

# ภาคผนวก ง

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เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์



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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

| Sample Name | Parameter                    | Equipment Name       | ID No.     | Calibrated Date | Next Cal  | Freq. Calibrate (Months) |
|-------------|------------------------------|----------------------|------------|-----------------|-----------|--------------------------|
| Noise       | Leq 24 hrs                   | Sound Calibrator     | RYG_FS0496 | 17-Jan-23       | 17-Jan-24 | 12                       |
| Noise       | Leq 24 hrs                   | Sound Level Meter    | RYG_FS0493 | 13-Jan-23       | 13-Jan-24 | 12                       |
| Noise       | Noise Annoyance              | Sound Calibrator     | RYG_FS0496 | 17-Jan-23       | 17-Jan-24 | 12                       |
| Noise       | Noise Annoyance              | Sound Level Meter    | RYG_FS0493 | 13-Jan-23       | 13-Jan-24 | 12                       |
| Noise       | Noise Annoyance              | Sound Calibrator     | RYG_FS0213 | 26-Jan-23       | 26-Jan-24 | 12                       |
| Noise       | Noise Annoyance              | Sound Level Meter    | RYG_FS0023 | 13-Jan-23       | 13-Jan-24 | 12                       |
| Rayong Lab  | pH at 25 °C                  | pH meter             | RYG_EN0183 | 27-Feb-23       | 27-Feb-24 | 12                       |
| Rayong Lab  | Color (at Original pH)       | SPECTROPHOTOMETER    | RYG_EN0037 | 18-Sep-23       | 18-Mar-25 | 18                       |
| Rayong Lab  | Color (at pH 7.0)            | SPECTROPHOTOMETER    | RYG_EN0037 | 18-Sep-23       | 18-Mar-25 | 18                       |
| Rayong Lab  | BOD                          | DO meter with Sensor | RYG_EN0032 | 24-Jul-23       | 24-Jan-25 | 18                       |
| Rayong Lab  | BOD                          | Incubator            | RYG_EN0154 | 29-May-23       | 29-Nov-24 | 18                       |
| Rayong Lab  | COD                          | SPECTROPHOTOMETER    | RYG_EN0037 | 18-Sep-23       | 18-Mar-25 | 18                       |
| Rayong Lab  | Total Suspended Solids       | Electronic Balance   | RYG_EN0002 | 1-Mar-23        | 1-Mar-24  | 12                       |
| Rayong Lab  | Total Suspended Solids       | Hot Air Oven         | RYG_EN0010 | 20-Oct-22       | 20-Apr-24 | 18                       |
| Rayong Lab  | Total Dissolved Solids 180°C | Electronic Balance   | RYG_EN0002 | 1-Mar-23        | 1-Mar-24  | 12                       |
| Rayong Lab  | Total Dissolved Solids 180°C | Hot Air Oven         | RYG_EN0010 | 20-Oct-22       | 20-Apr-24 | 18                       |
| Rayong Lab  | Oil & Grease                 | Electronic Balance   | RYG_EN0002 | 1-Mar-23        | 1-Mar-24  | 12                       |
| Rayong Lab  | Oil & Grease                 | Hot Air Oven         | RYG_EN0006 | 20-Oct-22       | 20-Apr-24 | 18                       |
| Rayong Lab  | Oil & Grease                 | Water Bath           | RYG_EN0061 | 20-Oct-22       | 20-Apr-24 | 18                       |
| Rayong Lab  | Temperature                  | pH meter             | RYG_FS0574 | 3-Apr-23        | 3-Apr-24  | 12                       |
| Water Lab   | Total Organic carbon         | TOC Analyzer         | BKK_EN0066 | 11-May-23       | 11-May-24 | 12                       |

# SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangumru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com



NSC-TISI-TIS 17025  
CALIBRATION 0394

Cert. No. : ACC23005

Pages : 1 of 3

## Calibration Certificate

**Equipment :** SOUND CALIBRATOR  
**Manufacturer :** RION  
**Model :** NC-75  
**Serial No.:** 35002736  
**ID No.:** RYG\_FS0496

**Condition As Found :** GOOD

**Customer :** ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAEANG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

**Location :** -  
**Ambient Temperature :** ( 23.0 ± 3 ) °C  
**Pressure :** ( 101.3 ± 3 ) kPa  
**Relative Humidity :** ( 50.0 ± 20 ) %

**Received Date :** 06 JANUARY 2023  
**Calibration Date :** 17 JANUARY 2023  
**Date of Issue :** 19 JANUARY 2023



**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :** T. Petchurai  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

Continuation of Calibration Certificate

Cert. No. : ACC23005  
Job No. : VC66AC0024  
Pages : 2 of 3

Calibration Procedure : CP-AC-03

**Calibration Method :**

This equipment was calibrated by based on IEC-60942-2003 Standard.

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

**Condition of this result of calibration :**

1. Reference Standard Instruments :

| Instrument              | Model     | Serial No. | Cert. No.       | Due Date  |
|-------------------------|-----------|------------|-----------------|-----------|
| Waveform Generator      | 33511B    | MY52302742 | EF-0008-22      | 04-Feb-23 |
| Digital Multimeter      | 33461A    | MY53220104 | EEL.BP. 04/0265 | 09-Feb-23 |
| Digital Multimeter      | 33461A    | MY53220076 | EEL.BP. 03/0265 | 09-Feb-23 |
| Digital Multimeter      | 33461A    | MY60024273 | EEL.BP. 05/0265 | 09-Feb-23 |
| Programmable Attenuator | MAT-1070  | 62100114   | EF-0009-22      | 07-Feb-23 |
| Condenser Microphone    | 4180      | 2977900    | AA-1013-22      | 24-Feb-23 |
| Measuring Amplifier     | NA-42KAI  | 34560495   | AA-3005-22      | 22-Feb-23 |
| Audio Analyzer          | AVR-3360A | V744B6069  | EF-0010-22      | 07-Feb-23 |

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Continuation of Calibration Certificate

Cert. No. : ACC23005  
Job No. : VC66AC0024  
Pages : 3 of 3

**Result of calibration :**

**1. Sound pressure level**

| Specified sound pressure level (dB) | Measured value (dB) | Deviated value (dB) | Uncertainty (dB) | Tolerance limit (dB) |
|-------------------------------------|---------------------|---------------------|------------------|----------------------|
| 94                                  | 93.98               | -0.02               | 0.14             | 0.40                 |

**2. Frequency**

| Specified Frequency (Hz) | Measured value (Hz) | Deviated value ( % ) | Uncertainty ( % ) | Tolerance limit ( % ) |
|--------------------------|---------------------|----------------------|-------------------|-----------------------|
| 1000                     | 1000.0              | 0.0                  | 0.1               | 1.0                   |

**3. Total distortion**

| Measured value ( % ) | Uncertainty ( % ) | Tolerance limit ( % ) |
|----------------------|-------------------|-----------------------|
| 0.35                 | 0.10              | 3.0                   |

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

*P. P. P.*

*P. P. P.*

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Cert. No. : ACL23043  
Pages : 1 of 8

## Calibration Certificate

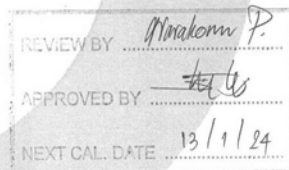
**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00900072 / 188465 / 01734  
**ID No.:** RYG\_FS0493

**Condition As Found :** GOOD

**Customer :** ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

**Location :** -  
**Ambient Temperature :** ( 23.0  $\pm$  3 ) °C  
**Pressure :** ( 101.3  $\pm$  3 ) kPa  
**Relative Humidity :** ( 50.0  $\pm$  20 ) %

**Received Date :** 06 JANUARY 2023  
**Calibration Date :** 13-18 JANUARY 2023  
**Date of Issue :** 19 JANUARY 2023



**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

*T. Petchurai*  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

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SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL23043  
Job No. : VC66AC0024  
Pages : 2 of 8

**Calibration Procedure :** CP-AC-01

### Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

### Condition of this result of calibration :

#### 1. Reference Standard Instruments :

| Instrument              | Model    | Serial No. | Cert. No.       | Due Date  |
|-------------------------|----------|------------|-----------------|-----------|
| Waveform Generator      | 33210A   | MY48017076 | EF-0007-22      | 04-Feb-23 |
| Waveform Generator      | 33511B   | MY52302742 | EF-0008-22      | 04-Feb-23 |
| Digital Multimeter      | 33461A   | MY53220104 | EEL.BP. 04/0265 | 09-Feb-23 |
| Digital Multimeter      | 33461A   | MY53220076 | EEL.BP. 03/0265 | 09-Feb-23 |
| Digital Multimeter      | 34461A   | MY60024273 | EEL.BP. 05/0265 | 09-Feb-23 |
| Programmable Attenuator | MAT-1070 | 62100114   | EF-0009-22      | 07-Feb-23 |
| Condenser Microphone    | 4180     | 2977900    | AA-1013-22      | 24-Feb-23 |
| Measuring Amplifier     | NA-42KAI | 34560495   | AA-3005-22      | 22-Feb-23 |

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

*T. Petchurai*



## Continuation of Calibration Certificate

Cert. No. : ACL23043  
Job No. : VC66AC0024  
Pages : 3 of 8

## Summary of Measurement Result :

| Parameter  | Pass | Fail | Uncertainty<br>(dB) | Maximum-permitted<br>uncertainty of<br>measurement (dB) |
|--|------|------|---------------------|---|
| 1. Absolute sensitivity                              | ✓    | -    | 0.2                 | N/A   |
| 2. Self-generated noise                              | ✓    | -    | 0.2                 | N/A   |
| 3. Acoustical signal tests of frequency weightings   |      |      |                     |   |
| 125 Hz   | ✓    | -    | 0.3                 | 0.6   |
| 1000 Hz  | ✓    | -    | 0.3                 | 0.6   |
| 8000 Hz  | ✓    | -    | 0.3                 | 0.7   |
| 4. Electrical signal tests of frequency weightings   |      |      |                     |   |
| For 10 Hz to 4 kHz                                   | ✓    | -    | 0.3                 | 0.6   |
| For > 4 kHz to 10 kHz                                | ✓    | -    | 0.3                 | 0.7   |
| For > 10 kHz to 20 kHz                               | -    | -    | -                   | 1.0   |
| 5. Frequency and time weightings at 1 kHz            | ✓    | -    | 0.2                 | 0.2   |
| 6. Long - term stability                             | ✓    | -    | 0.1                 | 0.1   |
| 7. Level linearity on the reference level range      | ✓    | -    | 0.2                 | 0.3   |
| 8. Level linearity including the level range control | ✓    | -    | 0.2                 | 0.3   |
| 9. Tone burst response                               | ✓    | -    | 0.2                 | 0.3   |
| 10. Peak C sound level                               | ✓    | -    | 0.2                 | 0.35  |
| 11. Overload indication                              | ✓    | -    | 0.2                 | 0.25  |
| 12. High level stability                             | ✓    | -    | 0.1                 | 0.1   |

## Continuation of Calibration Certificate

Cert. No. : ACL23043  
Job No. : VC66AC0024  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

| Reference<br>Acoustic Signal<br>( dB ) | Measured<br>Value<br>( dB ) | Deviation<br>( dB ) | Acceptance<br>Limit<br>( dB ) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.95)                           | 93.9                        | 0.0                 | ±0.3                          |

## 2. Self-generated noise

## 2.1 Normal test

| Measured Value<br>( dB ) |
|--------------------------|
| 14.2                     |

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

| Frequency<br>Weighting | Measured value<br>( dB ) |
|------------------------|--------------------------|
| A - weight             | 10.8                     |
| C - weight             | 17.2                     |
| Flat                   | 22.9                     |

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

| Frequency<br>( Hz ) | Deviation from various frequency weighting response curve (dB) |          |          |                      |
|---------------------|--|----------|----------|----------------------|
|                     | Flat   | C-weight | A-weight | Acceptance<br>Limits |
| 125                 | 0.3  | 0.3      | 0.3      | ± 1.5                |
| 1000                | 0.0  | 0.0      | 0.0      | ± 1.0                |
| 8000                | -1.0   | -0.9     | -0.9     | ±5.0                 |

Continuation of Calibration Certificate

Cert. No. : ACL23043  
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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

| Frequency<br>( Hz ) | Deviation from various frequency weighting response curve (dB) |          |          |                      |
|---------------------|--|----------|----------|----------------------|
|                     | Flat   | C-weight | A-weight | Acceptance<br>Limits |
| 63                  | -0.1   | -0.1     | -0.1     | ±2.0                 |
| 125                 | -0.1   | 0.0      | -0.1     | ±1.5                 |
| 250                 | 0.0  | 0.0      | -0.1     | ±1.5                 |
| 500                 | 0.0  | 0.0      | -0.1     | ±1.5                 |
| 1000                | 0.0  | 0.0      | 0.0      | ±1.0                 |
| 2000                | 0.0  | 0.0      | 0.0      | ±2.0                 |
| 4000                | 0.0  | 0.0      | 0.0      | ±3.0                 |
| 8000                | 0.0  | 0.1      | 0.1      | ±5.0                 |

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

| Frequency<br>Weighting | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|------------------------|-----------------------------|-----------------------------|--------------------------------|
| A - weight             | 94.0                        | 0.0                         | -                              |
| C - weight             | 94.0                        | 0.0                         | ± 0.2                          |
| Flat                   | 94.0                        | 0.0                         | ± 0.2                          |

5.2 Time weighting at 1 kHz

| Frequency<br>Weighting | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast                   | 94.0                        | 0.0                         | -                              |
| Slow                   | 94.0                        | 0.0                         | ± 0.1                          |
| Leq                    | 94.0                        | 0.0                         | ± 0.1                          |

6. Long - term stability

| Frequency<br>Weighting | SLM Display<br>at initial<br>( dB ) | SLM Display<br>at final<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight             | 94.0                                | 94.0                              | 0.0                         | ± 0.3                          |

*T. R. R. R.*

Continuation of Calibration Certificate

Cert. No. : ACL23043  
Job No. : VC66AC0024  
Pages : 6 of 8

7. Level linearity on the reference level range

| Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 137.0                          | 137.0                       | 0.0                         | ± 1.1                          |
| 136.0                          | 136.0                       | 0.0                         | ± 1.1                          |
| 135.0                          | 135.0                       | 0.0                         | ± 1.1                          |
| 134.0                          | 134.0                       | 0.0                         | ± 1.1                          |
| 133.0                          | 133.0                       | 0.0                         | ± 1.1                          |
| 132.0                          | 132.0                       | 0.0                         | ± 1.1                          |
| 131.0                          | 131.0                       | 0.0                         | ± 1.1                          |
| 129.0                          | 129.0                       | 0.0                         | ± 1.1                          |
| 124.0                          | 124.0                       | 0.0                         | ± 1.1                          |
| 119.0                          | 119.0                       | 0.0                         | ± 1.1                          |
| 114.0                          | 114.0                       | 0.0                         | ± 1.1                          |
| 109.0                          | 109.0                       | 0.0                         | ± 1.1                          |
| 104.0                          | 104.0                       | 0.0                         | ± 1.1                          |
| 99.0                           | 99.0                        | 0.0                         | ± 1.1                          |
| 94.0                           | 94.0                        | 0.0                         | ± 1.1                          |
| 89.0                           | 89.0                        | 0.0                         | ± 1.1                          |
| 84.0                           | 84.0                        | 0.0                         | ± 1.1                          |
| 79.0                           | 79.0                        | 0.0                         | ± 1.1                          |
| 74.0                           | 74.0                        | 0.0                         | ± 1.1                          |
| 69.0                           | 69.0                        | 0.0                         | ± 1.1                          |
| 64.0                           | 64.0                        | 0.0                         | ± 1.1                          |
| 59.0                           | 59.0                        | 0.0                         | ± 1.1                          |
| 54.0                           | 54.0                        | 0.0                         | ± 1.1                          |
| 49.0                           | 49.0                        | 0.0                         | ± 1.1                          |
| 44.0                           | 44.0                        | 0.0                         | ± 1.1                          |
| 39.0                           | 39.0                        | 0.0                         | ± 1.1                          |
| 34.0                           | 34.0                        | 0.0                         | ± 1.1                          |
| 30.0                           | 30.0                        | 0.0                         | ± 1.1                          |
| 29.0                           | 28.9                        | -0.1                        | ± 1.1                          |
| 28.0                           | 28.0                        | 0.0                         | ± 1.1                          |
| 27.0                           | 26.9                        | -0.1                        | ± 1.1                          |
| 26.0                           | 25.9                        | -0.1                        | ± 1.1                          |
| 25.0                           | 24.9                        | -0.1                        | ± 1.1                          |

*T. R. R. R.*

Continuation of Calibration Certificate

Cert. No. : ACL23043  
Job No. : VC66AC0024  
Pages : 7 of 8

8. Level linearity including the level range control

| Range | Anticipated Value ( dB ) | Measured Value ( dB ) | Deviated Value ( dB ) | Acceptance Limits ( dB ) |
|-------|--------------------------|-----------------------|-----------------------|--------------------------|
| Auto  | 94.0                     | 94.0                  | 0.0                   | ±1.1                     |

9. Tone burst response

| Time Weighting | Tone burst duration, Tb ( ms ) | Cycle | Anticipated Value ( dB ) | Measured Value ( dB ) | Deviated Value ( dB ) | Acceptance Limits ( dB ) |
|----------------|--------------------------------|-------|--------------------------|-----------------------|-----------------------|--------------------------|
| Fast           | 0.25                           | 1     | 108.0                    | 107.9                 | -0.1                  | 1.5 ; -5.0               |
|                | 2                              | 8     | 117.0                    | 117.0                 | 0.0                   | 1.0 ; -2.5               |
|                | 200                            | 800   | 134.0                    | 134.0                 | 0.0                   | ±1.0                     |
| Slow           | 2                              | 8     | 108.0                    | 108.0                 | 0.0                   | 1.5 ; -5.0               |
|                | 200                            | 800   | 127.6                    | 127.6                 | 0.0                   | ±1.0                     |
| SEL            | 0.25                           | 1     | 99.0                     | 98.9                  | -0.1                  | 1.5 ; -5.0               |
|                | 2                              | 8     | 108.0                    | 108.0                 | 0.0                   | 1.0 ; -2.5               |
|                | 200                            | 800   | 128.0                    | 128.0                 | 0.0                   | ±1.0                     |

10. Peak C sound level

| Number of cycle in test signal | Anticipated Value ( dB ) | Measured Value, L <sub>cpeak</sub> ( dB ) | Deviated Value ( dB ) | Acceptance Limits ( dB ) |
|--------------------------------|--------------------------|---|-----------------------|--------------------------|
| Continuous                     | 133.0                    | 133.0                                     | 0.0                   | -                        |
| One                            | 136.4                    | 136.4                                     | 0.0                   | ±3.0                     |

| Number of cycle in test signal | Anticipated Value ( dB ) | Measured Value ( dB ) | Deviated Value ( dB ) | Acceptance Limits ( dB ) |
|--------------------------------|--------------------------|-----------------------|-----------------------|--------------------------|
| Continuous                     | 133.0                    | 133.0                 | 0.0                   | -                        |
| Positive half cycle            | 135.4                    | 135.1                 | -0.3                  | ±2.0                     |
| Negative half cycle            | 135.4                    | 135.1                 | -0.3                  | ±2.0                     |

Continuation of Calibration Certificate

Cert. No. : ACL23043  
Job No. : VC66AC0024  
Pages : 8 of 8

11. Overload indication

| Measured value ( dB )   |                         | Deviated Value ( dB ) | Acceptance Limits ( dB ) |
|-------------------------|-------------------------|-----------------------|--------------------------|
| Positive one-half cycle | Negative one-half cycle |                       |                          |
| 89.6                    | 89.6                    | 0.0                   | ±1.5                     |

12. High level stability

| Frequency Weighting | SLM Display at initial ( dB ) | SLM Display at final ( dB ) | Deviated Value ( dB ) | Acceptance Limits ( dB ) |
|---------------------|-------------------------------|-----------------------------|-----------------------|--------------------------|
| A - weight          | 137.0                         | 137.0                       | 0.0                   | ±0.3                     |

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

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Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACC23009  
Pages : 1 of 3

## Calibration Certificate

**Equipment :** SOUND CALIBRATOR  
**Manufacturer :** RION  
**Model :** NC-74  
**Serial No.:** 34178121  
**ID No.:** RYG\_FS0213

**Condition As Found :** GOOD

**Customer :** ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAEANG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

**Location :** -  
**Ambient Temperature :** ( 23.0 ± 3 ) °C  
**Pressure :** ( 101.3 ± 3 ) kPa  
**Relative Humidity :** ( 50.0 ± 20 ) %

**Received Date :** 24 JANUARY 2023  
**Calibration Date :** 26 JANUARY 2023  
**Date of Issue :** 27 JANUARY 2023

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

*T. Petchurai*  
( Thanakul Petchurai )

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# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACC23009  
Job No. : VC66AC0031  
Pages : 2 of 3

**Calibration Procedure :** CP-AC-03

### Calibration Method :

This equipment was calibrated by based on IEC-60942-2003 Standard.

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

### Condition of this result of calibration :

#### 1. Reference Standard Instruments :

| Instrument              | Model     | Serial No. | Cert. No.       | Due Date  |
|-------------------------|-----------|------------|-----------------|-----------|
| Waveform Generator      | 33511B    | MY52302742 | EF-0008-22      | 04-Feb-23 |
| Digital Multimeter      | 33461A    | MY53220104 | EEL.BP. 04/0265 | 09-Feb-23 |
| Digital Multimeter      | 33461A    | MY53220076 | EEL.BP. 03/0265 | 09-Feb-23 |
| Digital Multimeter      | 33461A    | MY60024273 | EEL.BP. 05/0265 | 09-Feb-23 |
| Programmable Attenuator | MAT-1070  | 62100114   | EF-0009-22      | 07-Feb-23 |
| Condenser Microphone    | 4180      | 2977900    | AA-1013-22      | 24-Feb-23 |
| Measuring Amplifier     | NA-42KAI  | 34560495   | AA-3005-22      | 22-Feb-23 |
| Audio Analyzer          | AVR-3360A | V744B6069  | EF-0010-22      | 07-Feb-23 |

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

*T. Petchurai*

Continuation of Calibration Certificate

Cert. No. : ACC23009  
Job No. : VC66AC0031  
Pages : 3 of 3

**Result of calibration :**

**1. Sound pressure level**

| Specified sound pressure level (dB) | Measured value (dB) | Deviated value (dB) | Uncertainty (dB) | Tolerance limit (dB) |
|-------------------------------------|---------------------|---------------------|------------------|----------------------|
| 94                                  | 94.16               | 0.16                | 0.14             | 0.40                 |

**2. Frequency**

| Specified Frequency (Hz) | Measured value (Hz) | Deviated value (%) | Uncertainty (%) | Tolerance limit (%) |
|--------------------------|---------------------|--------------------|-----------------|---------------------|
| 1000                     | 1003.2              | 0.3                | 0.1             | 1.0                 |

**3. Total distortion**

| Measured value (%) | Uncertainty (%) | Tolerance limit (%) |
|--------------------|-----------------|---------------------|
| 1.97               | 0.10            | 3.0                 |

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate



451-451/1 Sirinthorn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com

Cert. No. : ACL23048  
Pages : 1 of 8

**Calibration Certificate**

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 01222724 / 143842 / 22771  
**ID No.:** RYG\_FS0023

**Condition As Found :** GOOD

**Customer :** ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWANG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

**Location :** -  
**Ambient Temperature :** ( 23.0  $\pm$  3 ) °C  
**Pressure :** ( 101.3  $\pm$  3 ) kPa  
**Relative Humidity :** ( 50.0  $\pm$  20 ) %  
**Received Date :** 06 JANUARY 2023  
**Calibration Date :** 13-18 JANUARY 2023  
**Date of Issue :** 19 JANUARY 2023

|                |              |
|----------------|--------------|
| REVIEW BY      | Nathakorn P. |
| APPROVED BY    | T. Petchur   |
| NEXT CAL. DATE | 13/1/24      |

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

T. Petchur  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

Continuation of Calibration Certificate

Cert. No. : ACL23048  
Job No. : VC66AC0024  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

**Condition of this result of calibration :**

1. Reference Standard Instruments :

| Instrument              | Model    | Serial No. | Cert. No.       | Due Date  |
|-------------------------|----------|------------|-----------------|-----------|
| Waveform Generator      | 33210A   | MY48017076 | EF-0007-22      | 04-Feb-23 |
| Waveform Generator      | 33511B   | MY52302742 | EF-0008-22      | 04-Feb-23 |
| Digital Multimeter      | 33461A   | MY53220104 | EEL.BP. 04/0265 | 09-Feb-23 |
| Digital Multimeter      | 33461A   | MY53220076 | EEL.BP. 03/0265 | 09-Feb-23 |
| Digital Multimeter      | 34461A   | MY60024273 | EEL.BP. 05/0265 | 09-Feb-23 |
| Programmable Attenuator | MAT-1070 | 62100114   | EF-0009-22      | 07-Feb-23 |
| Condenser Microphone    | 4180     | 2977900    | AA-1013-22      | 24-Feb-23 |
| Measuring Amplifier     | NA-42KAI | 34560495   | AA-3005-22      | 22-Feb-23 |

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

*Handwritten signature*

Continuation of Calibration Certificate

Cert. No. : ACL23048  
Job No. : VC66AC0024  
Pages : 3 of 8

**Summary of Measurement Result :**

| Parameter  | Pass | Fail | Uncertainty (dB) | Maximum-permitted uncertainty of measurement (dB) |
|--|------|------|------------------|---|
| 1. Absolute sensitivity                              | ✓    | -    | 0.2              | N/A   |
| 2. Self-generated noise                              | ✓    | -    | 0.2              | N/A   |
| 3. Acoustical signal tests of frequency weightings   |      |      |                  |   |
| 125 Hz   | ✓    | -    | 0.3              | 0.6   |
| 1000 Hz  | ✓    | -    | 0.3              | 0.6   |
| 8000 Hz  | ✓    | -    | 0.3              | 0.7   |
| 4. Electrical signal tests of frequency weightings   |      |      |                  |   |
| For 10 Hz to 4 kHz                                   | ✓    | -    | 0.3              | 0.6   |
| For > 4 kHz to 10 kHz                                | ✓    | -    | 0.3              | 0.7   |
| For > 10 kHz to 20 kHz                               | -    | -    | -                | 1.0   |
| 5. Frequency and time weightings at 1 kHz            | ✓    | -    | 0.2              | 0.2   |
| 6. Long - term stability                             | ✓    | -    | 0.1              | 0.1   |
| 7. Level linearity on the reference level range      | ✓    | -    | 0.2              | 0.3   |
| 8. Level linearity including the level range control | ✓    | -    | 0.2              | 0.3   |
| 9. Tone burst response                               | ✓    | -    | 0.2              | 0.3   |
| 10. Peak C sound level                               | ✓    | -    | 0.2              | 0.35  |
| 11. Overload indication                              | ✓    | -    | 0.2              | 0.25  |
| 12. High level stability                             | ✓    | -    | 0.1              | 0.1   |

*Handwritten signature*

## Continuation of Calibration Certificate

Cert. No. : ACL23048  
Job No. : VC66AC0024  
Pages : 4 of 8

**Result of calibration :****1. Absolute sensitivity**

| Reference<br>Acoustic Signal<br>( dB ) | Measured<br>Value<br>( dB ) | Deviation<br>( dB ) | Acceptance<br>Limit<br>( dB ) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.95)                           | 93.9                        | 0.0                 | ±0.3                          |

**2. Self-generated noise**

## 2.1 Normal test

| Measured Value<br>( dB ) |
|--------------------------|
| 15.4                     |

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

| Frequency<br>Weighting | Measured value<br>( dB ) |
|------------------------|--------------------------|
| A - weight             | 11.2                     |
| C - weight             | 17.6                     |
| Flat                   | 23.4                     |

**3. Acoustical signal tests of frequency weightings**

Meter free-field acoustic response at a level of 84 dB

| Frequency<br>( Hz ) | Deviation from various frequency weighting response curve (dB) |          |          | Acceptance<br>Limits |
|---------------------|--|----------|----------|----------------------|
|                     | Flat   | C-weight | A-weight |                      |
| 125                 | 0.2  | 0.2      | 0.2      | ± 1.5                |
| 1000                | -0.1   | -0.1     | -0.1     | ± 1.0                |
| 8000                | -0.8   | -0.8     | -0.7     | ±5.0                 |

## Continuation of Calibration Certificate

Cert. No. : ACL23048  
Job No. : VC66AC0024  
Pages : 5 of 8

**4. Electrical signal tests of frequency weightings**

Weighting network response with relative to 1 kHz.

| Frequency<br>( Hz ) | Deviation from various frequency weighting response curve (dB) |          |          |                      |
|---------------------|--|----------|----------|----------------------|
|                     | Flat   | C-weight | A-weight | Acceptance<br>Limits |
| 63                  | -0.1   | -0.1     | 0.0      | ±2.0                 |
| 125                 | 0.0  | 0.0      | 0.0      | ±1.5                 |
| 250                 | 0.0  | 0.0      | 0.0      | ±1.5                 |
| 500                 | 0.0  | 0.0      | 0.0      | ±1.5                 |
| 1000                | 0.0  | 0.0      | 0.0      | ±1.0                 |
| 2000                | 0.0  | 0.0      | 0.0      | ±2.0                 |
| 4000                | 0.0  | 0.0      | 0.0      | ±3.0                 |
| 8000                | 0.0  | 0.1      | 0.1      | ±5.0                 |

**5. Frequency and time weightings at 1 kHz**

## 5.1 Frequency weightings at 1 kHz

| Frequency<br>Weighting | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|------------------------|-----------------------------|-----------------------------|--------------------------------|
| A - weight             | 94.0                        | 0.0                         | -                              |
| C - weight             | 94.0                        | 0.0                         | ± 0.2                          |
| Flat                   | 94.0                        | 0.0                         | ± 0.2                          |

## 5.2 Time weighting at 1 kHz

| Frequency<br>Weighting | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast                   | 94.0                        | 0.0                         | -                              |
| Slow                   | 94.0                        | 0.0                         | ± 0.1                          |
| Leq                    | 94.0                        | 0.0                         | ± 0.1                          |

**6. Long - term stability**

| Frequency<br>Weighting | SLM Display<br>at initial<br>( dB ) | SLM Display<br>at final<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight             | 94.0                                | 94.0                              | 0.0                         | ± 0.3                          |



Continuation of Calibration Certificate

Cert. No. : ACL23048  
Job No. : VC66AC0024  
Pages : 6 of 8

7. Level linearity on the reference level range

| Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|---------------------|---------------------|------------------------|
| 137.0                  | 137.0               | 0.0                 | ± 1.1                  |
| 136.0                  | 136.0               | 0.0                 | ± 1.1                  |
| 135.0                  | 135.0               | 0.0                 | ± 1.1                  |
| 134.0                  | 134.0               | 0.0                 | ± 1.1                  |
| 133.0                  | 133.0               | 0.0                 | ± 1.1                  |
| 132.0                  | 132.0               | 0.0                 | ± 1.1                  |
| 131.0                  | 131.0               | 0.0                 | ± 1.1                  |
| 129.0                  | 129.0               | 0.0                 | ± 1.1                  |
| 124.0                  | 124.0               | 0.0                 | ± 1.1                  |
| 119.0                  | 119.0               | 0.0                 | ± 1.1                  |
| 114.0                  | 114.0               | 0.0                 | ± 1.1                  |
| 109.0                  | 109.0               | 0.0                 | ± 1.1                  |
| 104.0                  | 104.0               | 0.0                 | ± 1.1                  |
| 99.0                   | 99.0                | 0.0                 | ± 1.1                  |
| 94.0                   | 94.0                | 0.0                 | ± 1.1                  |
| 89.0                   | 89.0                | 0.0                 | ± 1.1                  |
| 84.0                   | 84.0                | 0.0                 | ± 1.1                  |
| 79.0                   | 79.0                | 0.0                 | ± 1.1                  |
| 74.0                   | 74.0                | 0.0                 | ± 1.1                  |
| 69.0                   | 69.0                | 0.0                 | ± 1.1                  |
| 64.0                   | 64.0                | 0.0                 | ± 1.1                  |
| 59.0                   | 59.0                | 0.0                 | ± 1.1                  |
| 54.0                   | 53.9                | -0.1                | ± 1.1                  |
| 49.0                   | 48.9                | -0.1                | ± 1.1                  |
| 44.0                   | 43.9                | -0.1                | ± 1.1                  |
| 39.0                   | 38.9                | -0.1                | ± 1.1                  |
| 34.0                   | 33.9                | -0.1                | ± 1.1                  |
| 30.0                   | 29.9                | -0.1                | ± 1.1                  |
| 29.0                   | 28.8                | -0.2                | ± 1.1                  |
| 28.0                   | 27.9                | -0.1                | ± 1.1                  |
| 27.0                   | 26.8                | -0.2                | ± 1.1                  |
| 26.0                   | 25.9                | -0.1                | ± 1.1                  |
| 25.0                   | 24.8                | -0.2                | ± 1.1                  |

Continuation of Calibration Certificate

Cert. No. : ACL23048  
Job No. : VC66AC0024  
Pages : 7 of 8

8. Level linearity including the level range control

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|------------------------|---------------------|---------------------|------------------------|
| Auto  | 94.0                   | 94.0                | 0.0                 | ±1.1                   |

9. Tone burst response

| Time Weighting | Tone burst duration, Tb (ms) | Cycle | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|----------------|------------------------------|-------|------------------------|---------------------|---------------------|------------------------|
| Fast           | 0.25                         | 1     | 108.0                  | 107.9               | -0.1                | 1.5 ; -5.0             |
|                | 2                            | 8     | 117.0                  | 117.0               | 0.0                 | 1.0 ; -2.5             |
|                | 200                          | 800   | 134.0                  | 134.0               | 0.0                 | ±1.0                   |
| Slow           | 2                            | 8     | 108.0                  | 108.0               | 0.0                 | 1.5 ; -5.0             |
|                | 200                          | 800   | 127.6                  | 127.6               | 0.0                 | ±1.0                   |
| SEL            | 0.25                         | 1     | 99.0                   | 98.9                | -0.1                | 1.5 ; -5.0             |
|                | 2                            | 8     | 108.0                  | 108.0               | 0.0                 | 1.0 ; -2.5             |
|                | 200                          | 800   | 128.0                  | 128.0               | 0.0                 | ±1.0                   |

10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, L <sub>peak</sub> (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------|------------------------|--|---------------------|------------------------|
| Continuous                     | 133.0                  | 133.0                                  | 0.0                 | -                      |
| One                            | 136.4                  | 135.8                                  | -0.6                | ±3.0                   |

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------|------------------------|---------------------|---------------------|------------------------|
| Continuous                     | 133.0                  | 133.0               | 0.0                 | -                      |
| Positive half cycle            | 135.4                  | 135.2               | -0.2                | ±2.0                   |
| Negative half cycle            | 135.4                  | 135.2               | -0.2                | ±2.0                   |



## Continuation of Calibration Certificate

Cert. No. : ACL23048  
Job No. : VC66AC0024  
Pages : 8 of 8

## 11. Overload indication

| Measured value ( dB )      |                            | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|----------------------------|----------------------------|-----------------------------|--------------------------------|
| Positive<br>one-half cycle | Negative<br>one-half cycle |                             |                                |
| 89.6                       | 89.7                       | 0.1                         | ±1.5                           |

## 12. High level stability

| Frequency<br>Weighting | SLM Display<br>at initial<br>( dB ) | SLM Display<br>at final<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight             | 137.0                               | 137.0                             | 0.0                         | ±0.3                           |

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$   
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 23CH275  
Page.: 1 of 3

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : SevenCompact S220  
Serial No. : C104059460  
ID No. : RYG\_EN0183  
Condition As-Received: Used Item  
Received Date : 24 February 2023  
Calibration Date : 27 February 2023  
Reference : 2302-0886DSC-2  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
(Rayong Branch)  
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,  
Rayong 21140, Thailand

Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In - house method :  
- CP-CH5 by direct measurement with standard  
voltage calibrator and direct measurement with  
certified reference material (CRM)  
- CP-CH8 by comparison with standard thermometer

|                |                    |
|----------------|--------------------|
| REVIEW BY      | <i>N. Banit</i>    |
| APPROVED BY    | <i>P. Saitthip</i> |
| NEXT CAL. DATE | 27/2/24            |

Calibrated by : Walalak Sirithean

Approved by : *Saitthip*  
Approved Signatory

- ( ) Malee Butkruea  
(✓) Saitthip Meangmai  
( ) Warakorn Lerngagtrakul

Issue Date : 28 February 2023  
The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Cert.No.: 23CH275  
Page.: 2 of 3

#### Condition of this calibration result

##### 1. Reference Standard Instrument :-

| Instrument                     | Serial No. | ID No.   | Cert. No. | Due Date    |
|--------------------------------|------------|----------|-----------|-------------|
| 1) Document Process Calibrator | 54030049   | 130RC116 | 22E2769   | 24 Aug 2023 |
| 2) Ref. Standard Thermometer   | 4982054    | 110RC044 | 22I1306   | 27 Oct 2023 |

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

- Traceable to National Institute of Metrology (Thailand), NIMT

##### 2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

| Buffer Solution | Manufacturer | Lot No. | Exp. date    |
|-----------------|--------------|---------|--------------|
| pH 4.008        | CPA chem     | 826588  | 09 July 2024 |
| pH 6.987        | CPA chem     | 826589  | 09 July 2023 |
| pH 10.010       | CPA chem     | 863835  | 28 Dec 2023  |

##### 3. This certificate is valid only to the item calibrated on date and place of calibration.

#### Calibration Results

##### Function : mV Measurement

##### Performing standard curve by Fluke at pH (4,7,10)

| Unit Under Calibration       | Nominal Value | Standard Voltage Input | Actual Reading |        | Uncertainty of Measurement<br>( $\pm$ mV) | Coverage factor<br><i>k</i> |
|------------------------------|---------------|------------------------|----------------|--------|---|-----------------------------|
|                              | pH            | mV                     | mV             | pH     |   |                             |
| pH Meter<br>S/N.: C104059460 | 4.000         | 177.48                 | 177.4          | 4.000  | 0.058                                     | 2.00                        |
|                              | 7.000         | 0.00                   | -0.1           | 7.000  | 0.058                                     | 2.00                        |
|                              | 10.000        | -177.48                | -177.5         | 10.000 | 0.058                                     | 2.00                        |

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Cert.No.: 23CH275  
Page.: 3 of 3

#### Calibration Results

##### Function : pH Measurement

##### Performing three buffers standard curve by using buffer nominal pH (4,7,10)

| Unit Under Calibration        | Standard pH Buffer Solution | Actual pH Reading | Actual mV Reading (mV) | Uncertainty of pH measurement ( $\pm$ ) | Coverage factor<br><i>k</i> |
|-------------------------------|-----------------------------|-------------------|------------------------|---|-----------------------------|
| pH Electrode<br>S/N.: 1453404 | 4.008                       | 4.008             | 179.1                  | 0.0046                                  | 2.00                        |
|                               | 6.987                       | 6.988             | 4.7                    | 0.0084                                  | 2.00                        |
|                               | 10.010                      | 10.013            | -172.4                 | 0.0069                                  | 2.00                        |

##### Function : Temperature Measurement

##### (\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLabExpert Pro-ISM

- Serial No. : 1453404

Dimension of probe;

- Length : 120 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

| Calibration Point (°C) | Standard Temperature (°C) | UUC* Reading (°C) | Error (°C) | Uncertainty of measurement ( $\pm$ °C) | Coverage factor<br><i>k</i> |
|------------------------|---------------------------|-------------------|------------|--|-----------------------------|
| 25.0                   | 25.001                    | 24.8              | -0.201     | 0.13                                   | 2.00                        |

Remark : - UUC\* = Unit Under Calibration

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484



## Certificate of Calibration

Certificate No. : 23E753  
Page : 1 of 2

Equipment : pH Meter  
Manufacturer: Mettler Toledo  
Model : SevenCompact S220  
Serial No.: C104059480  
ID No.: RYG\_EN0183

Condition As-Received: Used Item  
Received Date: 24 February 2023  
Calibration Date: 28 February 2023

Reference: 2302-0886DSC  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 10 ) %  
Submitted by: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,  
Rayong 21140, Thailand

Procedure used: Calibration were conducted using In-house calibration Procedure CP-E17 According to direct measurement method with Multi-Product Calibrator.

### Condition of this result of calibration

1.Reference standards instruments :

| Instrument                  | Model | Serial No. | Certificate No. | Due Date    |
|-----------------------------|-------|------------|-----------------|-------------|
| 1) Multi-Product Calibrator | 5500A | 6440007    | 22E1670         | 18 May 2023 |

2.This result of calibration was made on requested at the point specified by customer.

3.The certificate is valid only to the item calibrated on date and place of calibration.

4.This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Wutchareeporn Wongchulikrane  
Issue Date : 02 March 2023  
Approved Signatory :  
[ ] Phalinee Prabpaipal  
[x] Nuntawat Khamchai  
[ ] Pornthippa Tameyakul

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Cert. No.: 23E753  
Page.: 2 of 2

### Result of calibration :- (\*) Without adjustment ( ) After adjustment

| Function: | DC voltage measuremer | Range:       | 2000   | mV          |  |
|-----------|-----------------------|--------------|--------|-------------|--|
|           | Standard Value        | UUC* Reading | Error  | Uncertainty |  |
|           | ( mV )                | ( mV )       | ( mV ) | ( ± μV )    |  |
|           | -200.0000             | -200.0       | 0.0    | 72          |  |
|           | -150.0000             | -150.0       | 0.0    | 69          |  |
|           | -100.0000             | -100.0       | 0.0    | 65          |  |
|           | -50.0000              | -50.0        | 0.0    | 62          |  |
|           | 0.0000                | 0.0          | 0.0    | 58          |  |
|           | 50.0000               | 50.0         | 0.0    | 62          |  |
|           | 100.0000              | 99.9         | -0.1   | 65          |  |
|           | 150.0000              | 149.9        | -0.1   | 69          |  |
|           | 200.0000              | 199.9        | -0.1   | 72          |  |

The 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 %

UUC\* = Unit Under Calibration.

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## Certificate of Calibration

Equipment: SPECTROPHOTOMETER

Model: DR6000

Serial No. (or ID.): 1627845 (RYG\_EN0037)

Manufacturer: HACH

Condition: In Condition

Certificate No.: C06230441

Issued Date: 19 September 2023

Job No.: WO-00005382

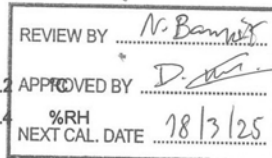
Page: 1 of 3

Customer: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)

616/10 Moo 5 T.Maenam Khu,

A.Pluakdaeng, Rayong 21140, Thailand.

Environment Condition: Temperature 23.9 °C ± 0.2  
Humidity 65.3 %RH ± 1.4



Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) (Wet Chemistry)

616/10 Moo 5 T.Maenam Khu,

A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By: Mr.Nattapat Rungueang

Calibration Date: 18 September 2023

The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04

Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Sarna Scientific Limited.

The standard for Wavelength Certificate No. 111583 and 111584

The standard for Photometric Certificate No. 9114984 and 111588

The standard for Stray light Certificate No. 111586 and 111585

The standard for Spectral resolution Certificate No. 111587

(Mr. Nattapat Rungueang)

Person in charge

(Mr. Nitinun Srihawan)

Authorized signatory

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

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

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

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

Delivering Growth - in Asia and Beyond.

CAL-FM-C06-15: 12 Sep 2022



Certificate No.: C06230441

Page 2 of 3

### Calibration Results:

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm

| Standard Wavelength | Unit Under Calibration | Correction | Uncertainty |
|---------------------|------------------------|------------|-------------|
| 418.61              | 418.3                  | 0.31       | 0.13        |
| 536.66              | 536.6                  | 0.06       | 0.13        |
| 637.98              | 638.3                  | -0.32      | 0.13        |
| 748.48              | 748.7                  | -0.22      | 0.13        |
| 807.03              | 807.4                  | -0.37      | 0.13        |

Photometric Accuracy (Absorbance)

| Wavelength | Standard absorbance | Unit Under Calibration | Correction | Uncertainty |
|------------|---------------------|------------------------|------------|-------------|
| 420 nm     | 0.0000              | 0.000                  | 0.0000     | 0.0045      |
|            | 0.2930              | 0.289                  | 0.0040     | 0.0045      |
|            | 0.5168              | 0.519                  | -0.0022    | 0.0045      |
|            | 1.0298              | 1.029                  | 0.0008     | 0.0045      |
| 440 nm     | 0.0000              | 0.000                  | 0.0000     | 0.0045      |
|            | 0.2867              | 0.283                  | 0.0037     | 0.0045      |
|            | 0.5073              | 0.509                  | -0.0017    | 0.0045      |
|            | 1.0083              | 1.007                  | 0.0013     | 0.0045      |
| 465 nm     | 0.0000              | 0.000                  | 0.0000     | 0.0045      |
|            | 0.2516              | 0.250                  | 0.0016     | 0.0045      |
|            | 0.4595              | 0.462                  | -0.0025    | 0.0045      |
|            | 0.9334              | 0.933                  | 0.0004     | 0.0045      |
| 546.1 nm   | 0.0000              | 0.000                  | 0.0000     | 0.0045      |
|            | 0.2461              | 0.245                  | 0.0011     | 0.0045      |
|            | 0.4652              | 0.466                  | -0.0008    | 0.0045      |
|            | 0.9468              | 0.946                  | 0.0008     | 0.0045      |
| 590 nm     | 0.0000              | 0.000                  | 0.0000     | 0.0045      |
|            | 0.2594              | 0.259                  | 0.0004     | 0.0045      |
|            | 0.5040              | 0.505                  | -0.0010    | 0.0045      |
|            | 1.0032              | 1.002                  | 0.0012     | 0.0045      |
| 635 nm     | 0.0000              | 0.000                  | 0.0000     | 0.0045      |
|            | 0.2579              | 0.257                  | 0.0009     | 0.0045      |
|            | 0.4971              | 0.497                  | 0.0001     | 0.0045      |
|            | 0.9720              | 0.971                  | 0.0010     | 0.0045      |

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

Delivering Growth - in Asia and Beyond.

CAL-FM-C06-15: 12 Sep 2022

### Calibration Results:

#### Without Adjustment

| Photometric Accuracy (Absorbance) |                      |                        |                  |             |
|-----------------------------------|----------------------|------------------------|------------------|-------------|
| Wavelength                        | Standard absorbance  | Unit Under Calibration | Correction       | Uncertainty |
| 235 nm                            | 0.0000               | 0.000                  | 0.0000           | 0.0080      |
|                                   | 0.7355               | 0.737                  | -0.0015          | 0.0080      |
| 257 nm                            | 0.0000               | 0.000                  | 0.0000           | 0.0080      |
|                                   | 0.8574               | 0.857                  | 0.0004           | 0.0080      |
| 313 nm                            | 0.0000               | 0.000                  | 0.0000           | 0.0080      |
|                                   | 0.2864               | 0.290                  | -0.0036          | 0.0080      |
| 350 nm                            | 0.0000               | 0.000                  | 0.0000           | 0.0080      |
|                                   | 0.6374               | 0.637                  | 0.0004           | 0.0080      |
| Stray light *                     |                      |                        |                  |             |
| Standard: cut-off                 | UUC: Wavelength (nm) | UUC: Transmission (%T) | Absorbance ( A ) |             |
| 260.62 +/- 0.11 nm                | 260.6                | 1.3                    | 1.886            |             |
| 391.44 +/- 0.11 nm                | 391.4                | 1.3                    | 1.886            |             |
| Spectral Resolution *             |                      |                        |                  |             |
| Nominal Concentration 0.02 % v/v  | Peak                 | Trough                 | Ratio            | SBW         |
| Standard Wavelength ( nm )        | 268.66               | 266.69                 | 1.38             | 2.00        |
| UUC: Wavelength (nm)              | 268.2                | 266.1                  |                  |             |
| Std Absorbance ( A )              | 0.4566               | 0.2780                 |                  |             |
| Absorbance ( A )                  | 0.413                | 0.300                  |                  |             |

\* Calibration Marked " Not TISI Accredited " in this Certificate have been included for completeness.

The End of Certificate

## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00005382

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: DR6000

หมายเลขเครื่อง: 1627845

| ตรวจสอบ (รับ)                       |                          | รายการตรวจเช็ค                                    | ตรวจสอบ (ส่ง)                       |                          | หมายเหตุ    |
|-------------------------------------|--------------------------|---|-------------------------------------|--------------------------|-------------|
| 18 Sep 2023                         |                          |   | 18 Sep 2023                         |                          |             |
| ปกติ                                | ไม่ปกติ                  |   | ปกติ                                | ไม่ปกติ                  |             |
|                                     |                          | General   |                                     |                          |             |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 1. ความสมบูรณ์เครื่อง                             | <input checked="" type="checkbox"/> | <input type="checkbox"/> |             |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 2. ความสะอาด ( ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง) | <input checked="" type="checkbox"/> | <input type="checkbox"/> |             |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Swich)       | <input checked="" type="checkbox"/> | <input type="checkbox"/> |             |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 4. ปุ่มกด (Keypad)                                | <input checked="" type="checkbox"/> | <input type="checkbox"/> |             |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 5. หน้าจอ (Display, Screen Contrast)              | <input checked="" type="checkbox"/> | <input type="checkbox"/> |             |
|                                     |                          | Spectrophotometer                                 |                                     |                          |             |
| <input type="checkbox"/>            | <input type="checkbox"/> | 6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC        | <input type="checkbox"/>            | <input type="checkbox"/> |             |
| <input type="checkbox"/>            | <input type="checkbox"/> | 7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)  | <input type="checkbox"/>            | <input type="checkbox"/> |             |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 8. ความยาวคลื่น (Wavelength Check)                | <input checked="" type="checkbox"/> | <input type="checkbox"/> | *           |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 9. แหล่งกำเนิดแสง (UV < 3,000 hour)               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 9.2 Hours   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 10. แหล่งกำเนิดแสง (Visible < 5,000 hour)         | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 741.5 Hours |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 11. ช่องวัดหลายตัวอย่าง (Carousel Module)         | <input checked="" type="checkbox"/> | <input type="checkbox"/> |             |
|                                     |                          | pH Meter and Conductivity Meter                   |                                     |                          |             |
| <input type="checkbox"/>            | <input type="checkbox"/> | 12. อิเล็กโทรด ( Electrode and Connection Cable ) | <input type="checkbox"/>            | <input type="checkbox"/> |             |
| <input type="checkbox"/>            | <input type="checkbox"/> | 13. ระดับสารละลายใน Electrode (Level KCl )        | <input type="checkbox"/>            | <input type="checkbox"/> |             |
| <input type="checkbox"/>            | <input type="checkbox"/> | 14. ฝาปิดกันปลาย Electrode (Dust Protection Hood) | <input type="checkbox"/>            | <input type="checkbox"/> |             |
| <input type="checkbox"/>            | <input type="checkbox"/> | 15. ขาจับอิเล็กโทรด (Stand)                       | <input type="checkbox"/>            | <input type="checkbox"/> |             |
|                                     |                          | Turbidimeter                                      |                                     |                          |             |
| <input type="checkbox"/>            | <input type="checkbox"/> | 16. ค่าความขุ่นที่ต่ำสุด (No Sample)              | <input type="checkbox"/>            | <input type="checkbox"/> |             |
| <input type="checkbox"/>            | <input type="checkbox"/> | 17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นเกิน 3.0) | <input type="checkbox"/>            | <input type="checkbox"/> |             |
|                                     |                          | Automatic titrator                                |                                     |                          |             |
| <input type="checkbox"/>            | <input type="checkbox"/> | 18. สภาพ Piston Burettes                          | <input type="checkbox"/>            | <input type="checkbox"/> |             |
| <input type="checkbox"/>            | <input type="checkbox"/> | 19. Function Rinsing and Dosing                   | <input type="checkbox"/>            | <input type="checkbox"/> |             |
| <input type="checkbox"/>            | <input type="checkbox"/> | 20. ระบบท่อสายยางและอุปกรณ์ประกอบ                 | <input type="checkbox"/>            | <input type="checkbox"/> |             |

เพิ่มเต็ม/ข้อแนะนำ : \*656.1nm=656.1nm

\*486.0nm=485.5nm

Mr.Nattapat Rungrueang


Service Engineer





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000 FAX. 0-2719-9484

Cert.No.: 23TW168  
Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5000-115V  
Serial No. : 15E102796  
ID No. : RYG\_EN0032  
Received Date : 21 July 2023  
Test Date : 24 July 2023  
Reference : 2307-0713DSC-1  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
Rayong Branch  
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,  
Rayong 21140, Thailand  
Laboratory Condition : Temperature ( 25 ± 5 ) °C  
Humidity (50 ± 20) %  
Test Procedure : In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method  
Tested by : Walalak Sirithean  
Approved by :   
Approved Signatory  
( ) Malee Butkruea  
(✓) Saitthip Meangmai  
( ) Warakorn Lerngagtrakul  
Issue Date : 26 July 2023

|                |  |
|----------------|--|
| REVIEW BY      |   |
| APPROVED BY    |  |
| NEXT CAL. DATE | 24/01/25   |

B 0320211



Cert.No.: 23TW168  
Page.: 2 of 2

### Condition of this result of calibration

1. Reference Standard Instruments :  
This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

| Instruments | Serial No. | ID No.   | Certificate No. | Due Date    |
|-------------|------------|----------|-----------------|-------------|
| 1) Burette  | -          | 130BU10  | 23CG1172        | 22 Mar 2025 |
| 2) Balance  | 1126143764 | 140RC004 | 22MM50          | 20 Sep 2023 |

### 2. Standard Material :-

| Material                        | Manufacturer | Lot.No.   | Assay  |
|---------------------------------|--------------|-----------|--------|
| Sodium Thiosulfate pentahydrate | Merck        | AM1763316 | 100.2% |

**Result :** Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 15E100464

| Titration Method<br>(Azide Modification Method)<br>(mg/L) | DO Meter<br>Reading<br>(mg/L) | Standard Deviation<br>(mg/L) |
|---|-------------------------------|------------------------------|
| 8.18  | 8.17                          | 0.0055                       |

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may concerned. Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

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a 1172155



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 23LM125  
Page.: 1 of 2

## Certificate of Calibration

**Equipment :** DO Meter with Sensor  
**Manufacturer :** YSI  
**Model :** 5000-115V  
**Serial No. :** 15E102796  
**ID No. :** RYG\_EN0032  
**Submitted by :** ALS Laboratory Group (Thailand) Co.,Ltd.  
Rayong Branch  
616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng,  
Rayong 21140 Thailand  
**Location :** TPA On Site Calibration Laboratory  
**Received Order :** 25 July 2023  
**Calibrated Date :** 27 July 2023  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %  
**AC Line Voltage :** ( 220 ± 22 ) V

**Calibrated by :** Preecha Hlahib

**Approved by :**

Approved Signatory

( ) Pornthippa Tameyakul  
( ) Malee Butkruea  
(✓) Suwit Imjai

**Issue Date :** 31 July 2023

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0053616



**Equipment :** DO Meter with Sensor  
**Condition As-Received :** Used Item  
**Reference :** 2307-0713DSC-2  
**Procedure Used :-**

**Cert. No.:** 23LM125  
**Page.:** 2 of 2

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer ( IPRT ) into Temperature Bath.

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

| Instrument             | Serial No. | Cert. No. | Traceable | Due Date    |
|------------------------|------------|-----------|-----------|-------------|
| 1) Digital Thermometer | 2188080    | 221285    | TPA       | 21 Oct 2023 |

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

**Result of Calibration :-** ( \* ) Without Adjustment

**Function :** Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 1228475367

| Calibration Point<br>( °C ) | Immersion Depth<br>( mm ) | Standard Temperature<br>( °C ) | UUC*<br>Reading<br>( °C ) | Error<br>( °C ) | Uncertainty<br>( ± °C ) | Coverage Factor<br>k |
|-----------------------------|---------------------------|--------------------------------|---------------------------|-----------------|-------------------------|----------------------|
| 20.00                       | 100                       | 20.011                         | 19.91                     | -0.101 ±        | 0.15                    | 2.00                 |

**UUC\* :** Unit Under Calibration

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

-o0o-

a 1159515



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 23TM962  
Page : 1 of 3

## Certificate of Calibration

Equipment : Low Temp. Incubator  
Manufacturer : Memmert  
Model : IPP750  
Serial No. : V818.0084  
ID No. : RYG\_EN0154  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
(Rayong Branch)  
616/10 Moo 5 T: Maenam Khu,  
A. Pluakdaeng, Rayong 21140 Thailand  
Location : BOD Room  
Received Order : 29 May 2023  
Calibration Date : 29 May 2023  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$

Calibrated by : Man Pattanapongpaiboon

Approved by :

Approved Signatory

- ( ) Pornthippa Tameyakul  
( ) Malee Butkruea  
(✓) Suwit Imjai

Issue Date : 7 June 2023

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0054967



Equipment : Low Temp. Incubator  
Condition As-Received : Used Item  
Reference : 2305-0898OC-2  
Procedure Used :-

Cert. No.: 23TM962  
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ).

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

#### 1. Reference standard instrument:-

| Instrument           | Model  | Serial No. | Cert. No. | Due Date    |
|----------------------|--------|------------|-----------|-------------|
| 1 ) Data Acquisition | 34972A | MY57013711 | 22LM93    | 02 Jul 2023 |

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

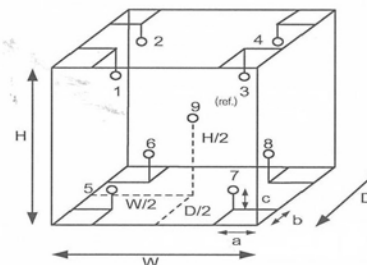
Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

### Environment during calibration

|                    | Beginning | Finished |
|--------------------|-----------|----------|
| Temp. ( °C )       | 23        | 23       |
| REL.Humid. ( % )   | 54        | 56       |
| AC Supply ( Volt ) | 223       | 222      |



### Probe Installation Details :

a = 10 cm  
b = 10 cm  
c = 10 cm

### Dimension of Chamber :

D = 0.60 m  
W = 1.0 m  
H = 1.2 m  
Capacity = 0.75 m<sup>3</sup>

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1          | 18-18RTD-01       |
| 2          | 18-18RTD-02       |
| 3          | 18-18RTD-03       |
| 4          | 18-18RTD-04       |
| 5          | 18-18RTD-05       |
| 6          | 18-18RTD-10       |
| 7          | 18-18RTD-07       |
| 8          | 22-18RTD-08       |
| 9 (ref.)   | 18-18RTD-09       |

a 1165130





Equipment : Low Temp. Incubator  
 Condition As-Received : Used Item  
 Reference : 2305-0898OC-2  
 Result of Calibration :- ( \* ) Without Adjustment  
 Function of UUC\* : Temperature Source  
 Fresh air setting : Close

Cert. No.: 23TM962  
 Page : 3 of 3

| Calibration Point ( °C ) | UUC* Setting ( °C ) | UUC* Reading ( °C ) | Temperature stability ( ± °C ) | Temperature uniformity ( °C ) | Overall Variation ( °C ) | Coverage Factor k |
|--------------------------|---------------------|---------------------|--------------------------------|-------------------------------|--------------------------|-------------------|
| 20.0                     | 20.0                | 20.0                | 0.019                          | 0.72                          | 1.0                      | 2                 |

| Calibration<br>Point<br>( °C ) | Measured Temperature ( °C ) |        |        |        |        |        |        |        |          | Uncertainty<br>( ± °C ) |
|--------------------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|----------|-------------------------|
|                                | Position                    |        |        |        |        |        |        |        |          |                         |
|                                | 1                           | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9 (ref.) |                         |
| 20.0                           | 19.547                      | 19.780 | 19.487 | 19.529 | 19.408 | 20.139 | 20.112 | 20.406 | 20.116   | 0.30                    |

**Average\*** : The average of 30 values in each position.

**Temperature stability** : One-half of the greatest maximum difference of measured temperature at any one sensor.

**Temperature uniformity** : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

**Overall Variation** : The Difference of the maximum and minimum measured temperatures throughout observation.

**UUC\*** : Unit Under Calibration

**Note** : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

-000-

*Signature*

a 1165129

RYG\_EN0002

Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310

Tel: +66 2643 8361-6, e-mail: service.thailand@sartorius.com



NSC-TISI-TIS 17025  
 CALIBRATION 0426

SARTORIUS

REVIEW BY *Thaniat*  
 APPROVED BY *D. Chonchai*  
 NEXT CAL. DATE 01/03/24

# Certificate of Calibration

Model Number : MSE224S-100-DU  
 Description : Analytical Balance  
 Serial Number : 0026207038  
 ID No. : RYG\_EN0002  
 Manufacturer : Sartorius

Certificate No. : 23BCI0112  
 Issued Date : Friday, March 03, 2023  
 Reference No. : 204833  
 Page No. : 1 of 2

Customer Name : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
 616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand.

Calibrated Place : ALS Laboratory Group (Thailand) Co., Ltd.(Balance Room)  
 616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong.21140, Thailand.

Calibrated By : Mr.Chonchai Inthana  
 Calibration Date : Wednesday, March 01, 2023

Calibration Procedure No. : This calibration was conducted by  
 Using in-house calibration procedure number (WI-003)  
 Based on UKAS LAB 14 : 2019

**Metrological data :**  
 Capacity : 220 g Readability : 0.0001 g

**Ambients Conditions:**  
 Temperature : 23.6 °C ± 5.0 °C  
 Humidity : 60.0 % RH ± 10.0 % RH  
 Pressure : ±

Reasons for calibration

☐ New Installation ☐ Service / Repaired ☒ Re-calibration/ Maintenance

Equipment Condition: ☒ Good Operate ☐ Fair

## Measurement Method UKAS Publication Ref :Lab 14

The measurement uncertainty stated is the expended 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). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came form list of Sartorius Metrological Specifications.

## Traceability:

| Model Number  | Description                                       | Traceability | Certificate No. | Due Date    |
|---------------|---|--------------|-----------------|-------------|
| YCS011-522-00 | Sartorius weight set 1mg - 5000g E2,YCS011-522-00 | SPC-RT       | C02212565       | 14-Sep-2023 |
| MHB-382SD     | Humidity/Barometer/Temp Lutron MHB-382SD          | DKSH         | C19220444       | 5-Sep-2023  |

This certificate relate and apply this equipment only.

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*Signature*  
 Mr.chonchai Inthana(Technical Manager)

SOP FM 33 03 February 2022



**Sartorius (Thailand) Co., Ltd.**

129 Rama 9 Road, Huaykwang, Bangkok 10310  
Tel: +66 2643 8361-6 Fax: +66 2643-8367, e-mail: service.thailand@sartorius.com

**SARTORIUS**

# Certificate of Calibration

Model Number : MSE224S-100-DU  
Description : Analytical Balance  
Serial Number : 0026207038  
ID No. : RYG\_EN0002  
Manufacturer : Sartorius

Certificate No. : 23BCI0112  
Issued Date : Friday, March 03, 2023  
Reference No. : 204833  
Page No. : 2 of 2

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

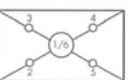

The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.

|                             |          |          |
|-----------------------------|----------|----------|
| Nominal Value : (Low Load)  | 20.0000  | 199.9999 |
| 20 g                        | 20.0000  | 200.0000 |
| Tolerance                   | 20.0000  | 199.9999 |
| 0.0001 g                    | 20.0000  | 200.0000 |
|                             | 20.0000  | 199.9999 |
| Nominal Value : (High Load) | 200.0000 | 199.9999 |
| 200 g                       | 19.9999  | 200.0000 |
| Tolerance                   | 20.0000  | 200.0000 |
| 0.0001 g                    | 20.0000  | 199.9999 |
|                             | 20.0000  | 200.0000 |
| Standard Deviation          | 0.00003  | 0.00005  |

**Eccentricity (Off-center loading error)**

The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).

|                 |        |   |
|-----------------|--------|---|
| Nominal value : | 100    | g |
| Tolerance       | 0.0004 | g |



| Difference |         |
|------------|---------|
| 1          | —       |
| 2          | -0.0001 |
| 3          | -0.0001 |
| 4          | 0.0001  |
| 5          | 0.0002  |
| 6          | -       |

**Linearity**

The linearity, also called linearity error. Describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

| Tolerance 0.0002 g |                         |                 |           |             |
|--------------------|-------------------------|-----------------|-----------|-------------|
| Nominal Value      | Conventional Mass Value | Displayed Value | Deviation | Uncertainty |
| (g)                | (g)                     | (g)             | (g)       | (g)         |
| 0.01               | 0.0100                  | 0.0100          | 0.0000    | 0.00014     |
| 0.05               | 0.0500                  | 0.0500          | 0.0000    | 0.00014     |
| 0.1                | 0.1000                  | 0.1000          | 0.0000    | 0.00014     |
| 0.5                | 0.5000                  | 0.5000          | 0.0000    | 0.00014     |
| 1                  | 1.0000                  | 1.0000          | 0.0000    | 0.00014     |
| 5                  | 5.0000                  | 5.0000          | 0.0000    | 0.00014     |
| 10                 | 10.0000                 | 10.0001         | 0.0001    | 0.00014     |
| 20                 | 20.0000                 | 20.0000         | 0.0000    | 0.00024     |
| 50                 | 50.0000                 | 50.0000         | 0.0000    | 0.00015     |
| 100                | 100.0000                | 99.9999         | -0.0001   | 0.00019     |
| 200                | 200.0000                | 200.0000        | 0.0000    | 0.00032     |

End of Report.

RYG\_EN0010



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Cert. No. : 22TM1517  
Page : 1 of 3

## Certificate of Calibration

Equipment : Hot Air Oven  
Manufacturer : Memmert  
Model : UFE 500  
Serial No. : G511.1572  
ID No. : RYG\_EN0010  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
616/10 Moo 5 T. Maenam Khu,  
A. Pluakdaeng,  
Rayong 21140 Thailand  
Location : Oven Room  
Received Order : 20 October 2022  
Calibration Date : 20 October 2022  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Man Pattanapongpaiboon

Approved by : Manu  
Approved Signatory

( ) Pornthippa Tameyakul  
(x) Malee Butkruea  
( ) Suwit Imjai

Issue Date : 2 November 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2210-0376OC-2

Cert. No.: 22TM1517  
Page : 2 of 3

**Procedure Used :-**

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

| Instrument           | Model  | Serial No. | Cert. No. | Due Date    |
|----------------------|--------|------------|-----------|-------------|
| 1 ) Data Acquisition | 34972A | MY49023932 | 22LM97    | 29 Jul 2023 |

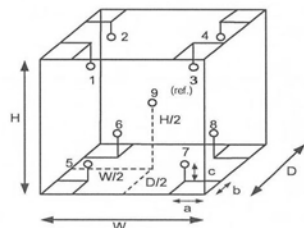
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Close



| Environment during calibration |           |          |
|--------------------------------|-----------|----------|
|                                | Beginning | Finished |
| Temp. ( °C )                   | 25        | 25       |
| REL.Humid. ( % )               | 54        | 59       |
| AC Supply ( Volt )             | 223       | 225      |

Ref. Std. ID No.: @  
Calibration Point

| Position : | ( 180 ) °C | ( 104 ) °C  |
|------------|------------|-------------|
| 1          | 21-16TC-01 | 20-16RTD-01 |
| 2          | 21-16TC-02 | 20-16RTD-02 |
| 3          | 21-16TC-03 | 20-16RTD-03 |
| 4          | 21-16TC-04 | 20-16RTD-04 |
| 5          | 21-16TC-05 | 22-16RTD-05 |
| 6          | 21-16TC-06 | 20-16RTD-06 |
| 7          | 21-16TC-07 | 20-16RTD-07 |
| 8          | 21-16TC-08 | 22-16RTD-08 |
| 9 (ref.)   | 21-16TC-09 | 22-16RTD-09 |

Probe Installation Details :      Dimension of Chamber :  
a = 5.0 cm      D = 0.40 m  
b = 5.0 cm      W = 0.56 m  
c = 5.0 cm      H = 0.48 m  
Capacity = 0.11 m<sup>3</sup>

a 1132466



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2210-0376OC-2  
**Result of Calibration :-** ( \* ) Without Adjustment

Cert. No.: 22TM1517  
Page : 3 of 3

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Close

| Calibration Point ( °C ) | UUC* Setting ( °C ) | UUC* Reading ( °C ) | Temperature stability ( ± °C ) | Temperature uniformity ( °C ) | Overall Variation ( °C ) | Uncertainty ( ± °C ) | Coverage Factor k |
|--------------------------|---------------------|---------------------|--------------------------------|-------------------------------|--------------------------|----------------------|-------------------|
| 104.0                    | 104.0               | 104.0               | 0.076                          | 0.52                          | 0.60                     | 0.42                 | 2                 |
| 180.0                    | 180.0               | 180.0               | 0.13                           | 0.88                          | 1.2                      | 1.1                  | 2                 |

| Calibration Point ( °C ) | Measured Temperature ( °C ) |         |         |         |         |         |         |         |          |
|--------------------------|-----------------------------|---------|---------|---------|---------|---------|---------|---------|----------|
|                          | Position                    |         |         |         |         |         |         |         |          |
|                          | 1                           | 2       | 3       | 4       | 5       | 6       | 7       | 8       | 9 (ref.) |
| 104.0                    | 103.768                     | 103.734 | 103.723 | 103.800 | 104.215 | 104.131 | 104.132 | 103.740 | 103.747  |
| 180.0                    | 179.723                     | 179.359 | 179.439 | 179.489 | 180.361 | 180.114 | 180.131 | 180.243 | 179.605  |

**Average\* :** The average of 30 values in each position.

**Temperature stability :** One-half of the greatest maximum difference of measured temperature at any one sensor

**Temperature uniformity :** The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

**Overall Variation :** The Difference of the maximum and minimum measured temperatures throughout observation

**UUC\* :** Unit Under Calibration

**Note :** The reported uncertainty of measurement was included stability and excluded uniformity .

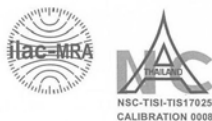
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

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a 1132465



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TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM1492  
Page : 1 of 3

## Certificate of Calibration

**Equipment :** Hot Air Oven  
**Manufacturer :** Memmert  
**Model :** UM 400  
**Serial No. :** b495.0899  
**ID No. :** RYG\_EN0006  
**Submitted by :** ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
616/10 Moo 5, T. Maenam Khu,  
A. Pluakdaeng,  
Rayong 21140, Thailand  
**Location :** Oven Room  
**Received Order :** 20 October 2022  
**Calibration Date :** 20 October 2022  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %  
**Calibrated by :** Preecha Hlahib

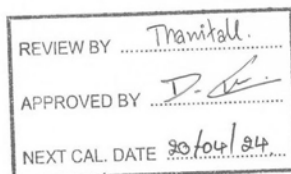
**Approved by :**   
Approved Signatory

( ) Pornthippa Tameyakul  
(✓) Malee Butkruea  
( ) Suwit Imjai

**Issue Date :** 2 November 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



**Equipment :** Hot Air Oven  
**Condition As-Received :** Used Item  
**Reference :** 2210-03760C-1

**Cert. No.:** 22TM1492  
**Page :** 2 of 3

### Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ).

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

#### 1. Reference standard instrument:-

| Instrument           | Model  | Serial No. | Cert. No. | Due Date    |
|----------------------|--------|------------|-----------|-------------|
| 1 ) Data Acquisition | 34970A | MY44035217 | 21LM30    | 23 Dec 2022 |

2. This certificate is valid only to the item calibrated on date and place of calibration.

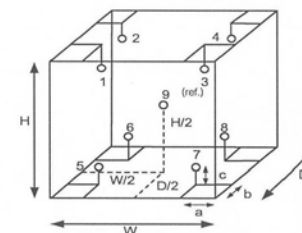
3. This certification is traceable to the International System of Unit.

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Close

| Environment during calibration |           |          |
|--------------------------------|-----------|----------|
|                                | Beginning | Finished |
| Temp. ( °C )                   | 28        | 29       |
| REL.Humid. ( % )               | 43        | 47       |
| AC Supply ( Volt )             | 220       | 221      |



#### Probe Installation Details :

a = 5.0 cm  
b = 5.0 cm  
c = 5.0 cm

#### Dimension of Chamber :

D = 0.33 m  
W = 0.40 m  
H = 0.40 m  
Capacity = 0.053 m³

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1          | 18-10RTD-01       |
| 2          | 18-10RTD-02       |
| 3          | 18-10RTD-03       |
| 4          | 18-10RTD-04       |
| 5          | 18-10RTD-05       |
| 6          | 18-10RTD-06       |
| 7          | 18-10RTD-07       |
| 8          | 18-10RTD-08       |
| 9 (ref.)   | 18-10RTD-09       |



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2210-0376OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 22TM1492  
Page : 3 of 3

| Calibration Point<br>( °C ) | UUC*<br>Setting<br>( °C ) | UUC*<br>Reading<br>( °C ) | Temperature<br>stability<br>( ± °C ) | Temperature<br>uniformity<br>( °C ) | Overall<br>Variation<br>( °C ) | Uncertainty<br>( ± °C ) | Coverage<br>Factor<br>k |
|-----------------------------|---------------------------|---------------------------|--------------------------------------|-------------------------------------|--------------------------------|-------------------------|-------------------------|
| 70.0                        | 70.0                      | 70.0                      | 0.079                                | 0.47                                | 0.77                           | 0.42                    | 2                       |

| Calibration Point<br>( °C ) | Measured Temperature ( °C ) |        |        |        |        |        |        |        |          |
|-----------------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|----------|
|                             | Position                    |        |        |        |        |        |        |        |          |
|                             | 1                           | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9 (ref.) |
| 70.0                        | 70.262                      | 69.995 | 70.079 | 70.177 | 70.664 | 70.039 | 70.688 | 70.149 | 70.328   |

Average\* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation

UUC\* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

-o0o-

Malu.

a 1132472

RYG\_EN0061



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Cert. No.: 22TM1491  
Page : 1 of 3

## Certificate of Calibration

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WNB22  
Serial No. : L513.0648  
ID No. : RYG\_EN0061  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
616/10 Moo 5, T. Maenam Khu,  
A. Pluakdaeng,  
Rayong 21140, Thailand  
Location : Wet Chemistry Lab  
Received Order : 20 October 2022  
Calibration Date : 20 October 2022  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Preecha Hlahib

Approved by :   
Approved Signatory  
( ) Ponthippa Tameyakul  
( ✓ ) Malee Butkruea  
( ) Suwit Imjai

Issue Date : 2 November 2022

The Uncertainties are for a confidence probability of approximately 95%

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A 0046906



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2210-0376OC-4  
Cert. No.: 22TM1491  
Page : 2 of 3

**Procedure Used :-**

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer ( IPRT ).

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

| Instrument           | Model  | Serial No. | Cert. No. | Due Date    |
|----------------------|--------|------------|-----------|-------------|
| 1 ) Data Acquisition | 34970A | MY44035217 | 21LM30    | 23 Dec 2022 |

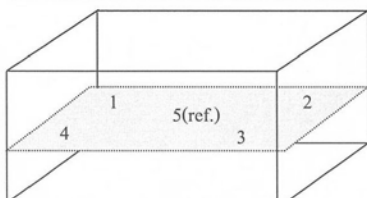
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

|                          | Environmental |           | AC Voltage Supply |
|--------------------------|---------------|-----------|-------------------|
|                          | ( °C )        | ( %R.H. ) |                   |
| Beginning of Calibration | 24            | 53        | 222               |
| Finished of Calibration  | 24            | 50        | 221               |



Front

| Position : | Ref. Std. S/N.: |
|------------|-----------------|
| 1          | N37P300726      |
| 2          | N37P300727      |
| 3          | N37P300728      |
| 4          | N37P300729      |
| 5(ref.)    | N37P300730      |

*Malu*

a 1132471



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2210-0376OC-4  
Cert. No.: 22TM1491  
Page : 3 of 3

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

| Calibration point<br>( °C ) | UUC*<br>Setting<br>( °C ) | UUC*<br>Reading<br>( °C ) | Average* Standard Reading ( °C ) |        |        |        |          |
|-----------------------------|---------------------------|---------------------------|----------------------------------|--------|--------|--------|----------|
|                             |                           |                           | Position                         |        |        |        |          |
|                             |                           |                           | 1                                | 2      | 3      | 4      | 5 (ref.) |
| 85.0                        | 85.0                      | 85.0                      | 84.527                           | 84.563 | 84.628 | 84.516 | 84.580   |

| Calibration point<br>( °C ) | Uniformity<br>( °C ) | Stability<br>( ± °C ) | Uncertainty<br>( ± °C ) | Coverage Factor<br>k |
|-----------------------------|----------------------|-----------------------|-------------------------|----------------------|
| 85.0                        | 0.12                 | 0.081                 | 0.18                    | 2                    |

**Average\* :** The average of 30 values in each position.

**Uniformity :** The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

**Stability :** One-half of the greatest maximum difference of measured temperature at any one probe.

**UUC\* :** Unit Under Calibration

**Note :** The reported uncertainty of measurement was included stability and excluded uniformity.

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

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*Malu*

a 1132470





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Cert.No.: 23CH442  
Page.: 1 of 2

## Certificate of Calibration

**Equipment :** pH Meter  
**Manufacturer :** Mettler Toledo  
**Model :** Seven2Go TM pH/mV S2  
**Serial No. :** C202355606  
**ID No. :** RYG\_FS0574  
**Condition As-Received:** Used Item  
**Received Date :** 31 March 2023  
**Calibration Date :** 03 April 2023  
**Reference :** 2303-1133DSC-3  
**Submitted by :** ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch  
616/10 Moo 5, T.Maenam Khu,  
A.Pluakdaeng, Rayong 21140, Thailand  
**Ambient Temperature :** (25 ± 2.5) °C  
**Relative Humidity :** (50 ± 15) %  
**Calibration Procedure :** In - house method :  
- CP-CH5 by direct measurement with standard  
voltage calibrator and direct measurement  
with certified reference material (CRM)

**Calibrated by :** Warakorn Lerngagtrakul

**Approved by :**   
Approved Signatory

( / ) Malee Butkruea  
( ) Saitthip Meangmai  
( ) Warakorn Lerngagtrakul

**Issue Date :** 5 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0052954



Cert. No.: 23CH442  
Page.: 2 of 2

### Condition of this calibration result

1. Reference Standard Instrument : -

| Instrument                     | Serial No. | ID No.   | Cert. No. | Due Date    |
|--------------------------------|------------|----------|-----------|-------------|
| 1) Document Process Calibrator | 54030049   | 130RC116 | 22E2769   | 24 Aug 2023 |

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

- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

| Buffer Solution | Manufacturer | Lot No. | Exp. date    |
|-----------------|--------------|---------|--------------|
| pH 4.008        | CPA chem     | 863832  | 28 Dec 2024  |
| pH 6.987        | CPA chem     | 826589  | 09 July 2023 |
| pH 10.010       | CPA chem     | 863835  | 28 Dec 2023  |

3. This certificate is valid only to the item calibrated on date and place of calibration.

### Calibration Results

Function : mV Measurement

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

| Unit Under Calibration | Nominal Value | Standard Voltage Input | Actual Reading |       | Uncertainty of Measurement | Coverage factor |
|------------------------|---------------|------------------------|----------------|-------|----------------------------|-----------------|
|                        | pH            | mV                     | mV             | pH    | ( ±mV )                    | k               |
| pH Meter               | 4.00          | 177.48                 | 177            | 4.00  | 0.58                       | 2.00            |
| S/N.: C202355606       | 7.00          | 0.00                   | 0              | 7.00  | 0.58                       | 2.00            |
|                        | 10.00         | -177.48                | -178           | 10.00 | 0.58                       | 2.00            |

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

| Unit Under Calibration        | Standard pH Buffer Solution | Actual pH Reading | Actual mV Reading ( mV ) | Uncertainty of pH measurement ( ± ) | Coverage factor k |
|-------------------------------|-----------------------------|-------------------|--------------------------|-------------------------------------|-------------------|
| pH Electrode<br>S/N.: 2015870 | 4.008                       | 4.01              | 170                      | 0.0071                              | 2.00              |
|                               | 6.987                       | 7.00              | -5                       | 0.011                               | 2.00              |
|                               | 10.010                      | 10.01             | -181                     | 0.0095                              | 2.00              |

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

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a 1156432



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 23LM86  
Page.: 1 of 2

## Certificate of Calibration

**Equipment :** pH Meter with Sensor  
**Manufacturer :** Mettler Toledo  
**Model :** Seven2GoTM pH/mV S2  
**Serial No. :** C202355606  
**ID No. :** RYG\_FS0574  
**Submitted by :** ALS Laboratory Group (Thailand) Co.,Ltd.  
Rayong Branch  
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,  
Rayong 21140, Thailand  
**Location :** TPA On Site Calibration Laboratory  
**Received Order :** 31 March 2023  
**Calibrated Date :** 05 April 2023  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %  
**AC Line Voltage :** ( 220 ± 22 ) V

**Calibrated by :** Preecha Hlahib

**Approved by :**   
Approved Signatory

( ) Pornthippa Tameyakul  
( / ) Malee Butkruea  
( ) Suwit Imjai

**Issue Date :** 21 April 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0053338



**Equipment :** pH Meter with Sensor  
**Condition As-Received :** Used Item  
**Reference :** 2303-1133DSC-4  
**Procedure Used :-**

**Cert. No.:** 23LM86  
**Page.:** 2 of 2

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer ( IPRT ) into Temperature Bath.

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

| Instrument   | Model | Serial No. | Cert. No. | Due Date    |
|--|-------|------------|-----------|-------------|
| 1) Digital Thermometer   | 1502A | A52847     | 2211325   | 31 Oct 2023 |
| 2. This certificate is valid only to the item calibrated on date and place of calibration. |       |            |           |             |
| 3. This certification is traceable to the International System of Unit.                    |       |            |           |             |

**Result of Calibration :-** ( \* ) Without Adjustment

**Function :** Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 2015870

| Calibration Point<br>( °C ) | Immersion Depth<br>( mm ) | Standard Temperature<br>( °C ) | UUC* Reading<br>( °C ) | Error<br>( °C ) | Uncertainty<br>( ± °C ) | Coverage Factor<br>k |
|-----------------------------|---------------------------|--------------------------------|------------------------|-----------------|-------------------------|----------------------|
| 25.0                        | 100                       | 25.002                         | 25.1                   | 0.098           | 0.16                    | 2.00                 |
| 40.0                        | 100                       | 40.001                         | 40.2                   | 0.199           | 0.16                    | 2.00                 |
| 60.0                        | 100                       | 60.005                         | 60.5                   | 0.495           | 0.16                    | 2.00                 |

UUC\* : Unit Under Calibration

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

-o0o-



a 1157393





# Automation Service Co.,Ltd. BKK EN0066

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Lamphun Branch : 122/5 M.4, T.Ban Klang, A.Muang, Lamphun 51000 Tel/Fax. 053-581-876  
website : www.automation.co.th

MTOC : L-0508/2023

Report No. : ALS-416/01

## TOC-L Maintenance Report

Instrument : Total Organic Carbon Analyzer Measuring : TC 0 ~ 30000 mg/L  
Model : TOC-LCSH Place of Installation : -  
Serial No. : H54425300416 Department : LABORATORY  
Manufacture : Shimadzu

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaen Suan Luang, Khet Suan Luang,  
Bangkok 10250 Thailand

Date of Maintenance : 11 / 05 / 2023

Ambient Condition : Temperature  $25.5 \pm 5^\circ\text{C}$   
Humidifier  $56 \pm 15\% \text{RH}$

Maintenance By : Peerapong Sangpan  
(Mr. Peerapong Sangpan)  
Technician

Approved By : P. Phungsomsak  
(Mr. Nipon Phungsomsak)  
Technician Manager

User Name : Siriluk P.  
(Siriluk Puengpang)

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|                |                   |
|----------------|-------------------|
| REVIEW BY      | <u>Siriluk P.</u> |
| APPROVED BY    | <u>KL AL</u>      |
| NEXT CAL. DATE | <u>11/05/2024</u> |



# Automation Service Co.,Ltd.

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website : www.automation.co.th

MTOC : L-0508/2023

Report No. : ALS-416/01

## Maintenance Sheet

Customer : ALS Laboratory Date : 11 / 05 / 2023  
Model : TOC-LCSH Serial No. H54425300416

| Item | Carry out maintenance work   | Result | Exchange | Comment                                   |
|------|--|--------|----------|---|
| 1.   | Check functionality of the device  |        |          |   |
|      | Check furnace temperature (Standard cat. $680^\circ\text{C}$ / for TN cat. $720^\circ\text{C}$ ) | O.K.   |          |   |
|      | Check dehumidifier temperature ( $1^\circ\text{C}$ )   | O.K.   |          |   |
|      | Check the entire flow line related to leakage  | O.K.   |          |   |
|      | Check baseline status (OK)   | O.K.   |          |   |
|      | Check carrier gas pressure ( $200 \pm 10 \text{ kPa}$ )  | O.K.   |          |   |
|      | Check carrier gas flow rate ( $150 \text{ mL/min}$ )   | O.K.   |          |   |
| 2.   | Tubes  |        |          |   |
|      | Check all tubing for contamination, if necessary clean them                                      | O.K.   |          |   |
|      | Check all tubing for tight connection  | O.K.   |          |   |
| 3.   | Container and Drainage   |        |          |   |
|      | Fill up humidifier with pure water to max. level   | O.K.   |          |   |
|      | Check filling of dilution water and acid container   | O.K.   |          |   |
|      | Rinse Drain Pot, after wards refill again with pure water  | O.K.   |          |   |
|      | Check if outlet flow is in proper conditions   | O.K.   |          |   |
| 4.   | TC and IC Injection  |        |          |   |
|      | Clean injector Block   | O.K.   |          |   |
|      | Check injector Block for wear  | O.K.   |          |   |
|      | Check injection tube adjustment  | O.K.   |          |   |
|      | Check injection for leakage  | O.K.   |          |   |
|      | Check injection for clogging   | O.K.   |          |   |
| 5.   | IC Measurement (N-type)  |        |          |   |
|      | Check acidification in syringe   |        |          |   |
|      | Check sparging in syringe  |        |          |   |
| 6.   | Eye check of 8-Port valve, for sample residues or moist spots that indicate possible leakage     | O.K.   |          |   |
| 7.   | Check and if necessary exchange consumable, Maintenance parts                                    | O.K.   |          | See list of consumable, maintenance parts |

Inspection by : Peerapong Sangpan  
(Mr. Peerapong Sangpan)  
Technician

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## Automation Service Co.,Ltd.

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 website : www.automation.co.th

MTOC : L-0508/2023

Report No. : ALS-416/01

| Item | Carry out maintenance work  | Result | Exchange | Comment          |
|------|---|--------|----------|------------------|
| 8.   | Due to instrument condition, clean the instrument inside and outside.   | O.K.   |          |                  |
| 9.   | After checking the system and exchanging of consumable and maintenance parts a new 1-3 point calibration have to be done. | O.K.   |          | Addition test 1. |
| 10.  | After wards the calibration perform check sample measurement.   | O.K.   |          | Addition test 2. |

### Addition test

| Test no. | Test conditions  | Meas. value                    | Result                                       |
|----------|--|--------------------------------|--|
| 1.       | Calibration TC standard solution at 0, 0.1, 0.5, 1, 5, 10, 20 Injection volume 50 µL No. of measurement 2 times (Max.3)  | 1.0000                         | Attachment :<br>ALS-416/02<br>Page 1/4 - 2/4 |
|          | Criteria : $R^2 = 0.995$ or more   |                                | Pass   |
| 2.       | Measurement of reagent water and TC standard solution at 5.0 mg/L injection volume 50 µL No. of measurement 2 times ( Max.3 ) and calculate accuracy by<br>Meas. of TC standard - Meas. of Reagent water | 5.202 - 0.2705<br>= 4.9315 ppm | Attachment :<br>ALS-416/02<br>Page 3/4 - 4/4 |
|          | Criteria : Accuracy %Recovery 10% or less  |                                | Pass   |

Inspection by : Peerapong Sangpan  
 ( Mr. Peerapong Sangpan )  
 Technician



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MTOC : L-0508/2023

Report No. : ALS-416/01

### List of Consumable, Maintenance parts

| Pos. | Part Number  | Part Name  | Result | Exchange | Recommended Interval                       |
|------|--------------|--|--------|----------|--|
| 1.   | 036-11209-84 | O-ring, 4D P10A<br>( Viton , for TC,IC Slider)     | O.K.   | √        | 1 time per year,<br>Depending on condition |
| 2.   | 036-11219-84 | O-ring, 4D P20<br>(for sealing TC-Combustion tube) | O.K.   |          | 1 time per year,<br>Depending on condition |
| 3.   | 638-15025    | O-ring, PIFE<br>(for TC,IC-Slider)                 | O.K.   |          | 1 time per year,<br>Depending on condition |
| 4.   | 630-00105-01 | Platinum net, (2pcs-set)<br>(to support catalyst)  | O.K.   |          | 6 month same time as<br>catalyst exchange  |
| 5.   | 630-00557    | Silica Wool<br>(to support catalyst)               | O.K.   |          | 6 month same time as<br>catalyst exchange  |
| 6.   | 630-00992    | Halogen Scrubber                                   | O.K.   |          | 6 month                                    |
| 7.   | 630-00996    | High Sensitivity TC Catalyst<br>(When installed)   | N/A    |          | Depending on condition                     |
| 8.   | 638-60116    | Regular Catalyst (33g)<br>(When installed)         | O.K.   |          | 6 month                                    |
| 9.   | 638-56251-01 | 8-Port valve rotor                                 | O.K.   |          | 1 time per year                            |
| 10.  | 638-41323    | TC-Combustion Tube                                 | O.K.   |          | 6 month same time as<br>catalyst exchange  |
| 11.  | 631-43404-01 | Packing, gasket slider<br>(for TC-Injection tube)  | O.K.   |          | 1 time per year,<br>Depending on condition |
| 12.  | 638-59296    | Syringe 5mL  | O.K.   |          | Depending on condition                     |
| 13.  | 638-59296-01 | Plunger Tip<br>(for syringe 5mL)                   | O.K.   | √        | 6 month                                    |
| 14.  | 042-00405-11 | IC reagent supply pump head                        | O.K.   |          | 1 time per year                            |
| 15.  | 630-00999    | CO2-Absorber<br>(for cell space purge)             | O.K.   |          | 1 time per year                            |
| 16.  | 630-00964    | Molecular Sieves 13x                               | O.K.   |          | 1 time per year                            |

Note. Table indicates the guidelines replacement periods when NPOC measurement is performed on sample that are comparatively as clean as tap water ,use standard catalyst and at a rate of about 500 sample per month ( operating five days a week )

Inspector By : Peerapong Sangpan  
 ( Mr. Peerapong Sangpan )  
 Technician

# TOC-Control L Report

2023\_05\_11\_001\_PM\_1\_2.dlx

## Instr. Information

Instrument Options  
Catalyst

TOC/ASI/IC Unit/  
Regular Sensitivity

## Cal. Curve

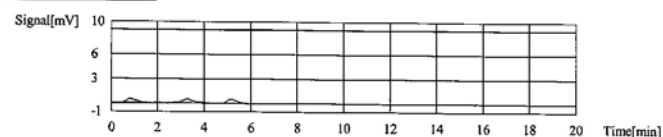
Sample Name: Untitled  
Sample ID: Untitled  
Cal. Curve: TC 0.1 - 20 ppm; 2023\_05\_11\_12\_18\_04.cal  
Status: Completed

| Typical  | Result |
|----------|--------|
| Standard | TC     |

Conc: 0.000mg/L

| Run | Area  | Conc | Std. Dev. | Mean  | Time                  |
|-----|-------|------|-----------|-------|-----------------------|
| 1   | 2.038 | 50uL | 1.000     | ***** | 5/11/2023 12:21:23 PM |
| 2   | 1.285 | 50uL | 1.000     | ***** | 5/11/2023 12:23:32 PM |
| 3   | 1.302 | 50uL | 1.000     | ***** | 5/11/2023 12:23:44 PM |

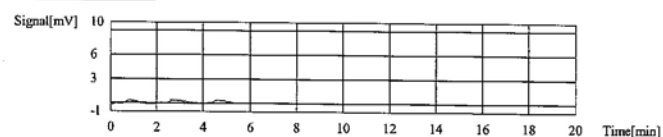
Acid Add: 0.000%  
Mean Area: 1.294  
SD Area: 0.01202  
CV Area: 0.93%



Conc: 0.1000mg/L

| Run | Area  | Conc | Std. Dev. | Mean  | Time                  |
|-----|-------|------|-----------|-------|-----------------------|
| 1   | 1.728 | 50uL | 10.00     | ***** | 5/11/2023 12:32:39 PM |
| 2   | 1.414 | 50uL | 10.00     | ***** | 5/11/2023 12:35:28 PM |
| 3   | 1.539 | 50uL | 10.00     | ***** | 5/11/2023 12:38:16 PM |

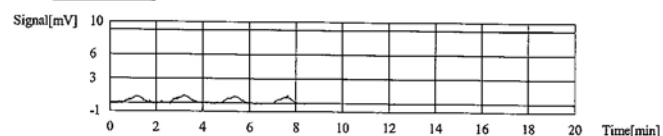
Acid Add: 0.000%  
Mean Area: 1.477  
SD Area: 0.08839  
CV Area: 5.99%



Conc: 0.5000mg/L

| Run | Area  | Conc | Std. Dev. | Mean  | Time                  |
|-----|-------|------|-----------|-------|-----------------------|
| 1   | 3.597 | 50uL | 2.000     | ***** | 5/11/2023 12:44:42 PM |
| 2   | 3.821 | 50uL | 2.000     | ***** | 5/11/2023 12:47:13 PM |
| 3   | 3.230 | 50uL | 2.000     | ***** | 5/11/2023 12:49:40 PM |
| 4   | 3.262 | 50uL | 2.000     | ***** | 5/11/2023 12:51:34 PM |

Acid Add: 0.000%  
Mean Area: 3.246  
SD Area: 0.02263  
CV Area: 0.70%



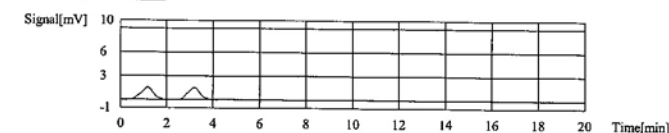
Conc: 1.000mg/L

# TOC-Control L Report

2023\_05\_11\_001\_PM\_1\_2.dlx

| Run | Area  | Conc | Std. Dev. | Mean  | Time                  |
|-----|-------|------|-----------|-------|-----------------------|
| 1   | 5.557 | 50uL | 1.000     | ***** | 5/11/2023 12:55:11 PM |
| 2   | 5.433 | 50uL | 1.000     | ***** | 5/11/2023 12:57:34 PM |

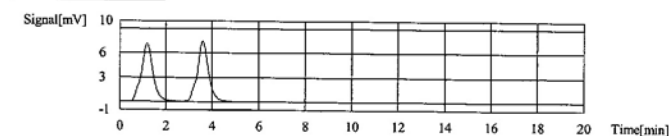
Acid Add: 0.000%  
Mean Area: 5.495  
SD Area: 0.08768  
CV Area: 1.60%



Conc: 5.000mg/L

| Run | Area  | Conc | Std. Dev. | Mean  | Time                 |
|-----|-------|------|-----------|-------|----------------------|
| 1   | 24.52 | 50uL | 4.000     | ***** | 5/11/2023 1:04:59 PM |
| 2   | 24.85 | 50uL | 4.000     | ***** | 5/11/2023 1:07:47 PM |

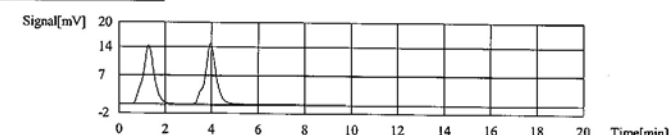
Acid Add: 0.000%  
Mean Area: 24.69  
SD Area: 0.2333  
CV Area: 0.95%



Conc: 10.00mg/L

| Run | Area  | Conc | Std. Dev. | Mean  | Time                 |
|-----|-------|------|-----------|-------|----------------------|
| 1   | 48.44 | 50uL | 2.000     | ***** | 5/11/2023 1:14:25 PM |
| 2   | 48.88 | 50uL | 2.000     | ***** | 5/11/2023 1:17:20 PM |

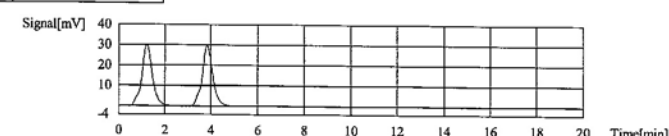
Acid Add: 0.000%  
Mean Area: 48.66  
SD Area: 0.3111  
CV Area: 0.64%



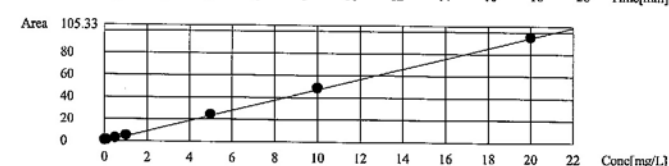
Conc: 20.00mg/L

| Run | Area  | Conc | Std. Dev. | Mean  | Time                 |
|-----|-------|------|-----------|-------|----------------------|
| 1   | 95.93 | 50uL | 1.000     | ***** | 5/11/2023 1:21:11 PM |
| 2   | 95.58 | 50uL | 1.000     | ***** | 5/11/2023 1:24:09 PM |

Acid Add: 0.000%  
Mean Area: 95.75  
SD Area: 0.2475  
CV Area: 0.26%



Slope: 4.742  
Intercept: 0.000  
r^2: 1.0000  
r: 1.0000  
RSE(%): N/A  
Zero Shift: Yes



# TOC-Control L Report

2023\_05\_11\_001\_PM\_1\_2.tlx

## Instr. Information

Instrument Options  
Catalyst

TOC/ASI/IC Unit/  
Regular Sensitivity

## Sample

Sample Name: TC\_5  
Sample ID: Untitled  
Origin: TC 0.1 - 20 ppm.cal  
Status: Completed  
Chk. Result

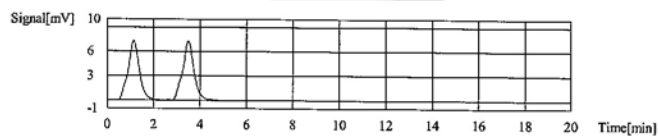
| Area    | Conc | Vol   | Unit | Time         |
|---------|------|-------|------|--------------|
| Unknown | TC   | 1.000 |      | TC:5.202mg/L |

1. Det

Anal.: TC

| No. | Area  | Conc      | Vol  | Unit  | Time                                    |
|-----|-------|-----------|------|-------|---|
| 1   | 24.51 | 5.169mg/L | 50uL | 1.000 | TC 0.1 - 20 ppm.2023_05_11_12_18_04.cal |
| 2   | 24.83 | 5.236mg/L | 50uL | 1.000 | TC 0.1 - 20 ppm.2023_05_11_12_18_04.cal |

Mean Area: 24.67  
Mean Conc: 5.202mg/L



# TOC-Control L Report

2023\_05\_11\_001\_PM\_1\_2.tlx

## Instr. Information

Instrument Options  
Catalyst

TOC/ASI/IC Unit/  
Regular Sensitivity

## Sample

Sample Name: Water  
Sample ID: Untitled  
Origin: TC 0.1 - 20 ppm.cal  
Status: Completed  
Chk. Result

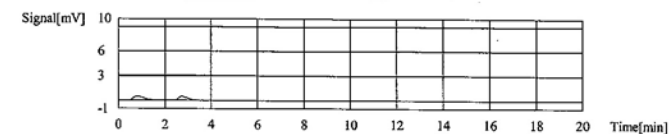
| Area    | Conc | Vol   | Unit | Time          |
|---------|------|-------|------|---------------|
| Unknown | TC   | 1.000 |      | TC:0.2705mg/L |

1. Det

Anal.: TC

| No. | Area  | Conc       | Vol  | Unit  | Time                                    |
|-----|-------|------------|------|-------|---|
| 1   | 1.311 | 0.2765mg/L | 50uL | 1.000 | TC 0.1 - 20 ppm.2023_05_11_12_18_04.cal |
| 2   | 1.254 | 0.2644mg/L | 50uL | 1.000 | TC 0.1 - 20 ppm.2023_05_11_12_18_04.cal |

Mean Area: 1.283  
Mean Conc: 0.2705mg/L





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website : www.automation.co.th

MTOC : L-0509/2023

Report No. : ALS-799/01

### ASI Maintenance Report

Instrument : Automatic Sample Injector Measuring : Vial 40 mL  
Model : ASI-L Place of Installation : -  
Serial No. : H57415200799 Department : LABOLATORY  
Manufacture : Shimadzu

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaen Suan Luang, Khet Suan Luang,  
Bangkok 10250 Thailand

Date of Maintenance : 11 / 05 / 2023

Ambient Condition : Temperature  $25.5 \pm 5^\circ\text{C}$   
Humidifier  $56 \pm 15\% \text{RH}$

Maintenance By : Peerapong Sangpan  
( Mr. Peerapong Sangpan )  
Technician

Approved By : N. Phongsomsak  
( Mr. Nipon Phongsomsak )  
Technician Manager

User Name : Sinluk P.  
( Mr. Sinluk Puengpang )

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## Automation Service Co.,Ltd.

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Lamphun Branch : 122/5 M.4, T.Ban Klang, A.Muang, Lamphun 51000 Tel/Fax. 053-581-876  
website : www.automation.co.th

MTOC : L-0509/2023

Report No. : ALS-799/01

### Maintenance Sheet

Customer : ALS Laboratory Date : 11 / 05 / 2023  
Model : ASI-L Serial No. H57415200799

| Item | Carry out maintenance work                                    | Result | Exchange | Comment                                   |
|------|---|--------|----------|---|
| 1.   | Arm Drive section   | O.K.   |          |   |
|      | Check Arm Drive Belt for wear and tension                     | O.K.   |          |   |
|      | Check grease of Screw Arm Drive                               | O.K.   |          |   |
| 2.   | Rinse pump (only ASI-V 24ml, 40ml)                            | O.K.   |          |   |
|      | Check pump rate(>40mL/min)                                    | O.K.   |          |   |
|      | Check pump and tube connection for leakage                    | O.K.   |          |   |
|      | Check if outlet flow is in proper condition                   | O.K.   |          |   |
| 3.   | Check and if necessary exchange consumable, Maintenance parts | O.K.   |          | See appropriate list of maintenance parts |
| 4.   | Check Stirrer [When installed]                                | O.K.   |          |   |
| 5.   | Verify ASI function via mechanical check                      | O.K.   |          |   |

Inspection by : Peerapong Sangpan  
( Mr. Peerapong Sangpan )  
Technician

SHIMADZU ANALYZER  
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MTOC : L-0509/2023

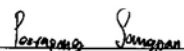
Report No. : ALS-799/01

### List of Consumable, Maintenance parts

| Pos. | Part Number  | Part Name  | Result | Exchange | Recommended Interval  |
|------|--------------|--|--------|----------|---|
| 1.   | 017-27021-01 | Grease Paste, Lubricant<br>100g  | O.K.   | √        | 1 time per year   |
| 2.   | 032-22661-02 | Belt, 60S2m596, Arm Drive  | O.K.   |          | 1 time per year<br>Depending on condition                     |
| 3.   | 034-03067-02 | Spring, F-642, Arm Drive   | O.K.   |          | Depending on condition  |
| 4.   | 042-00405-11 | Pump Head, for ASI Rinse<br>Pump<br>(only ASI-V 24mL, 40mL)                  | O.K.   |          | After 300 h of operating                                      |
| 5.   | 638-41448-01 | Std. Needle Type1 24mL,<br>40mL*<br>(for tube 2, 1x1, 6),[ Sparge<br>needle] | N/A    |          | Depending on condition  |
| 6.   | 638-41448-02 | Std. Needle Type1 125mL*<br>(for tube 2, 1x1, 6)                             | N/A    |          | Depending on condition  |
| 7.   | 631-41660-03 | Flare Pipe 2x1,5x700mm*<br>(for Standard Needle Type1<br>24mL,40mL, 125mL)   | N/A    |          | Depending on condition<br>(may cut to origin length<br>600mm) |
| 8.   | 638-41450-01 | Needle for Suspended<br>Particles,*<br>0,8mm (only ASI-V 24mL,<br>40mL)      | N/A    |          | Depending on condition  |
| 9.   | 638-41450-01 | Std. Needle Type2 125mL*<br>(for tube 1,4x0,9)                               | N/A    |          | Depending on condition  |
| 10.  | 638-41472-01 | Std. Needle Type2 24mL,<br>40mL*<br>(for tube 1,4x0,9)                       | O.K.   |          | Depending on condition  |
| 11.  | 631-41660-02 | Flare Pipe 1,4x0,9x600mm*<br>(for Suspended + Needle<br>Type2)               | O.K.   |          | Depending on condition  |
| 12.  | 638-41449-01 | Double Needle , only<br>24mL,40mL<br>(simultaneous sparge type)*             | N/A    |          | Depending on condition  |
| 13.  | 631-41660-01 | Flare Pipe 1,1x0,6x600mm*<br>(for Double Needle<br>24mL,40mL)                | N/A    |          | Depending on condition  |

\*Note: needed parts depending on installed needle types!

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