           | Acetophenone     | ok            |
|                          | Adj. R-Square           | Propiophenone    | ok            |
|                          | X                       | Acetanilide      | ok            |
|                          | X                       | Acetophenone     | ok            |
|                          | X                       | Propiophenone    | ok            |
|                          | Y                       | Acetanilide      | ok            |
|                          | Y                       | Acetophenone     | ok            |
|                          | Y                       | Propiophenone    | ok            |
|                          | W                       | Acetanilide      | ok            |
|                          | W                       | Acetophenone     | ok            |
|                          | W                       | Propiophenone    | ok            |
|                          | F(X)                    | Acetanilide      | ok            |
|                          | F(X)                    | Acetophenone     | ok            |
|                          | F(X)                    | Propiophenone    | ok            |

# ThermoFisher S C I E N T I F I C

## Chromeleon Operational Qualification, Part 2

### Most Frequently Used Parameters: Comparison with Expected Results

| <i>Variable Category</i> | <i>Report Variable</i>   | <i>Peak Name</i> | <i>Status</i> |
|--------------------------|--------------------------|------------------|---------------|
| Peak Calibration         | Residual for Cal.Point X | Acetanilide      | ok            |
|                          | Residual for Cal.Point X | Acetophenone     | ok            |
|                          | Residual for Cal.Point X | Propiophenone    | ok            |
|                          | Calibration Point Status | Acetanilide      | ok            |
|                          | Calibration Point Status | Acetophenone     | ok            |
|                          | Calibration Point Status | Propiophenone    | ok            |
|                          | Amount                   | Acetanilide      | ok            |
|                          | Amount                   | Acetophenone     | ok            |
|                          | Amount                   | Propiophenone    | ok            |
| Component                | Cal.Type                 | Acetanilide      | ok            |
|                          | Peak Type                | Acetanilide      | ok            |
|                          | Left Limit               | Acetophenone     | ok            |
|                          | Right Limit              | Acetanilide      | ok            |
|                          | Group                    | Acetanilide      | ok            |
|                          | Factor                   | Acetophenone     | ok            |
|                          | Amount                   | Acetanilide      | ok            |
|                          | Conc.Unit                | Acetophenone     | ok            |

# ThermoFisher SCIENTIFIC

## Chromeleon Operational Qualification, Part 2

### Most Frequently Used Parameters: Comparison with Expected Results

| <u>Variable Category</u> | <u>Report Variable</u> | <u>Peak Name</u> | <u>Status</u> |
|--------------------------|------------------------|------------------|---------------|
| Peak Purity              | PPI                    | Acetanilide      | ok            |
|                          | PPI                    | Acetophenone     | ok            |
|                          | PPI                    | Propiophenone    | ok            |
|                          | RSD PPI                | Acetanilide      | ok            |
|                          | RSD PPI                | Acetophenone     | ok            |
|                          | RSD PPI                | Propiophenone    | ok            |
|                          | Match                  | Acetanilide      | ok            |
|                          | Match                  | Acetophenone     | ok            |
|                          | Match                  | Propiophenone    | ok            |
|                          | RSD Match              | Acetanilide      | ok            |
|                          | RSD Match              | Acetophenone     | ok            |
|                          | RSD Match              | Propiophenone    | ok            |
|                          | Rel.Max at             | Acetanilide      | ok            |
|                          | Rel.Max at             | Acetophenone     | ok            |
|                          | Rel.Max at             | Propiophenone    | ok            |

**Test Result:**      **Passed**

# ThermoFisher SCIENTIFIC

## Chromeleon Operational Qualification, Part 3 System Suitability Test: Comparison with Expected Results

| <i>Variable Category</i>               | <i>Report Variable</i>     | <i>Status</i> |
|--|----------------------------|---------------|
| System Suitability<br>Test Case        | Number                     | ok            |
|  | Name                       | ok            |
|  | Inj. Condition             | ok            |
|  | Eval. Formula              | ok            |
|  | Operator                   | ok            |
|  | Statistics                 | ok            |
|  | Rounding                   | ok            |
|  | MinimumNumberOfInjections  | ok            |
|  | MaximumNumberOfInjections  | ok            |
|  | Channel                    | ok            |
|  | Peak                       | ok            |
|  | Ref. Value Formula 1       | ok            |
|  | Ref. Value Formula 2       | ok            |
|  | N.A.                       | ok            |
| System Suitability<br>Test Case Result | Inj. Eval. Result          | ok            |
|  | Eval. Result               | ok            |
|  | Peak Result                | ok            |
|  | Injection Condition Result | ok            |
|  | Ref. Value 1               | ok            |
|  | Ref. Value 2               | ok            |
|  | Result                     | ok            |
|  | Message                    | ok            |
|  | Average                    | ok            |
|  | Count                      | ok            |
|  | Maximum                    | ok            |
|  | Minimum                    | ok            |
|  | Range                      | ok            |
|  | Rel. Range                 | ok            |
|  | Rel. Std. Dev.             | ok            |
|  | Std. Dev.                  | ok            |
|  | Sum                        | ok            |

**Test Result:      Passed**



Chromeleon

|  |      |
|--|------|
| Part 1 - Verification of Selected Results                                  | PASS |
| Part 2 - Most Frequently Used Parameters: Comparison with Expected Results | PASS |
| Part 3 - System Suitability Test: comparison with Expected Results         | PASS |

OVERALL TEST RESULT: **PASS**

  
ARCHEMICA  
บริษัท อาร์เคมีกา อินเตอร์เนชั่นแนล จำกัด  
ARCHEMICA INTERNATIONAL CO.,LTD.

| Field Service Representative Signature: | Customer Signature: |
|---|---------------------|
| <i>Nutdana</i>                          |                     |
| Date: 25/7/24                           | Date:               |

## OQ REVIEW AND COMPLETION

**ThermoFisher**  
SCIENTIFIC

These Operational Qualification Results should be reviewed by the Customer. If the qualification is accepted, both the Customer and the Service Representative should sign the Operational Qualification Results, below.

### OPERATIONAL QUALIFICATION RESULTS

Based upon the actual results obtained, this Operational Qualification **PASSED** the acceptance criteria described in the Operational Qualification in the Installation Checklist procedure.

#### Service Representative

A Field Service Representative signature below confirms the completion of all aspects of the Operational Qualification and have concluded that the system has been successfully verified to be operating as required.

#### Customer

A Customer signature below confirms the completion of all aspects of the Operational Qualification have been completed and that the system has been successfully verified to be operating as required.



| Field Service Representative Signature: | Customer Signature: |
|---|---------------------|
| <i>Nutdara</i>                          |                     |
| Date: 25/7/24                           | Date:               |

OQ EXCEPTIONS AND COMMENTS



N/A

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| Field Service Representative Signature: | Customer Signature: |
|---|---------------------|
| Nutana                                  |                     |
| Date: 25/7/24                           | Date:               |

# PQ

---

## Performance Qualification



TEST EQUIPMENT AND STANDARDS



Test Equipment

| Equipment        | Manufacturer      | Model       | Serial Number | Cal/Ver Date | Good Until |
|------------------|-------------------|-------------|---------------|--------------|------------|
| IC Qualification | Thermo Scientific | Test Box II | 21379153      | N/A          | N/A        |
| Multimeter       | FLUKE             | 289         | 20920144      | N/A          | N/A        |
| Thermocouple     | FLUKE             | K Type      | 20920144      | N/A          | N/A        |
| Balance          | Ohaus             | SPX2202     | C327437137    | N/A          | N/A        |
| N/A              | N/A               | N/A         | N/A           | N/A          | N/A        |

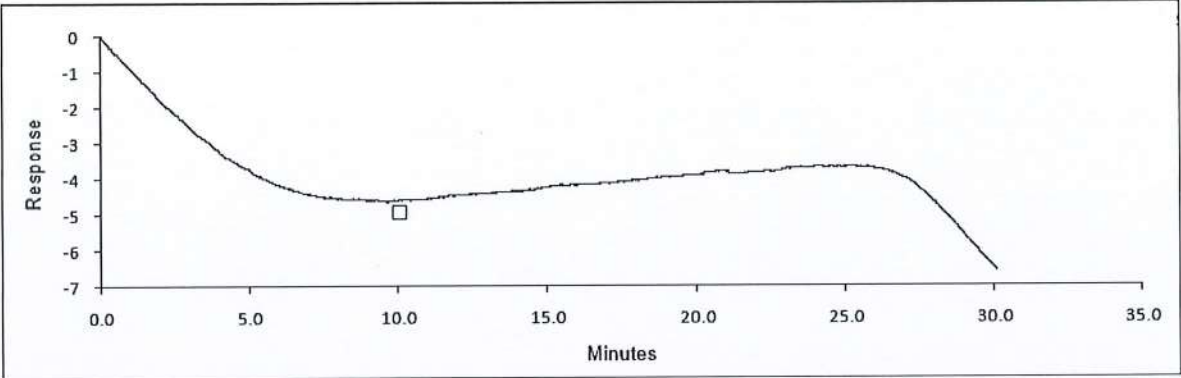
Standards/Chemicals

| Description | Manufacturer      | Concentration | Part Number | Lot Number | Expiration Date |
|-------------|-------------------|---------------|-------------|------------|-----------------|
| Nitrate     | Thermo Scientific | 5 ppm         | 060254      | 231226     | N/A             |
| Nitrate     | Thermo Scientific | 10 ppm        | 060254      | 231226     | N/A             |
| Nitrate     | Thermo Scientific | 25 ppm        | 060254      | 231226     | N/A             |
| Nitrate     | Thermo Scientific | 50 ppm        | 060254      | 231226     | N/A             |
| Nitrate     | Thermo Scientific | 100 ppm       | 060254      | 231226     | N/A             |
| Nitrate     | Thermo Scientific | 1000 ppm      | 060254      | 231226     | N/A             |
| N/A         | N/A               | N/A           | N/A         | N/A        | N/A             |
| N/A         | N/A               | N/A           | N/A         | N/A        | N/A             |
| N/A         | N/A               | N/A           | N/A         | N/A        | N/A             |
| N/A         | N/A               | N/A           | N/A         | N/A        | N/A             |



| Field Service Representative Signature: | Customer Signature: |
|---|---------------------|
| <i>Nutdanai</i>                         |                     |
| Date: <i>25/7/24</i>                    | Date:               |

NOISE AND DRIFT (CD)



Information

|             |   |
|-------------|---|
| System Name | Aqion RFIC  |
| Detector SN | 221260053   |
| Data Path   | chrom://desktop-32t6h3b/ChromeleonLocal/Archemica/Warranty/2024/1st Warranty Year 2 PMPQ 25-Jul-024/IC OQ.seq/273.smp/ECD_1.channel/ECD_1.chm |

Noise and Drift

| Test  | Measured (nS) | OQ Limit (nS) | Result | Conversion Factor |
|-------|---------------|---------------|--------|-------------------|
| Noise | 1.1 nS        | ≤ 2.0 nS      | PASS   | 1000              |
| Drift | 0.7 nS/hr     | ≤ 20.0 nS/hr  | PASS   | 1000              |

OVERALL TEST RESULT: **PASS**



| Field Service Representative Signature: | Customer Signature: |
|---|---------------------|
| <i>Nutdang</i>                          |                     |
| Date: 25/7/24                           | Date:               |

REPEATABILITY (CD)



Information

|             |   |
|-------------|---|
| System Name | Aqion RFIC  |
| Detector SN | 221260053   |
| Data Path   | ChromeleonLocal://Archemica/Warranty/2024/1st Warranty Year 2 PMPQ 25-Jul-024/IC OQ |

Peak Results

| Sample Name     | Injection Volume (µL) | Retention Time (min) | Area  |
|-----------------|-----------------------|----------------------|-------|
| Repeatability 1 | 25                    | 0.3583               | 2.654 |
| Repeatability 2 | 25                    | 0.36                 | 2.659 |
| Repeatability 3 | 25                    | 0.3583               | 2.665 |
| Repeatability 4 | 25                    | 0.3583               | 2.67  |
| Repeatability 5 | 25                    | 0.3567               | 2.673 |
| Repeatability 6 | 25                    | 0.3567               | 2.68  |

Repeatability

| Test           | Measured (% RSD) | OQ Limit (% RSD) | Result |
|----------------|------------------|------------------|--------|
| Retention Time | 0.3              | ≤ 5.0            | PASS   |
| Area           | 0.4              | ≤ 1.0            | PASS   |



OVERALL TEST RESULT: PASS  
ARCHEMICA INTERNATIONAL CO.,LTD.

| Field Service Representative Signature: | Customer Signature: |
|---|---------------------|
| <i>Nutdana</i>                          |                     |
| Date: 25/7/24                           | Date:               |

Information

|             |   |
|-------------|---|
| System Name | Aqion RFIC  |
| Detector SN | 221260053   |
| Data Path   | ChromeleonLocal://Archemica/Warranty/2024/1st Warranty Year 2 PMPQ 25-Jul-024/IC OQ |

Peak Results

| Sample Name     | Injection Volume (µL) | Retention Time (min) | Area  |
|-----------------|-----------------------|----------------------|-------|
| Reference Blank | 25                    | 0.3583               | 0.01  |
| High Standard   | 25                    | 0.3583               | 47.06 |
| Carryover       | 25                    | 0.3533               | 0.022 |

Results

| Test | Observed (%) | OQ Limit (%) | Result |
|------|--------------|--------------|--------|
| AREA | 0.03         | ≤ 0.10       | PASS   |

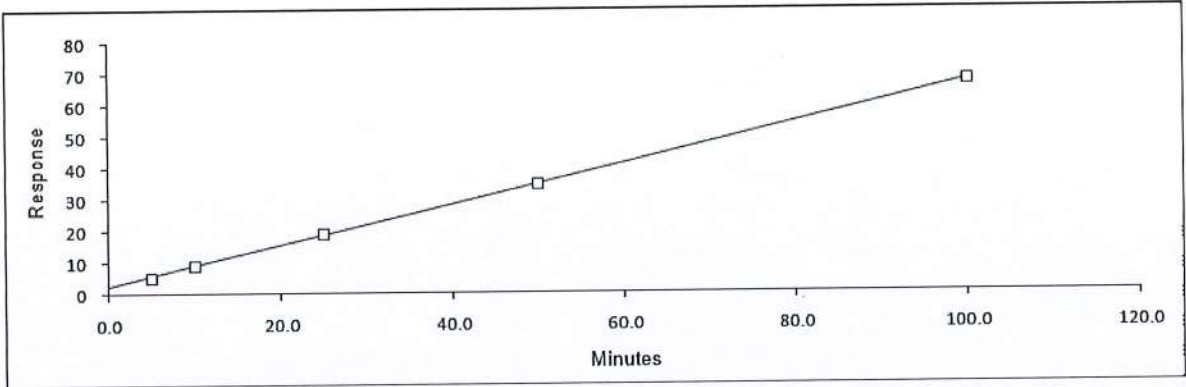
OVERALL TEST RESULT: PASS

ARCHEMICA  
บริษัท อีเคมิกา อินเตอร์เนชั่นแนล จำกัด  
ARCHEMICA INTERNATIONAL CO.,LTD.

| Field Service Representative Signature: | Customer Signature: |
|---|---------------------|
| Nutdara                                 |                     |
| Date: 25/7/24                           | Date:               |



DETECTOR LINEARITY (CD)



Information

|             |   |
|-------------|---|
| System Name | Aqion RFIC  |
| Detector SN | 221260053   |
| Data Path   | ChromeleonLocal://Archemica/Warranty/2024/1st Warranty Year 2 PMPQ 25-Jul-024/IC OQ |

Peak Results

| Sample Name           | Concentration | Peak Height | Calculated |
|-----------------------|---------------|-------------|------------|
| Detector Linearity 01 | 5             | 5.014       | 4.11       |
| Detector Linearity 02 | 10            | 9.227       | 10.57      |
| Detector Linearity 03 | 25            | 19.042      | 25.63      |
| Detector Linearity 04 | 50            | 34.755      | 49.73      |
| Detector Linearity 05 | 100           | 67.512      | 99.97      |

Linearity

| Test           | Observed | OQ Limit | Result |
|----------------|----------|----------|--------|
| r <sup>2</sup> | 1.000    | ≥ 0.999  | PASS   |



**OVERALL TEST RESULT: PASS**

ARCHEMICA INTERNATIONAL CO., LTD.

| Field Service Representative Signature: | Customer Signature: |
|---|---------------------|
| <i>Nutana</i>                           |                     |
| Date: 25/7/24                           | Date:               |



ELUENT GENERATOR TEST



EG Current Test

| Set Point (mM) | Expected (mA) | Reading (mA) | Deviation (mA) | OQ Limit (mA) | Result |
|----------------|---------------|--------------|----------------|---------------|--------|
| 1.00           | 1.6082        | 1.611        | 0.00           | ± 0.01        | PASS   |
| 5.00           | 8.041         | 8.047        | 0.01           | ± 0.05        | PASS   |
| 10.00          | 16.082        | 16.104       | 0.02           | ± 0.10        | PASS   |
| 50.00          | 80.41         | 80.46        | 0.05           | ± 0.50        | PASS   |
| 100.00         | 160.82        | 161.05       | 0.23           | ± 1.00        | PASS   |

OVERALL TEST RESULT: PASS



| Field Service Representative Signature: | Customer Signature: |
|---|---------------------|
| <i>Nytdang!</i>                         |                     |
| Date: 25/7/24                           | Date:               |

# IC PUMP FLOW RATE ACCURACY

**ThermoFisher**  
SCIENTIFIC

## IC Pump Flow Rate

| Set Point (mL) (mL/min) | Reading (mL/min) | Deviation (%) | OQ Limit (%) | Result |
|-------------------------|------------------|---------------|--------------|--------|
| 0.5                     | 0.4974           | 0.520         | ± 2.0        | PASS   |
| 1.0                     | 0.9914           | 0.86          | ± 2.0        | PASS   |

OVERALL TEST RESULT: PASS



| Field Service Representative Signature: | Customer Signature: |
|---|---------------------|
| <i>Nutdarni</i>                         |                     |
| Date: 25/7/24                           | Date:               |

TEMPERATURE ACCURACY



Column Compartment

| Set Point (°C) | Reading (°C) | Deviation (°C) | OQ Limit (°C) | Result |
|----------------|--------------|----------------|---------------|--------|
| 30.0           | 30.4         | 0.4            | ± 2.0         | PASS   |

  
OVERALL TEST RESULT: **PASS**  
ARCHEMICA INTERNATIONAL CO., LTD.  
บริษัท อาร์เคมีกา อินเตอร์เนชั่นแนล จำกัด

| Field Service Representative Signature: | Customer Signature: |
|---|---------------------|
| <i>Nytagal</i>                          |                     |
| Date: 25/7/24                           | Date:               |

# Certificate

---

**Certificate of Standards and  
Instruments for Qualification**



# Thermo SCIENTIFIC

## CERTIFICATE OF CONFORMITY

### IC QUALIFICATION TEST BOX II

This certificate validates that the product values referenced below meet or exceed all Thermo Scientific functional specifications and release requirements.

Instrument Serial Number: 21379153  
Instrument Part Number: 22000-60001

### TEST BOX LOADS AND FUNCTIONS

|   |      |        |   |         |        |
|---|------|--------|---|---------|--------|
| <input checked="" type="checkbox"/> AES         | 100Ω | +/- 5% | <input checked="" type="checkbox"/> CR-TC 3-pin ANA INT | 1.3KΩ   | +/- 5% |
| <input checked="" type="checkbox"/> EGC CAP KOH | 100Ω | +/- 5% | <input checked="" type="checkbox"/> CR-TC 3-pin CAP INT | 13.05kΩ | +/- 1% |
| <input checked="" type="checkbox"/> EGC CAP MSA | 100Ω | +/- 5% | <input checked="" type="checkbox"/> CR-TC 4-pin ANA INT | 1.3KΩ   | +/- 5% |
| <input checked="" type="checkbox"/> EGC ANA KOH | 100Ω | +/- 5% | <input checked="" type="checkbox"/> CR-TC 4-pin CAP INT | 13.05kΩ | +/- 1% |
| <input checked="" type="checkbox"/> EGC ANA MSA | 100Ω | +/- 5% | <input checked="" type="checkbox"/> EGC - Memory Test   |         |        |
| <input checked="" type="checkbox"/> ERS (CC)    | 12Ω  | +/- 5% | <input checked="" type="checkbox"/> ERS - Memory Test   |         |        |
| <input checked="" type="checkbox"/> ERC (CV)    | 250Ω | +/- 5% | <input checked="" type="checkbox"/> CR-TC - Memory Test |         |        |

บริษัท อีอาร์เคมิคัล อินเตอร์เนชันแนล จำกัด  
ARCHEMICA INTERNATIONAL CO., LTD.

Tester: Leonardo Amaya

Noted  
25/1/24

Date: 8-SEP-2021

P/N 22000-97001 C

May 15, 2018

To whom it may concern,

Be advised that the IC Qualification Test Box II (P/N 22000-60001) no longer comes with a sticker labelled "Periodic Calibration Required". An IC Qualification Test Box II can be used without any re-calibration after shipment.

Sincerely,



Thomas Wu  
ICSP Product Manager  
Thermo Fisher Scientific



บริษัท อาร์เคมีกา อินเตอร์เนชั่นแนล จำกัด  
ARCHEMICA INTERNATIONAL CO., LTD.  
Nathanai  
25/1/24





# SYSTRONICS CO.,LTD.

19/11-12, Sukhumvit Rd., Nernphra, Muang Rayong, Rayong 21150, Thailand

Tel.+66(38) 694 145-8, Fax.+66(38) 694 149



## CALIBRATION CERTIFICATE

Certificate No : EL231988

Job No : 23110140

Page : 1 of 5

Customer Name. : Archemica Lab Co., Ltd.

Customer Address. : 39 Soi Sukhumvit 63 ( Ekamai )

: Sukhumvit Rd.,North Klongton,

: Wattana , Bangkok 10110

Instrument Description. : TRUE RMS MULTIMETER

Manufacturer. : FLUKE

Model No. : 289

Serial Number. : 20920144

Received Date : 30 Nov 2023

Calibrated Date : 04 Dec 2023

Issued Date : 04 Dec 2023

Tag No : -

Service : -

Condition As Received : Used

### Calibration Procedure.

Calibration were conducted using in-house calibration procedure according to direct measurement with reference standard.

### Procedure No.

CP-EL-01, 02, 03, 04, 05, 06, 07, 10.

### Comment.

### Reference Standards Instrument.

| Instrument Name           | Model       | Serial No. | Cert. No.  | Due Date.   |
|---------------------------|-------------|------------|------------|-------------|
| Multi-Function Calibrator | Fluke 5522A | 2177901    | EE-0033-23 | 03 Apr 2024 |
| -                         | -           | -          | -          | -           |
| -                         | -           | -          | -          | -           |
| -                         | -           | -          | -          | -           |

### Traceability Information.

- Traceable to the International System of Units (SI) through the National Institute of Metrology (Thailand), NIMT.

### Environmental Conditions.

Temperature : (23 +/- 3) °C

Relative Humidity : (50 +/- 15) %

### Calibration Information.

- The result of calibration was found accurate as show on date and place of calibration only.
- The reported uncertainty of measurement is based on standard uncertainty multiplied by a coverage factor  $k = 2$ , providing confidence level of approximately 95%.

Calibrated by : Mr.Suputthana Prapasai

Approved by :

Approved Signatory

( ) Mr.Phitsanu Wangchai

( ) Mr.Tanawat Siripakdee

This certificate may not be reproduced, except in full unless permission for the publication of an approved abstract is obtained in writing from the calibration organization issuing this report.

ARCHIMECA INTERNATIONAL CO.,LTD.

Nv + Chnai  
25/11/24





# SYSTRONICS CO.,LTD.

19/11-12, Sukhumvit Rd., Nernphra, Muang Rayong, Rayong 21150, Thailand

Tel.+66(38) 694 145-8, Fax.+66(38) 694 149



HSC - TISI - TIS 17025  
CALIBRATION 0312

## CALIBRATION CERTIFICATE

Certificate No. EL231988

Page. 2 of 5

| Range | Standard Value | UUC*Reading | Error | (±) Uncertainty |
|-------|----------------|-------------|-------|-----------------|
|-------|----------------|-------------|-------|-----------------|

### Function : DC Voltage Measurement (Without Adjustment)

|      |    |             |            |           |            |
|------|----|-------------|------------|-----------|------------|
| 50   | mV | 0.0000 mV   | 0.000 mV   | 0.000 mV  | 0.0016 mV  |
| 50   | mV | 5.0000 mV   | 5.003 mV   | 0.003 mV  | 0.0016 mV  |
| 50   | mV | 45.0000 mV  | 45.002 mV  | 0.002 mV  | 0.0021 mV  |
| 50   | mV | -45.0000 mV | -44.999 mV | 0.001 mV  | 0.0021 mV  |
| 500  | mV | 50.0000 mV  | 50.00 mV   | 0.00 mV   | 0.0061 mV  |
| 500  | mV | 450.000 mV  | 450.00 mV  | 0.00 mV   | 0.0080 mV  |
| 500  | mV | -450.000 mV | -450.01 mV | -0.01 mV  | 0.0080 mV  |
| 5    | V  | 0.500000 V  | 0.5001 V   | 0.0001 V  | 0.000059 V |
| 5    | V  | 4.50000 V   | 4.5003 V   | 0.0003 V  | 0.000082 V |
| 5    | V  | -4.50000 V  | -4.5002 V  | -0.0002 V | 0.000082 V |
| 50   | V  | 5.00000 V   | 5.000 V    | 0.000 V   | 0.00059 V  |
| 50   | V  | 45.0000 V   | 45.002 V   | 0.002 V   | 0.00095 V  |
| 50   | V  | -45.0000 V  | -45.001 V  | -0.001 V  | 0.00095 V  |
| 500  | V  | 50.0000 V   | 50.00 V    | 0.00 V    | 0.0059 V   |
| 500  | V  | 450.000 V   | 450.03 V   | 0.03 V    | 0.0095 V   |
| 500  | V  | -450.000 V  | -450.02 V  | -0.02 V   | 0.0095 V   |
| 1000 | V  | 100.0000 V  | 100.0 V    | 0.0 V     | 0.058 V    |
| 1000 | V  | 900.000 V   | 899.9 V    | -0.1 V    | 0.060 V    |
| 1000 | V  | -900.000 V  | -899.9 V   | 0.1 V     | 0.060 V    |

### Function : DC Voltage Measurement LoZ (Without Adjustment)

|      |   |             |          |        |         |
|------|---|-------------|----------|--------|---------|
| 1000 | V | 0.0000000 V | 0.0 V    | 0.0 V  | 0.058 V |
| 1000 | V | 100.0000 V  | 100.0 V  | 0.0 V  | 0.058 V |
| 1000 | V | 900.000 V   | 900.5 V  | 0.5 V  | 0.060 V |
| 1000 | V | -900.000 V  | -900.5 V | -0.5 V | 0.060 V |

### Function : AC Voltage Measurement (Without Adjustment)

|      |    |           |       |           |          |           |
|------|----|-----------|-------|-----------|----------|-----------|
| 50   | mV | 5.000 mV  | 50 Hz | 5.007 mV  | 0.007 mV | 0.0053 mV |
| 50   | mV | 45.000 mV | 50 Hz | 45.015 mV | 0.015 mV | 0.013 mV  |
| 500  | mV | 50.000 mV | 50 Hz | 50.02 mV  | 0.02 mV  | 0.014 mV  |
| 500  | mV | 450.00 mV | 50 Hz | 450.22 mV | 0.22 mV  | 0.11 mV   |
| 5    | V  | 0.50000 V | 50 Hz | 0.5000 V  | 0.0000 V | 0.00012 V |
| 5    | V  | 4.5000 V  | 50 Hz | 4.5057 V  | 0.0057 V | 0.0011 V  |
| 50   | V  | 5.0000 V  | 50 Hz | 5.003 V   | 0.003 V  | 0.0012 V  |
| 50   | V  | 45.000 V  | 50 Hz | 45.045 V  | 0.045 V  | 0.0085 V  |
| 500  | V  | 50.000 V  | 50 Hz | 50.00 V   | 0.00 V   | 0.011 V   |
| 500  | V  | 450.00 V  | 50 Hz | 450.39 V  | 0.39 V   | 0.12 V    |
| 1000 | V  | 100.000 V | 50 Hz | 100.1 V   | 0.1 V    | 0.060 V   |
| 1000 | V  | 900.00 V  | 50 Hz | 900.6 V   | 0.6 V    | 0.23 V    |

Remark : (\*) UUC : Unit Under Calibration

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## CALIBRATION CERTIFICATE

Certificate No. EL231988

Page. 3 of 5

| Range   |    | Standard Value |       | UUC*Reading |  | Error      | (±) Uncertainty |
|---|----|----------------|-------|-------------|--|------------|-----------------|
| <b>Function : AC Voltage Measurement LoZ (Without Adjustment)</b> |    |                |       |             |  |            |                 |
| 1000  | V  | 100.000 V      | 50 Hz | 100.4 V     |  | 0.4 V      | 0.060 V         |
| 1000  | V  | 900.00 V       | 50 Hz | 904.1 V     |  | 4.1 V      | 0.23 V          |
| <b>Function : DC Current Measurement (Without Adjustment)</b>     |    |                |       |             |  |            |                 |
| 500   | uA | 0.000 uA       |       | 0.00 uA     |  | 0.00 uA    | 0.017 uA        |
| 500   | uA | 50.000 uA      |       | 50.02 uA    |  | 0.02 uA    | 0.023 uA        |
| 500   | uA | 450.00 uA      |       | 450.07 uA   |  | 0.07 uA    | 0.078 uA        |
| 5000  | uA | 500.00 uA      |       | 500.1 uA    |  | 0.1 uA     | 0.097 uA        |
| 5000  | uA | 4500.0 uA      |       | 4501.1 uA   |  | 1.1 uA     | 0.57 uA         |
| 50  | mA | 5.0000 mA      |       | 5.001 mA    |  | 0.001 mA   | 0.00082 mA      |
| 50  | mA | 45.000 mA      |       | 45.002 mA   |  | 0.002 mA   | 0.0058 mA       |
| 400   | mA | 40.000 mA      |       | 40.00 mA    |  | 0.00 mA    | 0.0077 mA       |
| 400   | mA | 360.00 mA      |       | 359.99 mA   |  | -0.01 mA   | 0.090 mA        |
| 5   | A  | 0.50000 A      |       | 0.5011 A    |  | 0.0011 A   | 0.00013 A       |
| 5   | A  | 4.5000 A       |       | 4.5007 A    |  | 0.0007 A   | 0.0022 A        |
| 10  | A  | 1.00000 A      |       | 1.002 A     |  | 0.002 A    | 0.00061 A       |
| 10  | A  | 9.0000 A       |       | 9.021 A     |  | 0.021 A    | 0.0040 A        |
| <b>Function : AC Current Measurement (Without Adjustment)</b>     |    |                |       |             |  |            |                 |
| 500   | uA | 50.00 uA       | 50 Hz | 49.92 uA    |  | -0.08 uA   | 0.13 uA         |
| 500   | uA | 450.00 uA      | 50 Hz | 449.89 uA   |  | -0.11 uA   | 0.48 uA         |
| 5000  | uA | 500.00 uA      | 50 Hz | 499.8 uA    |  | -0.2 uA    | 0.51 uA         |
| 5000  | uA | 4500.0 uA      | 50 Hz | 4502.0 uA   |  | 2.0 uA     | 3.1 uA          |
| 50  | mA | 5.0000 mA      | 50 Hz | 4.991 mA    |  | -0.009 mA  | 0.0032 mA       |
| 50  | mA | 45.000 mA      | 50 Hz | 44.987 mA   |  | -0.013 mA  | 0.031 mA        |
| 400   | mA | 40.000 mA      | 50 Hz | 40.00 mA    |  | 0.00 mA    | 0.029 mA        |
| 400   | mA | 360.00 mA      | 50 Hz | 360.14 mA   |  | 0.14 mA    | 0.22 mA         |
| 5   | A  | 0.50000 mA     | 50 Hz | 0.4995 mA   |  | -0.0005 mA | 0.00051 mA      |
| 5   | A  | 4.5000 mA      | 50 Hz | 4.4976 mA   |  | -0.0024 mA | 0.0031 mA       |
| 10  | A  | 1.00000 mA     | 50 Hz | 0.992 mA    |  | -0.008 mA  | 0.0011 mA       |
| 10  | A  | 9.0000 mA      | 50 Hz | 8.998 mA    |  | -0.002 mA  | 0.0045 mA       |

Remark : (\*) UUC : Unit Under Calibration

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## CALIBRATION CERTIFICATE

Certificate No. EL231988

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| Range   | Standard Value | UUC*Reading | Error       | (±) Uncertainty |
|---|----------------|-------------|-------------|-----------------|
| <b>Function : Resistance Measurement (Without Adjustment)</b>     |                |             |             |                 |
| 500 Ω   | 0.0000 Ω       | 0.00 Ω      | 0.00 Ω      | 0.0075 Ω        |
| 500 Ω   | 50.0000 Ω      | 50.00 Ω     | 0.00 Ω      | 0.0084 Ω        |
| 500 Ω   | 450.000 Ω      | 449.87 Ω    | -0.13 Ω     | 0.017 Ω         |
| 5 kΩ  | 0.500000 kΩ    | 0.5000 kΩ   | 0.0000 kΩ   | 0.000060 kΩ     |
| 5 kΩ  | 4.50000 kΩ     | 4.4997 kΩ   | -0.0003 kΩ  | 0.00017 kΩ      |
| 50 kΩ   | 5.00000 kΩ     | 4.999 kΩ    | -0.001 kΩ   | 0.00060 kΩ      |
| 50 kΩ   | 45.0000 kΩ     | 44.990 kΩ   | -0.010 kΩ   | 0.0017 kΩ       |
| 500 kΩ  | 50.0000 kΩ     | 50.00 kΩ    | 0.00 kΩ     | 0.0060 kΩ       |
| 500 kΩ  | 450.000 kΩ     | 449.88 kΩ   | -0.12 kΩ    | 0.018 kΩ        |
| 5 M Ω   | 0.500000 M Ω   | 0.5000 M Ω  | 0.0000 M Ω  | 0.000070 M Ω    |
| 5 M Ω   | 4.50000 M Ω    | 4.4989 M Ω  | -0.0011 M Ω | 0.00056 M Ω     |
| 30 M Ω  | 3.000000 M Ω   | 3.000 M Ω   | 0.000 M Ω   | 0.00061 M Ω     |
| 30 M Ω  | 27.00000 M Ω   | 26.988 M Ω  | -0.012 M Ω  | 0.0075 M Ω      |
| 50 M Ω  | 5.00000 M Ω    | 5.00 M Ω    | 0.00 M Ω    | 0.0059 M Ω      |
| 50 M Ω  | 45.0000 M Ω    | 44.95 M Ω   | -0.05 M Ω   | 0.021 M Ω       |
| 100 M Ω   | 10.00000 M Ω   | 10.0 M Ω    | 0.0 M Ω     | 0.058 M Ω       |
| 100 M Ω   | 90.0000 M Ω    | 89.9 M Ω    | -0.1 M Ω    | 0.069 M Ω       |
| 500 M Ω   | 250.0000 M Ω   | 249.5 M Ω   | -0.5 M Ω    | 0.68 M Ω        |
| 500 M Ω   | 450.00 M Ω     | 447.0 M Ω   | -3.0 M Ω    | 5.9 M Ω         |
| <b>Function : Resistance Measurement LoΩ (Without Adjustment)</b> |                |             |             |                 |
| 50 Ω  | 0.0000 Ω       | 0.000 Ω     | 0.000 Ω     | 0.0050 Ω        |
| 50 Ω  | 5.0000 Ω       | 5.008 Ω     | 0.008 Ω     | 0.0050 Ω        |
| 50 Ω  | 25.0000 Ω      | 25.015 Ω    | 0.015 Ω     | 0.0060 Ω        |
| 50 Ω  | 45.0000 Ω      | 45.008 Ω    | 0.008 Ω     | 0.0060 Ω        |
| <b>Function : Capacitance Measurement (Without Adjustment)</b>    |                |             |             |                 |
| 1 nF  | 0.0000 nF      | 0.000 nF    | 0.000 nF    | 0.0078 nF       |
| 1 nF  | 0.5000 nF      | 0.499 nF    | -0.001 nF   | 0.0098 nF       |
| 1 nF  | 0.9000 nF      | 0.898 nF    | -0.002 nF   | 0.012 nF        |
| 10 nF   | 1.0000 nF      | 1.00 nF     | 0.00 nF     | 0.013 nF        |
| 10 nF   | 9.0000 nF      | 9.01 nF     | 0.01 nF     | 0.029 nF        |
| 100 nF  | 10.0000 nF     | 10.0 nF     | 0.0 nF      | 0.064 nF        |
| 100 nF  | 90.000 nF      | 90.0 nF     | 0.0 nF      | 0.29 nF         |
| 1 uF  | 0.100000 uF    | 0.100 uF    | 0.000 uF    | 0.00064 uF      |
| 1 uF  | 0.90000 uF     | 0.900 uF    | 0.000 uF    | 0.0029 uF       |
| 10 uF   | 1.00000 uF     | 1.00 uF     | 0.00 uF     | 0.0064 uF       |
| 10 uF   | 9.0000 uF      | 9.01 uF     | 0.01 uF     | 0.028 uF        |
| 100 uF  | 10.0000 uF     | 10.0 uF     | 0.0 uF      | 0.064 uF        |
| 100 uF  | 90.000 uF      | 90.0 uF     | 0.0 uF      | 0.42 uF         |
| 1000 uF   | 100.000 uF     | 100 uF      | 0 uF        | 0.72 uF         |
| 1000 uF   | 900.00 uF      | 900 uF      | 0 uF        | 4.2 uF          |
| 10 mF   | 1.00000 mF     | 1.00 mF     | 0.00 mF     | 0.0072 mF       |
| 10 mF   | 9.0000 mF      | 8.99 mF     | -0.01 mF    | 0.043 mF        |
| 100 mF  | 10.0000 mF     | 10.0 mF     | 0.0 mF      | 0.072 mF        |
| 100 mF  | 90.000 mF      | 89.8 mF     | -0.2 mF     | 0.89 mF         |

Remark : (\*) UUC : Unit Under Calibration

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CALIBRATION 0312

## CALIBRATION CERTIFICATE

Certificate No. EL231988

Page. 5 of 5

| Range   |     | Standard Value |       | UUC*Reading |  | Error      | (±) Uncertainty |
|---|-----|----------------|-------|-------------|--|------------|-----------------|
| Function : Frequency Measurement (Without Adjustment) |     |                |       |             |  |            |                 |
| 100   | Hz  | 10.00 Hz       | @ 1 V | 10.000 Hz   |  | 0.000 Hz   | 0.00059 Hz      |
| 100   | Hz  | 90.00 Hz       | @ 1 V | 90.000 Hz   |  | 0.000 Hz   | 0.00066 Hz      |
| 1000  | Hz  | 100.00 Hz      | @ 1 V | 100.00 Hz   |  | 0.00 Hz    | 0.0058 Hz       |
| 1000  | Hz  | 900.0 Hz       | @ 1 V | 900.00 Hz   |  | 0.00 Hz    | 0.0061 Hz       |
| 10  | kHz | 1.0000 kHz     | @ 1 V | 1.0000 kHz  |  | 0.0000 kHz | 0.000058 kHz    |
| 10  | kHz | 9.000 kHz      | @ 1 V | 9.0000 kHz  |  | 0.0000 kHz | 0.000061 kHz    |
| 100   | kHz | 10.000 kHz     | @ 1 V | 10.000 kHz  |  | 0.000 kHz  | 0.00058 kHz     |
| 100   | kHz | 90.00 kHz      | @ 1 V | 90.000 kHz  |  | 0.000 kHz  | 0.00061 kHz     |
| 1000  | kHz | 100.00 kHz     | @ 1 V | 100.00 kHz  |  | 0.00 kHz   | 0.0058 kHz      |
| 1000  | kHz | 500.0 kHz      | @ 1 V | 500.00 kHz  |  | 0.00 kHz   | 0.0059 kHz      |

| Range  | Standard Value | Required UUC*Reading | UUC*Reading | Error  | (±) Uncertainty |
|--|----------------|----------------------|-------------|--------|-----------------|
| <b>Function : Thermocouple Measurement K Type (Without Adjustment)</b> |                |                      |             |        |                 |
| -200 to 1350 °C  | -5.550 mV      | -180.0 °C            | -178.6 °C   | 1.4 °C | 0.37 °C         |
| -200 to 1350 °C  | 0.000 mV       | 0.0 °C               | 0.7 °C      | 0.7 °C | 0.24 °C         |
| -200 to 1350 °C  | 4.096 mV       | 100.0 °C             | 100.7 °C    | 0.7 °C | 0.22 °C         |
| -200 to 1350 °C  | 24.905 mV      | 600.0 °C             | 600.8 °C    | 0.8 °C | 0.22 °C         |
| -200 to 1350 °C  | 37.326 mV      | 900.0 °C             | 900.8 °C    | 0.8 °C | 0.22 °C         |
| -200 to 1350 °C  | 48.838 mV      | 1200.0 °C            | 1200.9 °C   | 0.9 °C | 0.23 °C         |

**Remark :** (\*) UUC : Unit Under Calibration

**END OF CALIBRATION**

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ISC - TISI - TIS 17025  
CALIBRATION 0312

## CALIBRATION CERTIFICATE

Certificate No. TL230236

Job No. 23110140

Page. 1 of 2

Customer Name : Archemica Lab Co., Ltd.  
Customer Address : 39 Soi Sukhumvit 63 ( Ekamal ),  
Sukhumvit Rd., North Klomlong, Wattana ,  
Bangkok 10110.

Received Date : 30 Dec 2023  
Calibrated Date : 01 to 02 Dec 2023  
Issued Date : 02 Dec 2023

Instrument Description : Digital Thermometer with sensor  
Manufacturer : FLUKE  
Model No. : 289  
Serial Number : 20920144

Tag No. : -  
Service : -  
Condition As Received : Used Item

### Calibration Procedure.

Calibration were conducted using in-house calibration procedure according to comparison measurement with Platinum Resistance Thermometer ( PRT ) into temperature source.

### Procedure No.

CP-TL-01

### Comment.

### Reference Standards Instrument.

| Instrument Name                 | Model | Serial No. | Cert No.   | Due Date    |
|---------------------------------|-------|------------|------------|-------------|
| Platinum Resistance Thermometer | 5615  | 958332     | TT-0066-23 | 21 Jun 2024 |
| Thermometer Readout             | 1529  | B29730     | 22E4124    | 26 Dec 2023 |

### Traceability Information.

The temperature scale used was based on ITS-90.  
This certification is traceable to the International System of Units (SI).

### Environmental Conditions

Temperature :  $(23 \pm 3) ^\circ\text{C}$  Relative Humidity :  $(50 \pm 15) \% \text{RH}$

### Calibration Information.

The result of calibration was found accurate as show on date and place of calibration only.  
The reported uncertainty of measurement is based on standard uncertainty multiplied by a coverage factor (k), providing confidence level of approximately 95%.

Calibrated by : Nuttapon Srisuwan



Approved by :

Approved Signatory

(✓) Mr. Phitsanu Wangchai  
( ) Mr. Tanawat Siripakdee

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## CALIBRATION CERTIFICATE

Certificate No. TL230236

Page. 2 of 2

### Result of Calibration :

( Without Adjustment )

Sensor of UUC\* : Thermocouple Wire Type : K Serial No. : - ID/Tag No. : 20920144  
Dimension : Length : 1000 mm Diameter : 1.5 mm

| Immersion Depth | Standard Reading   | UUC* Reading       | Correction Value   | Uncertainty of Measurement ( $\pm$ ) | Coverage Factor |
|-----------------|--------------------|--------------------|--------------------|--------------------------------------|-----------------|
| mm              | $^{\circ}\text{C}$ | $^{\circ}\text{C}$ | $^{\circ}\text{C}$ | $^{\circ}\text{C}$                   | k =             |
| 150             | 0.0024             | 1.1                | -1.1               | 0.50                                 | 2.00            |
| 150             | 50.0051            | 49.7               | 0.3                | 0.50                                 | 2.00            |
| 150             | 100.0050           | 99.0               | 1.0                | 0.50                                 | 2.00            |

UUC\* : Unit Under Calibration

END OF CERTIFICATE

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# Certificate of Analysis

Better Separations Through  
Better Chemistry

## Dionex Nitrate OQ/PQ IC Standards Kit (Set of 6)

Product Number 060254  
Certificate of Analysis

Lot Number 231226

Expiration of Certification  
December 2024

The Dionex Nitrate Standard was developed to aid the analysis of anions by Ion Chromatography (IC). The single-ion standard was prepared by the dissolution of high-purity salt in  $\geq 18.2$  megohm deionized water, which was tested by IC for ionic contaminants. The bottle label states the nominal concentration value of the ionic component for informational purposes only. The actual ion concentration value was determined by Ion Chromatography. The IC system was standardized using the National Institute of Standards & Technology (NIST), Standard Reference Material, SRM 3185 (Nitrate Standard Solution). Actual concentration values determined for the single-ion is listed below.

### Dionex Nitrate Standard

| Vial # | Concentration<br>(mg/L) |
|--------|-------------------------|
| 1      | 5.08 $\pm$ 0.03         |
| 2      | 10.03 $\pm$ 0.14        |
| 3      | 25.16 $\pm$ 0.65        |
| 4      | 50.43 $\pm$ 0.09        |
| 5      | 99.7 $\pm$ 3            |
| 6      | 1014 $\pm$ 17           |

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The concentration value is based a proven reliable method of analysis. The estimated uncertainties are two standard deviations of the concentration value. The concentration value is warranted to be stable for one year from the date of manufacture.

The preparation and analyses of the Dionex Nitrate Standard was performed with extreme care by Thermo Scientific Corporation Consumables Manufacturing Department in Sunnyvale California.

Document No. 078690-01

20-Dec-2011

[thermoscientific.com/dionex](http://thermoscientific.com/dionex)

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XX21149-EN 0215S 031318-10

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(408) 737-0700



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thermo  
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# Certificate of Completion

This certifies that

**Nutdanai Laekhwan**

Has successfully completed

## OJT RPG Mentoring: Ion Chromatography System Qualification Service Training

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ARCHEMICA INTERNATIONAL CO., LTD.  
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**Preventive Maintenance**



**บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด**

**ฝ่ายบริการหลังการขาย**

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**ฝ่ายขายและการตลาด**

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## เงื่อนไขการให้บริการ Preventive Maintenance

บริษัทฯ จะส่งวิศวกรผู้ชำนาญ เพื่อให้บริการตามขอบข่ายของการบริการ เฉพาะ ในวันและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากวัน เวลา ราชการ (วันหยุดเสาร์ – อาทิตย์ หรือวันหยุด นักชดถุกษ์) บริษัท ฯ จะคิดค่าบริการเพิ่มเติมตามอัตราที่กฎหมายแรงงานกำหนดไว้

### ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายการผลการตรวจสอบเครื่องมือ

### หมายเหตุ

- ราคาดนี้ไม่รวมถึงค่าบริการซ่อม หรือ เปลี่ยนอะไหล่ที่ชำรุดเสียหาย หรือหมดสภาพการใช้งาน
- ในกรณีที่ผู้รับบริการอยู่นอกเขตพื้นที่ให้บริการ บริษัทฯ จำเป็นต้องคิดค่าใช้จ่ายเพิ่มเติม ได้แก่ ค่าเดินทาง เป็นต้น
- บริษัท ฯ ขอสงวนสิทธิ์ในการเปลี่ยนแปลงราคา โดยไม่แจ้งให้ทราบล่วงหน้า



## ช่องทางการติดต่อ



DKSH Technology Limited (บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด)

เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260

เลขประจำตัวผู้เสียภาษี 010-555-001-4547 (สำนักงานใหญ่)



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DKSH Scientific



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@dkshscientific

## Preventive Maintenance Contract

จำนวนในการทำสัญญาบริการ ...1...ครั้งต่อปี

ครั้งที่ ..1.. วันที่ 15/05/2024.....

### รายละเอียดผู้รับบริการ

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

### ผู้ติดต่อ

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

### รายละเอียดผู้ให้บริการ

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

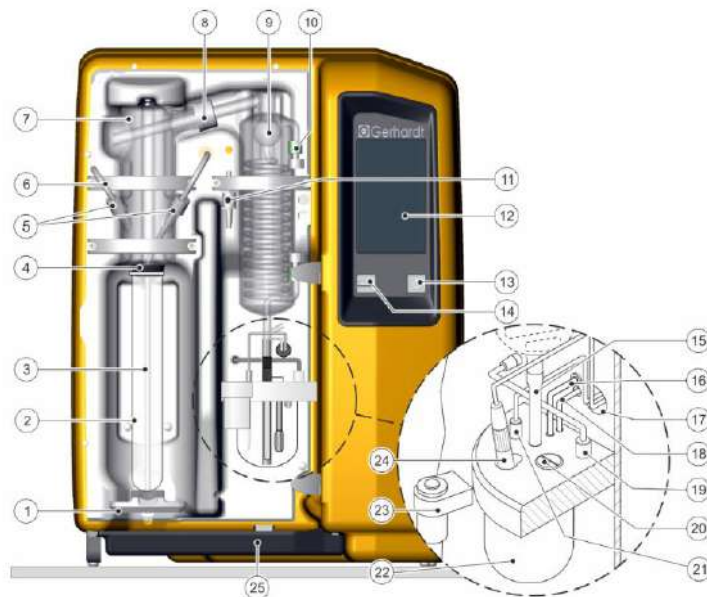
|                          |         |                          |   |
|--------------------------|---------|--------------------------|---|
| ลงนามผู้รับบริการ        |         | ลงนามผู้ให้บริการ        |  |
| ตัวจริง                  | (.....) | ตัวจริง                  | (นาย จิรายุส สเลอาด)  |
| ตำแหน่ง                  |         | ตำแหน่ง                  | Specialist, Technical Service.  |
| วันที่ / ประทับตราบริษัท |         | วันที่ / ประทับตราบริษัท | 15/05/2024  |

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

## Operational Qualification (OQ)

ตรวจสอบสภาพเครื่อง

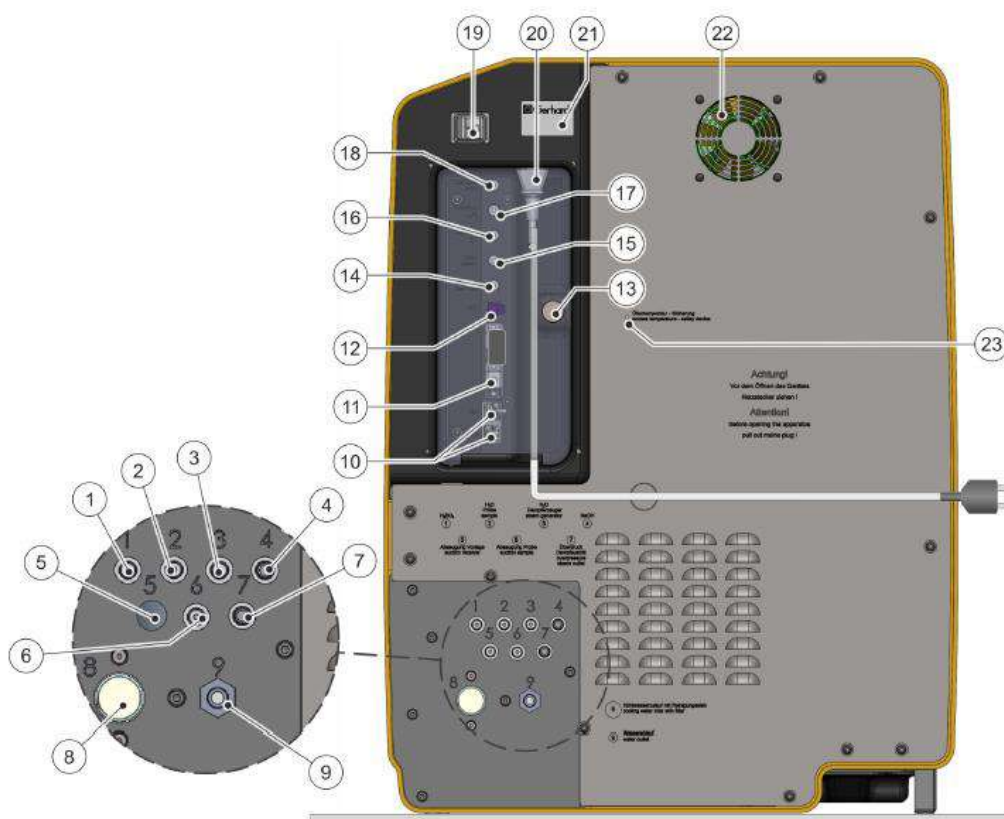
### FRONT



| No |   | PASS                                | FAIL                     | N/A                                 |
|----|---|-------------------------------------|--------------------------|-------------------------------------|
| 1  | Quick clamping device with clamping block         | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 2  | Digestion tube 250/300 ml                         | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 3  | PTFE steam inlet tubing                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 4  | Connection stopper , Viton                        | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 5  | Screw cap GL18                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 6  | PTFE-inlet tubing NaOH                            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 7  | Distribution head made of glass                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 8  | Screw cap GL32                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 9  | Distillation condenser made of glass              | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 10 | Screw cap GL14                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 11 | Ventilation valve                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 12 | Control panel                                     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 13 | Operating Button                                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 14 | USB interface (with protective cap)               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 15 | Silicone tubing 8/10 for distillate discharge **  | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 16 | Verprene tubing 4/8 , receiver suction **         | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 17 | Cable duct for electrode cable + titration tube** | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 18 | Silicone tubing 4/7 , boric acid inlet**          | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 19 | Sensor for level monitoring including connector** | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 20 | Agitator motor with propeller**                   | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 21 | Titration acid inlet tube **                      | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 22 | Receiver glass**                                  | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 23 | Holder for pH electrode , removable**             | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 24 | pH electrode (combined electrode)**               | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 25 | Drip tray PP                                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |

\*\* only VAP 450

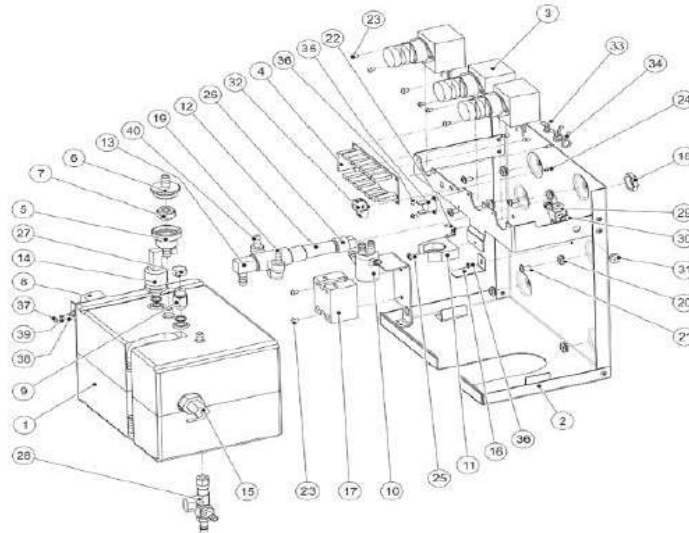
## REAR



| No |   | PASS                                | FAIL                     | N/A                                 |
|----|---|-------------------------------------|--------------------------|-------------------------------------|
| 1  | Tube connection for sample H3BO3 supply                   | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2  | Tube connection for sample H2O supply                     | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 3  | Tube connection for steam generator H2O supply            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 4  | Tube connection for NaOH supply                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 5  | Tube connection for receiver glass extraction             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 6  | Tube connection for sample waste extraction               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 7  | Tube connection , overpressure steam outlet               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 8  | Connection for cooling water supply (with cleaning sieve) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 9  | Tube connection for cooling water outlet                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 10 | 4 X USB interface   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 11 | 1 X RS-232 Interface                                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 12 | LAN Interface   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 13 | Screw cap for Perspex cover                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 14 | Connection socket for sample waste tank level monitoring  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 15 | Connection (not used)                                     | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 16 | Connection socket for H2O tank level monitoring           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 17 | Connection socket for H3BO3 tank level monitoring         | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 18 | Connection socket for NaOH tank level monitoring          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 19 | Overcurrent circuit breaker                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 20 | Apparatus socket (mains cable connection)                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 21 | Rating plate with serial number                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 22 | Exhaust air fan   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 23 | Excess temperature switch                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |

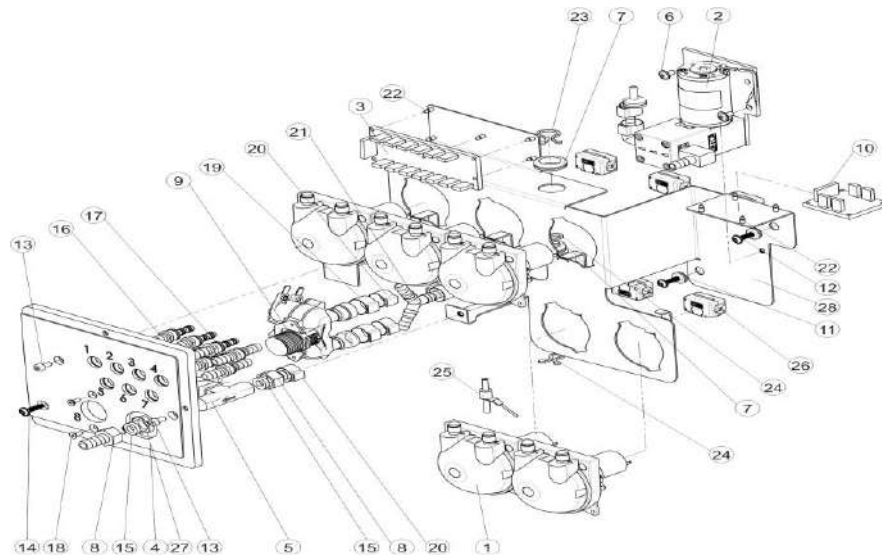


## Inside Steam generator



| No |   | PASS                                | FAIL                     | N/A                      |
|----|---|-------------------------------------|--------------------------|--------------------------|
| 1  | Steam generator                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2  | Steam generator traverse                        | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3  | Pinch valve                                     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4  | Circuit board distributor                       | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5  | Valve tubing connection                         | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6  | Housing safety valve                            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7  | Safety valve SKT                                | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8  | Excess temperature protection , steam generator | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9  | Safety valve G 1/8 0,5 bar                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10 | Ventilation glass pinch valve VAPODEST          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11 | Hose clamp for ventilation clamp                | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 12 | Distributor PP                                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 13 | Angle connection PP                             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 14 | Pressure transmitter                            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 15 | Level switch                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 16 | Fixing bracket steam generator                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 17 | Relay HT+                                       | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 18 | VA Hexagon nut 1/2"                             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 19 | Angle connection 1/8"                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 20 | Bushing nipple 6-10-14                          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 21 | VA Lens head screw M5 X 10                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 22 | Grounding connection , 2-pole                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 23 | VA Lens head screw M4 X 6                       | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 24 | Spacer bolt 5 mm                                | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 25 | VA Lens head screw M4 X 10                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 26 | Tubing connection                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 27 | Hose clamp 14.5 mm                              | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 28 | Module ball valve with nozzles                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 29 | Cross manifold with spout                       | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 30 | Seal copper G 1/8                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 31 | Locking screw 1/8"                              | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 32 | Pin strip                                       | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 33 | Bundle clamp 12 H 4500                          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 34 | Bundle clamp 12 H 4502                          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 35 | Temperature switch 80°C                         | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 36 | VA Lens head screw M3 X 6                       | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 37 | VA Hexagon nut M4                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 38 | Lins head screw M4 X 8                          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 39 | VA Spring washer                                | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 40 | Angle connection , reduced , 1/8" PP            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## Module Pump holder VAP200 - 450 V3



| No |  | PASS                                | FAIL                     | N/A                      |
|----|--|-------------------------------------|--------------------------|--------------------------|
| 1  | Peristaltic pump                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2  | Diaphragm pump NaOH. with non-return valve | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3  | Circuit board                              | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4  | Tubing connection module                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5  | Flow controller                            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6  | Lens head screw M5 x 10                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7  | Bushing nozzle                             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8  | Screw in socket                            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9  | Magnetic valve 2/2 way                     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10 | Circuit board distributor                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11 | Bushing nozzle                             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 12 | Screw 5 x 25                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 13 | Cylinder screw                             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 14 | Screw 5 x 20                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 15 | Seal EPDM 15 x 4                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 16 | Tubing connection piece 51x10x6,5          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 17 | Tubing connection piece 51x10x10           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 18 | Screw M4x10                                | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 19 | Clamp                                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 20 | Clamp                                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 21 | Y-tube connector                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 22 | Spacer bolt 5 mm                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 23 | Bundle clamp                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 24 | Bundle clamp                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 25 | Retrofit earthing pumpv                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 26 | Snap ferrite                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 27 | Nut G 3/8"                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 28 | Pump holder plate                          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Control panel



| No |                                      | PASS                                | FAIL                     |
|----|--------------------------------------|-------------------------------------|--------------------------|
| 1  | Title bar                            | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 2  | Status bar                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 3  | Navigation button                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 4  | Smart switch with multiple functions | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 5  | USB interface                        | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

## รายละเอียดการตรวจสอบ

### ขั้นตอนการบริการ

#### ตรวจสอบระบบไฟฟ้า (Electrical Test)

- ความต้านทานทางไฟฟ้าของเครื่องกับกราวด์
- กระแสไฟฟ้าที่ใช้งาน

#### ตรวจสอบสภาพเครื่อง (Optical Test)

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

#### ตรวจสอบ Function การทำงาน (The Function Test)

- ระบบสร้างและควบคุมความดันของ Steam
- ระบบการเติมน้ำเข้า Sample Tube
- ระบบการเติม Na OH
- ระบบการเติม H<sub>3</sub>BO<sub>3</sub>



## รายงานผลการให้บริการ

### 1. TECHNICAL DATA

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

#### 1.1 COOLING WATER BATH

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

#### 1.2 OPTICAL TEST VAP<sub>200</sub>

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

### 2. SYSTEM COOLING WATER INLET

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

### 3.SYSTEM CONTROL

|                                       | Pass                                | Fail                     | N/A                                 | Remark |
|---------------------------------------|-------------------------------------|--------------------------|-------------------------------------|--------|
| Display                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| Program                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| Adding NaOH                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| Adding H <sub>2</sub> O               | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| Adding H <sub>3</sub> BO <sub>3</sub> | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| Suction Sample                        | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| Suction Reciver                       | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |

### 4.SYSTEM DISTILLATION

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

**5. PUMP**

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

**6. The Following Program Run :**

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

**7. Measured pumps**

|                                     | Remark |
|-------------------------------------|--------|
| Pump NaOH Volume : <u>13,33</u> .ml | .....  |

Remark : .....

.....

## ข้อมูลสนับสนุนด้านเทคนิค (General Technical Support)

### การบำรุงรักษาทั่วไป (Basic maintenance)

#### Cleaning program

Glass parts and tubes must be rinsed daily before starting analysis in order to prevent clogging by crystallising chemicals.

The following settings are recommended for this:

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

➔ Insert a digestion tube (without sample) and start the program.

➔ All liquid carrying parts are cleaned. In the case of strong soiling, approx. 10 ml of sulphuric acid can also be added to the digestion tube.

#### General error message

| Fault description                        | Cause                               | Remedy  |
|--|-------------------------------------|---|
| 'Cooling water flow volume too low'      | Cooling water pressure under 1 bar  | <ul style="list-style-type: none"><li>■ Open water tap.</li><li>■ Check coolant pressure.</li><li>■ Check coolant tube.</li></ul> Program continues automatically once error has been fixed.                |
| 'Sample tube missing'                    | Sample tube missing.                | <ul style="list-style-type: none"><li>■ Insert sample tube.</li></ul> Continue program or restart.  |
| 'Distillation room protective door open' | Protection door not closed          | <ul style="list-style-type: none"><li>■ Close protection door.</li></ul> Program continues automatically once error has been fixed.   |
| 'Reagent storage/waste'                  | One or more storage tanks are empty | <ul style="list-style-type: none"><li>■ Fill storage tank.</li><li>■ Check correct seating of the universal sensors.</li></ul> The running program can be continued after rectification of the error.       |
|  | The sample waste tank is full.      | <ul style="list-style-type: none"><li>■ Empty sample waste tank.</li><li>■ Check correct seating of the universal sensors.</li></ul> The running program can be continued after rectification of the error. |

## Analytical errors

| Fault description                    | Cause  | Remedy  |
|--------------------------------------|--|---|
| Analysis results too high            | The chemicals used are contaminated with nitrogen compounds.                                       | <ul style="list-style-type: none"> <li>■ Detailed checking of the chemicals.</li> <li>■ Determination of a blank value.</li> <li>■ Replace the chemicals if necessary.</li> </ul>   |
|                                      | Violent reaction in the digestion tube, sodium hydroxide drops get into the receiver.              | <ul style="list-style-type: none"> <li>■ Increase of the water addition amount.</li> </ul>  |
|                                      | Glass bridge of the condenser is broken or worn out, sodium hydroxide drops get into the receiver. | <ul style="list-style-type: none"> <li>■ Replacement of the glass condenser.</li> </ul>   |
|                                      | Glass cleaning agents in the digestion tube.   | <ul style="list-style-type: none"> <li>■ Clean digestion tube in advance with distilled water.</li> </ul>   |
|                                      | Entrainment of ammonia from the previous sample.   | <ul style="list-style-type: none"> <li>■ Increase distillation time.</li> <li>■ Check whether the sample was previously sufficiently alkalisied.</li> </ul>   |
| Analysis result too low or no result | Incomplete distillation; distillation time too short.  | <ul style="list-style-type: none"> <li>■ No quantitative expulsion of the ammonia content.</li> <li>■ The distillation amount should be 100 ml.</li> </ul>  |
|                                      | Ammonia escapes at leaking places.   | <ul style="list-style-type: none"> <li>■ Sotted or defective Viton plugs; clean or replace.</li> <li>■ Check seals (GL screw connections) on the distribution head; replace if necessary.</li> <li>■ Check valve at the condenser is gummed up; clean or replace.</li> <li>■ Digestion tube is damaged at the neck extension.</li> <li>■ Distribution head glass leaks; replace.</li> </ul> |
|                                      | Addition amount of the sodium hydroxide too little; no ammonia development.                        | <ul style="list-style-type: none"> <li>■ Check the constant flow rate of the NaOH pump (see Technical Data).</li> </ul>   |
|                                      | Too low boric acid amount in the receiver; escaping ammonia is not completely bonded.              | <ul style="list-style-type: none"> <li>■ Increase of the boric acid amount.</li> </ul>  |
|                                      | Tube not completely immersed in the acid receiver.   | <ul style="list-style-type: none"> <li>■ Increase of the acid amount.</li> </ul>  |
|                                      | Formation of stable ammonia compounds which are not destroyed with sodium hydroxide.               | <ul style="list-style-type: none"> <li>■ This problem only occurs with catalysts containing mercury. Sodium sulphate solution destroys these compounds.</li> </ul>  |



การดูแลบำรุงรักษาเชิงป้องกัน

**Preventive Maintenance**



**บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด**

**ฝ่ายบริการหลังการขาย**

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

## เงื่อนไขการให้บริการ Preventive Maintenance

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

### ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายการผลการตรวจสอบเครื่องมือ

### หมายเหตุ

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

## ช่องทางการติดต่อ



**DKSH Technology Limited (บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด)**

เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260

เลขประจำตัวผู้เสียภาษี 010-555-001-4547 (สำนักงานใหญ่)



**Call center 0 2 639 7000**



**DKSH Scientific**



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**@dkshscientific**

## Preventive Maintenance Contract

จำนวนในการทำสัญญาบริการ ...1...ครั้งต่อปี

ครั้งที่ 1.. วันที่ 15/05/2024.....

### รายละเอียดผู้รับบริการ

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

### ผู้ติดต่อ

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

### รายละเอียดผู้ให้บริการ

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

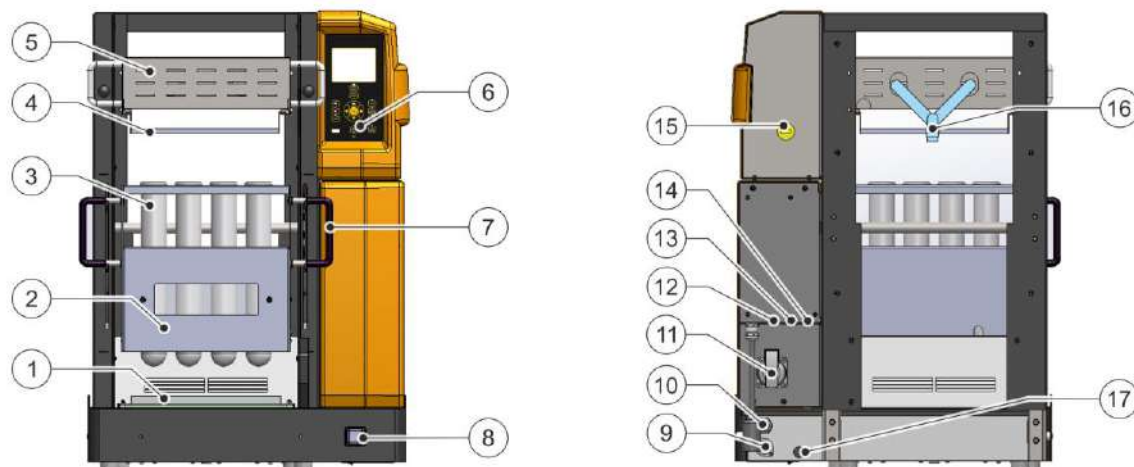
|                          |         |                          |   |
|--------------------------|---------|--------------------------|---|
| ลงนามผู้รับบริการ        |         | ลงนามผู้ให้บริการ        |  |
| ตัวบรรจง                 | (.....) | ตัวบรรจง                 | (นาย จิรายุส สเลอาด)  |
| ตำแหน่ง                  |         | ตำแหน่ง                  | Specialist, Technical Service.  |
| วันที่ / ประทับตราบริษัท |         | วันที่ / ประทับตราบริษัท | 15/05/2024  |



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

Part 3: ตรวจสอบเช็คสภาพเครื่อง

Front and rear view of KT-L version



| No. |  | PASS                                | Fail                     | N/A                                 | Remark     |
|-----|--|-------------------------------------|--------------------------|-------------------------------------|------------|
| 1   | KJELDATHERM digestion block                            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | เสื่อมสภาพ |
| 2   | Insert rack  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 3   | Digestion tube   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 4   | Stainless steel drip tray                              | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 5   | Exhaust manifold                                       | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 6   | Controls module, removable                             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 7   | Handle for insert rack                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 8   | Mains switch with overcurrent protection function      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 9   | Connection for lift unit                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 10  | Mains cable with plug                                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 11  | Power supply for TURBOSOG                              | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 12  | Connects controller module to block                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 13  | Connection for fan for cooling samples (optional)      | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |            |
| 14  | Connection for external cooling water valve (optional) | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |            |
| 15  | Connects controller module to block                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 16  | Connection for Iso-Versinic hose (extraction)          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 17  | Excess temperature fuse                                | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 18  | Lift   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |

## Part 4: สะเอียดและรายงานผลการให้บริการ Preventive Maintenance

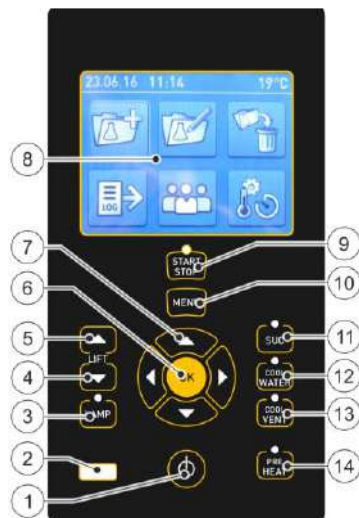
### 4.1 ตรวจเช็คระบบไฟฟ้า

|                           | Pass                                | Fai                      | N/A                      | Remark |
|---------------------------|-------------------------------------|--------------------------|--------------------------|--------|
| ใช้ไฟ 220 V 50 Hz         | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | .....  |
| กระแสไฟฟ้าตามพิกัดเครื่อง | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | .....  |

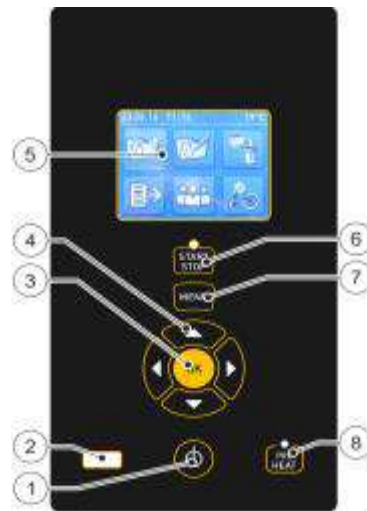
### 4.2 ตรวจสอบสภาพอุปกรณ์ภายนอก

|                             | Pass                                | Fail                     | N/A                                 | Remark     |
|-----------------------------|-------------------------------------|--------------------------|-------------------------------------|------------|
| สายไฟของเครื่อง             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....      |
| ท่อแก๊วรวมไอรกด             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....      |
| สายยางต่อกับท่อแก๊วรวมไอรกด | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....      |
| สภาพของ Aluminum block      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | เสื่อมสภาพ |
| การขึ้นลงของ Lift           | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....      |
| Light                       | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....      |
| Current Switch              | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....      |
| Thermostat                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....      |

#### 4.3 ตรวจสอบระบบการทำงาน



☐ KT-L



☒ KT

|  | Pass                                | Fail                     | N/A                                 | Remark |
|--|-------------------------------------|--------------------------|-------------------------------------|--------|
| Switch controller on or off.                     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| USB port   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| LAMP button                                      | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| LIFT down button                                 | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| LIFT up button                                   | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| OK button  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| Navigation buttons                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| Display  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| START/STOP button                                | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| MENU button                                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| SUC button                                       | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| COOLWATER button (optional)                      | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| COOL VENT button (optional)                      | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| PRE HEAT button                                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| การขึ้นของอุณหภูมิมากกว่า10องศาต่อนาทีที่250องศา | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| การทำงานของตัวป้องกันอุณหภูมิสูงเกิน             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| การทำงานของระบบควบคุมอุณหภูมิ                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |

## การบำรุงรักษาทั่วไป (Basic maintenance)

1. การย่อยตัวอย่างเกิดการเดือดที่รุนแรงอันเนื่องมาจากตัวอย่างนั้นสามารถป้องกันได้โดยแนะนำให้ย่อยด้วยการตั้งการเพิ่มอุณหภูมิเป็นระดับเช่น ย่อยที่ระดับอุณหภูมิ 250 C ครบเวลา 15 นาทีจึงเปลี่ยนเป็นอุณหภูมิ 380 C เพื่อป้องกันการล้นออกมา
2. เมื่อใช้เสร็จไม่ควรปล่อยให้ Tube เย็นกับตัวเครื่อง
3. ต้องนำถาดรองไอกรดใส่ทุกครั้งหลังจากใช้งานเสร็จ เพื่อป้องกันการหยดของไอกรดที่จะหยดลงมาที่ตัวเครื่อง
4. ทำความสะอาดตัวหลุมย่อยด้วยน้ำหรือผ้าชุบน้ำในกรณีที่มีคราบกรดหยดลงมาติดอยู่ในหลุม  
เพื่อป้องกันไม่ให้คราบดังกล่าวไปกั้นการแผ่อุณหภูมิ



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



## CERTIFICATE OF CALIBRATION

Certificate No : S2024/180

Page : 1/5

Order No : 243/2024

Customer : C.E.M Technology (Thailand) Co., Ltd  
Address : 219/43 Moo 12 Phet Kasem Rd., Omnoi, Krathum Baen, Samut Sakhon 74130  
Instrument : UV/VIS spectrophotometer  
Manufacture : Merck  
Model : Prove 100  
Serial Number : 1714112078  
Environment : Temperature (26.9 - 27.6) °C  
Humidity (74 - 72) %RH  
Received Date : September 24, 2024  
Calibration Date : September 24, 2024  
Issued Date : September 30, 2024  
Calibrate Status : No Adjustment  
Calibration Area : Customer area  
Roomname : Laboratory Room of C.E.M Technology (Thailand) Co., Ltd

Calibrated By : Pacharapol  
( Mr. Pacharapol Kwanbang )  
Calibration Engineer

Approved By : Wanchai  
( Mr. Wanchai Meesiri )  
Manager

This calibration certificate shall not be reproduced other than in full except with the prior written approval of the Bangkok High Lab Co.,Ltd.





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Certificate No : S2024/180

Page : 2/5

## 1. Photometric Accuracy

CRMs: Neutral Density Glass Filters

CRMs Serial Number: 10563

Traceability: Traceable to NIST, U.S.A. through Neutral density filters NIST SRM 930e & 1930, Double Aperture method through Starna certificate report no.113594

Spectral slit width : 4.00 nm

### 1.1 Reading scale at 420.0 nm

| Filter STDs (Abs)<br>Certificate | Average Measured<br>Value (A) | Correction<br>(A) | Uncertainty<br>± (A) |
|----------------------------------|-------------------------------|-------------------|----------------------|
| 0.0000                           | 0.000                         | 0.0000            | 0.0028               |
| 0.5604                           | 0.559                         | 0.0014            | 0.0044               |
| 1.0723                           | 1.071                         | 0.0013            | 0.0038               |
| 2.1753                           | 2.171                         | 0.0043            | 0.0064               |

### 1.2 Reading scale at 440.0 nm

| Filter STDs (Abs)<br>Certificate | Average Measured<br>Value (A) | Correction<br>(A) | Uncertainty<br>± (A) |
|----------------------------------|-------------------------------|-------------------|----------------------|
| 0.0000                           | 0.000                         | 0.0000            | 0.0028               |
| 0.5503                           | 0.549                         | 0.0013            | 0.0040               |
| 1.0467                           | 1.045                         | 0.0017            | 0.0040               |
| 2.1117                           | 2.111                         | 0.0007            | 0.0064               |

### 1.3 Reading scale at 465.0 nm

| Filter STDs (Abs)<br>Certificate | Average Measured<br>Value (A) | Correction<br>(A) | Uncertainty<br>± (A) |
|----------------------------------|-------------------------------|-------------------|----------------------|
| 0.0000                           | 0.000                         | 0.0000            | 0.0028               |
| 0.4996                           | 0.499                         | 0.0006            | 0.0034               |
| 0.9649                           | 0.964                         | 0.0009            | 0.0040               |
| 1.9646                           | 1.963                         | 0.0016            | 0.0060               |

### 1.4 Reading scale at 546.1 nm

| Filter STDs (Abs)<br>Certificate | Average Measured<br>Value (A) | Correction<br>(A) | Uncertainty<br>± (A) |
|----------------------------------|-------------------------------|-------------------|----------------------|
| 0.0000                           | 0.000                         | 0.0000            | 0.0028               |
| 0.5136                           | 0.512                         | 0.0016            | 0.0028               |
| 0.9765                           | 0.976                         | 0.0005            | 0.0028               |
| 1.9848                           | 1.982                         | 0.0028            | 0.0064               |



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Certificate No : S2024/180

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1.5 Reading scale at 590.0 nm

| Filter STDs (Abs)<br>Certificate | Average Measured<br>Value (A) | Correction<br>(A) | Uncertainty<br>± (A) |
|----------------------------------|-------------------------------|-------------------|----------------------|
| 0.0000                           | 0.000                         | 0.0000            | 0.0028               |
| 0.5424                           | 0.540                         | 0.0024            | 0.0029               |
| 1.0130                           | 1.012                         | 0.0010            | 0.0029               |
| 2.0238                           | 2.019                         | 0.0048            | 0.0061               |

1.6 Reading scale at 635.0 nm

| Filter STDs (Abs)<br>Certificate | Average Measured<br>Value (A) | Correction<br>(A) | Uncertainty<br>± (A) |
|----------------------------------|-------------------------------|-------------------|----------------------|
| 0.0000                           | 0.000                         | 0.0000            | 0.0028               |
| 0.5265                           | 0.525                         | 0.0015            | 0.0030               |
| 0.9667                           | 0.964                         | 0.0027            | 0.0031               |
| 1.9145                           | 1.911                         | 0.0035            | 0.0062               |

2. Photometric Accuracy

CRMs: Potassium Dichromate in Perchloric acid

CRMs Serial Number: 132023

Blank Serial Number: 128038

Traceability: Traceable to NIST, U.S.A. through crystalline potassium dichromate NIST SRM 935a through Starna certificate report no.120920

Spectral slit width : 4.00 nm

| Wavelength<br>(nm) | Certificate<br>(Abs) | Average Measured<br>Value (A) | Correction<br>(A) | Uncertainty<br>± (A) |
|--------------------|----------------------|-------------------------------|-------------------|----------------------|
| 235                | 0.0000               | #N/A                          | #N/A              | #N/A                 |
|                    | 0.7351               | #N/A                          | #N/A              | #N/A                 |
| 257                | 0.0000               | #N/A                          | #N/A              | #N/A                 |
|                    | 0.8564               | #N/A                          | #N/A              | #N/A                 |
| 313                | 0.0000               | #N/A                          | #N/A              | #N/A                 |
|                    | 0.2855               | #N/A                          | #N/A              | #N/A                 |
| 350                | 0.0000               | #N/A                          | #N/A              | #N/A                 |
|                    | 0.6363               | #N/A                          | #N/A              | #N/A                 |





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Certificate No : S2024/180

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### 3. Wavelength Accuracy

Spectral slit width : 4.00 nm

#### 3.1 CRMs: Holmium Glass Filter

CRMs Serial Number: 10763

Traceability Traceable to NIST Holmium oxide filter NIST SRM 2034, through Starna certificate report no. 113607

| Filter STDs (nm)<br>Certificate | Average Measured<br>Value (nm) | Correction<br>(nm) | Uncertainty<br>± (nm) |
|---------------------------------|--------------------------------|--------------------|-----------------------|
| 241.54                          | #N/A                           | #N/A               | #N/A                  |
| 279.40                          | #N/A                           | #N/A               | #N/A                  |
| 288.70                          | #N/A                           | #N/A               | #N/A                  |
| 334.22                          | 333.9                          | 0.32               | 0.12                  |
| 361.26                          | 361.1                          | 0.16               | 0.12                  |
| 418.48                          | 418.8                          | -0.32              | 0.12                  |
| 453.20                          | 453.3                          | -0.10              | 0.12                  |
| 460.06                          | 460.0                          | 0.06               | 0.12                  |
| 536.90                          | 536.4                          | 0.50               | 0.12                  |
| 637.94                          | 637.6                          | 0.34               | 0.12                  |

#### 3.2 CRMs: Didymium Glass Filter

CRMs Serial Number: 10764

Traceability Traceable to NIST Didymium filter NIST SRM 2034, through Starna certificate report no. 113608

| Filter STDs (nm)<br>Certificate | Average Measured<br>Value (nm) | Correction<br>(nm) | Uncertainty<br>± (nm) |
|---------------------------------|--------------------------------|--------------------|-----------------------|
| 585.48                          | 585.3                          | 0.18               | 0.12                  |
| 684.63                          | 684.6                          | 0.03               | 0.12                  |
| 740.27                          | 740.3                          | -0.03              | 0.12                  |
| 748.28                          | 748.7                          | -0.42              | 0.12                  |
| 807.16                          | 807.4                          | -0.24              | 0.12                  |
| 879.70                          | 879.3                          | 0.40               | 0.12                  |



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NSC-TISI-TIS 17025  
CALIBRATION 0366

Certificate No : S2024/180

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#### 4. \*Stray Light

CRMs: Potassium Chloride aqueous solution

CRMs Serial Number: 14912

Blank Serial Number: 14958

Traceability Traceable to NIST, U.S.A. potassium chloride NIST SRM2032, through Starna certificate report no.113597

Spectral slit width : 4.00 nm

| Wavelength<br>(nm) | Certificate | Average Measured |
|--------------------|-------------|------------------|
| 201.13             | >2A         | #N/A             |
| 201.13             | <1%T        | #N/A             |

#### 5. \*Spectral Resolution

CRMs: Toluene in Hexane

CRMs Serial Number: 14812

Blank Serial Number: 14803

Traceability Traceable to toluene in hexane NIST SRM2034,through Starna certificate report no. 113598

| Spectral slit width<br>(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: 1 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 -





# THAI CALIBRATION SERVICES CO., LTD.

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

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



## CALIBRATION CERTIFICATE

Certificate No.S2403073S

page 1 of 2

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

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

**Manufacturer :** Sartorius **Order No. :** 67S0768-1

**Model :** BSA224S-CW **Ambient temperature :**  $(22.5 \pm 5.0) ^\circ\text{C}$

**Accuracy class :** - **Relative humidity :**  $(47.0 \pm 10.0) \%$

**Capacity :** 220 g **Received date :** 02-Mar-2024

**Resolution :** 0.0001 g **Date of calibration :** 02-Mar-2024

**Serial No. :** 3139614148 **Date of issue :** 04-Mar-2024

**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 ( $\text{kg/m}^3$ ) |
|-----------------------|---------------|-------------|-----------------|------------|-----------------------------|
| 1 Standard weight set | 1 mg to 2 kg  | 15885+15849 | M2310001S       | 7-Oct-2024 | 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 : Sathaporn Rueangpluppla  
Technician

Approved Signatory :

Chonlatee Pongwatvisanon

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





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## CALIBRATION CERTIFICATE

Certificate No.S2403073S

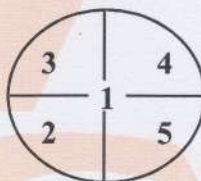
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### The repeatability of indication

| Nominal Value<br>( g ) | Standard Deviation of reading<br>( g ) | Maximum difference between<br>successive reading ( g ) | n |
|------------------------|--|--|---|
| 200                    | 0.00005                                | 0.0001   | 5 |

### The effect of eccentric application of a load on the indication (test load : 100 g)

| Position        | Balance Reading<br>( g ) |
|-----------------|--------------------------|
| Point 1         | 100.0000                 |
| Point 2         | 100.0000                 |
| Point 3         | 99.9999                  |
| Point 4         | 99.9999                  |
| Point 5         | 100.0000                 |
| Eccentric Value | 0.0001                   |



### The error of indication

| Nominal Value<br>( g ) | Value of Reference<br>Standard Weight<br>( g ) | Balance Reading<br>( g ) | Correction<br>( g ) | Uncertainty ( $\pm$ )<br>( g ) | k    |
|------------------------|--|--------------------------|---------------------|--------------------------------|------|
| Unload                 | 0.0000   | 0.0000                   | 0.0000              | 0.00016                        | 2.32 |
| 1                      | 1.0000   | 1.0000                   | 0.0000              | 0.00016                        | 2.28 |
| 2                      | 2.0000   | 2.0000                   | 0.0000              | 0.00016                        | 2.28 |
| 5                      | 5.0000   | 5.0000                   | 0.0000              | 0.00017                        | 2.28 |
| 10                     | 10.0000  | 9.9999                   | +0.0001             | 0.00017                        | 2.25 |
| 20                     | 20.0000  | 20.0000                  | 0.0000              | 0.00017                        | 2.21 |
| 50                     | 50.0000  | 49.9999                  | +0.0001             | 0.00017                        | 2.17 |
| 100                    | 99.9999  | 100.0000                 | -0.0001             | 0.00020                        | 2.08 |
| 120                    | 120.0000                                       | 119.9999                 | +0.0001             | 0.00023                        | 2.04 |
| 150                    | 150.0000                                       | 149.9999                 | +0.0001             | 0.00025                        | 2.03 |
| 200                    | 199.9999                                       | 199.9996                 | +0.0003             | 0.00028                        | 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--