

**ภาคผนวก จ**  
**เอกสารสอบเทียบเครื่องมือ**

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List of Instruments Certification for Environmental Quality Analysis

| No.                                  | Instrument/Equipment                         | Parameter   | Manufacturer         | Model/Serial No.                 | Calibrator   | Certification No. | Date of Calibration | Due date of Calibration* | Remark |
|--------------------------------------|--|---|----------------------|----------------------------------|--|-------------------|---------------------|--------------------------|--------|
| Equipment for Air Quality Analysis   |  |   |                      |                                  |  |                   |                     |                          |        |
| 1                                    | Analytical Balance<br>(Readability 0.1 mg)   | ฝุ่นละอองรวม (TPS)<br>ฝุ่นละอองขนาดเล็กที่สามารถเข้าถึงและสะสมในถุงลมปอดได้ | Mettler-Toledo       | MS204TS/00<br>C252436235         | National Food Institute,<br>Ministry of Industry, Thailand | 2402420-003-01    | 19 Apr 24           | 18 Apr 25                | -      |
| 2                                    | Analytical Balance<br>(Readability 0.001 mg) |   | Mettler-Toledo       | XP6 /<br>B322373893              | National Food Institute,<br>Ministry of Industry, Thailand | 2402420-002-01    | 19 Apr 24           | 18 Apr 25                | -      |
| 3                                    | UV-VIS Spectrophotometer                     | ก๊าซออกไซด์ของไนโตรเจน (NOx as NO2)   | Agilent Technologies | Cary60 G6860A /<br>MY15410009    | DQE Services Co.,Ltd.                                      | SP24-018          | 9 May 24            | 8 May 25                 | -      |
| Equipment for Water Quality Analysis |  |   |                      |                                  |  |                   |                     |                          |        |
| 4                                    | pH Meter                                     | อุณหภูมิ (Temperature)<br>ความเป็นกรด-ด่าง (pH)                             | Mettler-Toledo       | Seven Easy S20 /<br>1231155210   | National Food Institute,<br>Ministry of Industry, Thailand | 2401718-001-01    | 11 Mar 24           | 10 Mar 25                | -      |
| 5                                    | Analytical Balance<br>(Readability 0.1 mg)   | น้ำมันและไขมัน (Oil & Grease)   | Mettler-Toledo       | XSR204 /<br>C117635043           | Technology Promotion Association<br>(Thailand-Japan)       | 24MM293           | 11 May 24           | 10 May 25                | -      |
| 6                                    | Analytical Balance<br>(Readability 0.01 mg)  | ของแข็งละลายทั้งหมด (TDS)   | Mettler-Toledo       | XSR205DU /<br>C009071872         | National Food Institute,<br>Ministry of Industry, Thailand | 2402283-001-01    | 2 Apr 24            | 1 Apr 25                 | -      |
| 7                                    | Hot Air Oven                                 |   | Memmert              | UF55 /<br>B216.1666              | National Food Institute,<br>Ministry of Industry, Thailand | 2400141-001-01    | 11 Oct 23           | 10 Oct 24                | -      |
| 8                                    | BOD Incubator                                | บีโอดี (BOD5)   | Arco                 | UC4-1320 /<br>(UAE.WAO.015/2561) | Technology Promotion Association<br>(Thailand-Japan)       | 24TM303           | 10 Feb 24           | 9 Feb 25                 | -      |
| 9                                    | COD Reactor<br>(Heating Block)               | ซีโอดี (COD)  | Hanna                | H1839800-02 /<br>6480019101      | Hanna Instruments (Thailand) Ltd.                          | HIT-2413-0434     | 25 Mar 24           | 24 Mar 25                | -      |
| 10                                   | UV-VIS Spectrophotometer                     |   | Agilent Technologies | Cary60 G6860A /<br>MY15410009    | DQE Services Co.,Ltd.                                      | SP24-018          | 7 May 24            | 6 May 25                 | -      |
| 11                                   | Digester Unit                                | Total Kjeldahl Nitrogen (TKN)   | FOSS<br>TECATOR      | DT2520 /<br>91794469             | FOSS South East Asia                                       | 9809              | 8 Feb 24            | 7 Feb 25                 | -      |
| 12                                   | Distillation Unit<br>(Kjeldahl Method)       |   | FOSS<br>TECATOR      | KT200 /<br>91790524              | FOSS South East Asia                                       | 9810              | 9 Feb 24            | 7 Feb 25                 | -      |

Due Date of Calibration\* : Based on the annual calibration plan. At least 1 time per year.

## Calibration Certificate

**Certificate No.:** 2402420-003-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** MS204TS/00  
**Serial No.:** C252436235  
**ID No.:** UAE.AIR.023/2566  
**Order No.:** 2402420  
**Operation No.:** 2402420-003  
**Date of Receipt:** 19 April 2024  
**Date of Calibration:** 19 April 2024

**Calibrated by** Mr.Pheraphat Tuanjit  
Scientist

**Approved by**   
( Miss Preeyaporn Jaengkarnkit )  
Vice President, Department of Laboratory Services  
Responsible for the Technical Management Team

**Date of Issue:** 23 April 2024

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65



## Calibration Report

**Certificate No.:** 2402420-003-01

**Equipment:**

Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Model:** MS204TS/00

**Resolution:** 0.0001 g

**Serial No.:** C252436235

**ID No.:** UAE.AIR.023/2566

**Capacity:** 220 g

**Date of Calibration:** 19 April 2024

Page 2 of 3

**Environment Condition:** Ambient Temperature: 21.7 ± 1.5 °C Relative Humidity: 65 ± 6.7 %

**Place of Calibration:** Room 206 Balance Room 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Condition of Equipment:** Good Condition

**Condition of This Results of Calibration:**

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

| Reference Standard       | Model   | Serial No. | Calibrated By | Certificate No. | Due Date         |
|--------------------------|---------|------------|---------------|-----------------|------------------|
| Standard Weight Class E2 | 1-500mg | 15880      | TCS           | M2311181S       | 28 November 2024 |
| Standard Weight Class E2 | 1-500g  | 15882      | TCS           | M2311182S       | 28 November 2024 |

| Instrument         | Model  | Serial No.     | Calibrated By  | Certificate No. | Due Date     |
|--------------------|--------|----------------|----------------|-----------------|--------------|
| Thermo-Hygro Meter | 608-H1 | NFI.BTH 019/23 | Quality Reborn | QR24-0492       | 4 March 2025 |

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

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

**Calibration Results:**

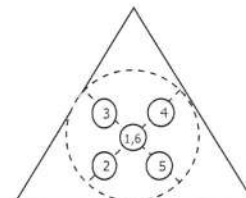
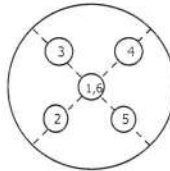
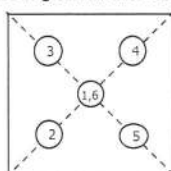
**1. Repeatability of Reading:**

| Nominal Value ( g ) | Standard Deviation of Reading ( g ) |
|---------------------|-------------------------------------|
| 100                 | 0.000074                            |
| 200                 | 0.000074                            |

**2. Off-Center Error:**

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



| 1        | 2        | 3        | 4        | 5        | 6        | (Maximum Difference) |
|----------|----------|----------|----------|----------|----------|----------------------|
| ( g )    | ( g )    | ( g )    | ( g )    | ( g )    | ( g )    | ( g )                |
| 100.0005 | 100.0006 | 100.0003 | 100.0006 | 100.0003 | 100.0005 | 0.0002               |

*P. Jaenghant*  
23 April 2024



## Calibration Report

**Certificate No.:** 2402420-003-01

**Equipment:**

Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Model:** MS204TS/00

**Resolution:** 0.0001 g

**Serial No.:** C252436235

**ID No.:** UAE.AIR.023/2566

**Capacity:** 220 g

**Date of Calibration:** 19 April 2024

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**Calibration Results:** (Continued)

**Calibration Range:** 0-200 g

**Calibration Adjustment:** Internal Calibration

### 3. Departure from Nominal Value:

| Nominal Value<br>( g ) | Standard Value<br>( g ) | Average Reading<br>( g ) | Correction<br>( g ) | Uncertainty<br>( ± g ) | Coverage Factor<br><i>k</i> |
|------------------------|-------------------------|--------------------------|---------------------|------------------------|-----------------------------|
| Unload                 | 0.00000                 | 0.0000                   | 0.0000              | 0.000094               | 2.00                        |
| 0.1                    | 0.10000                 | 0.1000                   | 0.0000              | 0.000094               | 2.00                        |
| 1                      | 0.99998                 | 1.0000                   | 0.0000              | 0.000097               | 2.00                        |
| 5                      | 4.99997                 | 5.0000                   | 0.0000              | 0.000096               | 2.00                        |
| 10                     | 10.00002                | 10.0000                  | 0.0000              | 0.00012                | 2.00                        |
| 20                     | 20.00003                | 20.0001                  | -0.0001             | 0.00014                | 2.00                        |
| 50                     | 49.99998                | 50.0003                  | -0.0003             | 0.00012                | 2.00                        |
| 70                     | 70.00000                | 70.0005                  | -0.0005             | 0.00017                | 2.00                        |
| 100                    | 99.99997                | 100.0006                 | -0.0006             | 0.00017                | 2.00                        |
| 150                    | 149.99994               | 150.0012                 | -0.0013             | 0.00022                | 2.00                        |
| 200                    | 200.00001               | 200.0015                 | -0.0015             | 0.00028                | 2.00                        |

*P. Jongsakul*  
23 April 2024

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 %.

----- End -----

F-CS-012 Revision: 01 Date: 20-04-65



## Calibration Certificate

**Certificate No.:** 2402420-002-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** XP6  
**Serial No.:** B322373893  
**ID No.:** UAE.AIR.019/2556  
**Order No.:** 2402420  
**Operation No.:** 2402420-002  
**Date of Receipt:** 19 April 2024  
**Date of Calibration:** 19 April 2024

**Calibrated by** Mr.Pheraphat Tuanjit  
Scientist

**Approved by**   
( Miss Preeyaporn Jaengkarnkit )

Vice President, Department of Laboratory Services  
Responsible for the Technical Management Team

**Date of Issue:** 23 April 2024

**The uncertainties are for a confidence probability of approximately 95%**

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65





## Calibration Report

**Certificate No.:** 2402420-002-01

**Equipment:** Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Model:** XP6

**Resolution:** 0.000001 g

**Serial No.:** B322373893

**ID No.:** UAE.AIR.019/2556

**Capacity:** 6.1 g

**Date of Calibration:** 19 April 2024

Page 2 of 3

**Environment Condition:** Ambient Temperature: 22.6 ± 1.8 °C Relative Humidity: 48 ± 6.0 %

**Place of Calibration:** Room 206 Balance Room 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Condition of Equipment:** Good Condition

### Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

| Reference Standard       | Model   | Serial No. | Calibrated By | Certificate No. | Due Date         |
|--------------------------|---------|------------|---------------|-----------------|------------------|
| Standard Weight Class E2 | 1-500mg | 15880      | TCS           | M2311181S       | 28 November 2024 |
| Standard Weight Class E2 | 1-500g  | 15882      | TCS           | M2311182S       | 28 November 2024 |

| Instrument         | Model  | Serial No.     | Calibrated By  | Certificate No. | Due Date     |
|--------------------|--------|----------------|----------------|-----------------|--------------|
| Thermo-Hygro Meter | 608-H1 | NFI.BTH 019/23 | Quality Reborn | QR24-0492       | 4 March 2025 |

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

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

### Calibration Results:

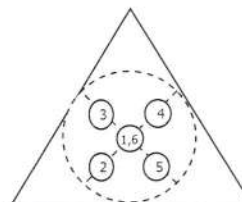
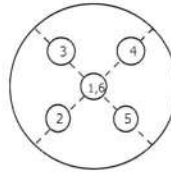
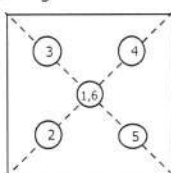
#### 1. Repeatability of Reading:

| Nominal Value ( g ) | Standard Deviation of Reading ( g ) |
|---------------------|-------------------------------------|
| 3                   | 0.0000057                           |
| 6                   | 0.0000019                           |

#### 2. Off-Center Error:

A mass of 2 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



| 1        | 2        | 3        | 4        | 5        | 6        | (Maximum Difference) |
|----------|----------|----------|----------|----------|----------|----------------------|
| ( g )    | ( g )    | ( g )    | ( g )    | ( g )    | ( g )    | ( g )                |
| 1.999981 | 1.999983 | 1.999980 | 1.999984 | 1.999983 | 1.999981 | 0.000003             |

P. Jongsakulit  
23 April 2024

## Calibration Report

**Certificate No.:** 2402420-002-01

**Equipment:** Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Model:** XP6

**Resolution:** 0.000001 g

**Serial No.:** B322373893

**ID No.:** UAE.AIR.019/2556

**Capacity:** 6.1 g

**Date of Calibration:** 19 April 2024

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**Calibration Results:** (Continued)

**Calibration Range:** 0-6 g

**Calibration Adjustment:** Internal Calibration

### 3. Departure from Nominal Value:

| Nominal Value<br>( g ) | Standard Value<br>( g ) | Average Reading<br>( g ) | Correction<br>( g ) | Uncertainty<br>( ± g ) | Coverage Factor<br>k |
|------------------------|-------------------------|--------------------------|---------------------|------------------------|----------------------|
| Unload                 | 0.0000000               | 0.000000                 | 0.000000            | 0.0000032              | 2.00                 |
| 0.01                   | 0.0099970               | 0.009999                 | -0.000002           | 0.0000047              | 2.00                 |
| 0.05                   | 0.0500010               | 0.050003                 | -0.000002           | 0.0000048              | 2.00                 |
| 0.10                   | 0.1000010               | 0.100001                 | 0.000000            | 0.0000069              | 2.00                 |
| 0.15                   | 0.1500020               | 0.150002                 | 0.000000            | 0.0000083              | 2.00                 |
| 0.17                   | 0.1700050               | 0.170006                 | -0.000001           | 0.000012               | 2.00                 |
| 0.20                   | 0.1999990               | 0.200002                 | -0.000003           | 0.0000083              | 2.00                 |
| 1.50                   | 1.4999750               | 1.499971                 | 0.000004            | 0.000027               | 2.00                 |
| 3.00                   | 2.9999680               | 2.999959                 | 0.000009            | 0.000028               | 2.00                 |
| 4.50                   | 4.4999810               | 4.499967                 | 0.000014            | 0.000022               | 2.00                 |
| 6.00                   | 5.9999490               | 5.999931                 | 0.000018            | 0.000032               | 2.00                 |

*S. Jongsakulkit*  
23 April 2024

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 %.

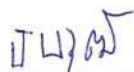
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F-CS-012 Revision: 01 Date: 20-04-65



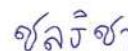
**CERTIFICATE OF CALIBRATION****Certificate No. :** SP24-018

Page 1 of 5

**Customer :** United Analyst and Engineering Consultant Co.,Ltd. (Head Office)**Address :** 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260**Location of calibration :** Laboratory 315**Equipment :** UV-Vis Spectrophotometer**Manufacturer :** Agilent Technologies**Model :** Cary 60**Serial No. :** MY15410009**ID No. :** UAE.WAT.020/2558**Received Date :** 7 May 2024**Calibration Date :** 7 May 2024**Issue Date :** 9 May 2024**Condition Instrument :** Good**Calibrated by :**

( Mr.Tanawut Rittidach )

Technical Manager

**Approved by :**

( Ms. Chonthicha Sangngern )

Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.



## REPORT OF CALIBRATION

**Certificate No. :** SP24-018

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**Environment Condition :** Ambient Temperature  $25 \pm 5$  °CRelative humidity  $55 \pm 20$  %RH**Calibration method :** In-house method CP-01 Based on ASTM E275-08**Certified Reference Materials :**

| Material                | Serial No. | Certificate No. | Due date        |
|-------------------------|------------|-----------------|-----------------|
| Absorbance Standard set | 25760      | 115663          | 25 October 2025 |
| Absorbance Standard set | 25757      | 115638          | 25 October 2025 |
| Wavelength Standard set | 25806      | 115657          | 25 October 2025 |
| Wavelength Standard set | 25758      | 115665          | 25 October 2025 |

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

Institute of Standards and Technology (NIST) through Sarna Scientific Limited

**Spectral Band Width of UUC :** 1.5 nm.**Scan Speed of UUC :** 60 nm/min**Scan Interval of UUC :** 0.15 nm.**Resolution of UUC :** Photometric 0.0001 Abs.

Wavelength 0.1 nm.

## REPORT OF CALIBRATION

Certificate No. : SP24-018

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Calibration Results : Without adjustment

Photometric Accuracy :

| Wavelength<br>(nm.) | CRMs Values<br>(Abs) | UUC Reading<br>(Abs) | Correction<br>(Abs) | Uncertainty<br>(Abs) | Coverage factor<br><i>k</i> |
|---------------------|----------------------|----------------------|---------------------|----------------------|-----------------------------|
| 420                 | 0.0000               | 0.0000               | 0.0000              | 0.0028               | 2.00                        |
|                     | 0.5780               | 0.5747               | 0.0033              | 0.0031               | 2.00                        |
|                     | 1.0484               | 1.0438               | 0.0046              | 0.0029               | 2.00                        |
|                     | 2.1876               | 2.1832               | 0.0044              | 0.0080               | 2.00                        |
| 440                 | 0.0000               | 0.0000               | 0.0000              | 0.0028               | 2.00                        |
|                     | 0.5595               | 0.5581               | 0.0014              | 0.0034               | 2.00                        |
|                     | 1.0239               | 1.0231               | 0.0008              | 0.0035               | 2.00                        |
|                     | 2.1230               | 2.1219               | 0.0011              | 0.0080               | 2.00                        |
| 465                 | 0.0000               | 0.0000               | 0.0000              | 0.0028               | 2.00                        |
|                     | 0.5230               | 0.5184               | 0.0046              | 0.0030               | 2.00                        |
|                     | 0.9633               | 0.9614               | 0.0019              | 0.0029               | 2.00                        |
|                     | 1.9753               | 1.9731               | 0.0022              | 0.0070               | 2.00                        |
| 546.1               | 0.0000               | 0.0000               | 0.0000              | 0.0028               | 2.00                        |
|                     | 0.5181               | 0.5150               | 0.0031              | 0.0031               | 2.00                        |
|                     | 1.0002               | 0.9964               | 0.0038              | 0.0033               | 2.00                        |
|                     | 1.9973               | 1.9914               | 0.0059              | 0.0088               | 2.00                        |
| 590                 | 0.0000               | 0.0000               | 0.0000              | 0.0028               | 2.00                        |
|                     | 0.5517               | 0.5485               | 0.0032              | 0.0030               | 2.00                        |
|                     | 1.0803               | 1.0772               | 0.0031              | 0.0030               | 2.00                        |
|                     | 2.0373               | 2.0293               | 0.0080              | 0.0080               | 2.00                        |
| 635                 | 0.0000               | 0.0000               | 0.0000              | 0.0028               | 2.00                        |
|                     | 0.5591               | 0.5565               | 0.0026              | 0.0031               | 2.00                        |
|                     | 1.0518               | 1.0482               | 0.0036              | 0.0030               | 2.00                        |
|                     | 1.9274               | 1.9202               | 0.0072              | 0.0079               | 2.00                        |

## REPORT OF CALIBRATION

Certificate No. : SP24-018

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### Photometric Accuracy :

| Wavelength<br>(nm.) | CRMs Values<br>(Abs) | UUC Reading<br>(Abs) | Correction<br>(Abs) | Uncertainty<br>(Abs) | Coverage factor<br><i>k</i> |
|---------------------|----------------------|----------------------|---------------------|----------------------|-----------------------------|
| 235                 | 0.0000               | 0.0000               | 0.0000              | 0.0050               | 2.00                        |
|                     | 0.7469               | 0.7435               | 0.0034              | 0.0057               | 2.00                        |
| 257                 | 0.0000               | 0.0000               | 0.0000              | 0.0050               | 2.00                        |
|                     | 0.8674               | 0.8639               | 0.0035              | 0.0060               | 2.00                        |
| 313                 | 0.0000               | 0.0000               | 0.0000              | 0.0050               | 2.00                        |
|                     | 0.2919               | 0.2907               | 0.0012              | 0.0051               | 2.00                        |
| 350                 | 0.0000               | 0.0000               | 0.0000              | 0.0050               | 2.00                        |
|                     | 0.6430               | 0.6402               | 0.0028              | 0.0055               | 2.00                        |

## REPORT OF CALIBRATION

Certificate No. : SP24-018

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### Wavelength Accuracy :

| CRMs Values<br>(nm.) | UUC Reading<br>(nm.) | Correction<br>(nm.) | Uncertainty<br>(nm.) | Coverage factor<br><i>k</i> |
|----------------------|----------------------|---------------------|----------------------|-----------------------------|
| 241.72               | 242.0                | -0.28               | 0.18                 | 2.00                        |
| 279.45               | 279.5                | -0.05               | 0.18                 | 2.00                        |
| 287.81               | 287.9                | -0.09               | 0.18                 | 2.00                        |
| 334.06               | 333.9                | 0.16                | 0.18                 | 2.00                        |
| 360.93               | 360.5                | 0.43                | 0.18                 | 2.00                        |
| 418.59               | 418.1                | 0.49                | 0.18                 | 2.00                        |
| 445.94               | 445.6                | 0.34                | 0.18                 | 2.00                        |
| 453.66               | 453.3                | 0.36                | 0.18                 | 2.00                        |
| 460.02               | 459.8                | 0.22                | 0.18                 | 2.00                        |
| 536.59               | 536.0                | 0.59                | 0.18                 | 2.00                        |
| 637.98               | 638.7                | -0.72               | 0.18                 | 2.00                        |
| 431.38               | 430.8                | 0.58                | 0.18                 | 2.00                        |
| 472.50               | 472.4                | 0.10                | 0.18                 | 2.00                        |
| 513.47               | 513.7                | -0.23               | 0.18                 | 2.00                        |
| 528.88               | 529.1                | -0.22               | 0.18                 | 2.00                        |
| 573.17               | 573.5                | -0.33               | 0.18                 | 2.00                        |
| 585.35               | 585.2                | 0.15                | 0.20                 | 2.00                        |
| 684.40               | 685.1                | -0.70               | 0.18                 | 2.00                        |
| 740.72               | 741.4                | -0.68               | 0.20                 | 2.00                        |
| 748.55               | 749.1                | -0.55               | 0.18                 | 2.00                        |
| 807.03               | 807.3                | -0.27               | 0.18                 | 2.00                        |
| 879.28               | 879.3                | -0.02               | 0.18                 | 2.00                        |

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement *U* is stated as the standard uncertainty of measurement multiplied by the coverage factor *k*,

which for a normal distribution corresponds to a coverage probability of approximately 95%

- \* Indicates non TISI accredited

- End of Certificate -



## Calibration Certificate

**Certificate No.:** 2401718-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

**Equipment:** pH Meter  
**Manufacturer:** METTLER TOLEDO  
**Model:** SevenEasy pH  
**Serial No.:** 1231155210  
**ID No.:** UAE.WAT.010/2553  
**Order No.:** 2401718  
**Operation No.:** 2401718-001  
**Date of Receipt:** 27 February 2024  
**Date of Calibration:** 11 March 2024

**Calibrated by** Mr.Manas Somsak  
Specialist

**Approved by**   
( Mr.Pheraphat Tuanjit )

Manager, Division of Calibration Laboratory

**Date of Issue:** 12 March 2024

Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65





## Calibration Report

**Certificate No.:** 2401718-001-01

**Equipment:** pH Meter **Resolution:** 0.01 pH ; 1 mV

**Manufacturer:** METTLER TOLEDO **Model:** SevenEasy pH

**Serial No.:** 1231155210 **Type:** Bench top

**ID No.:** UAE.WAT.010/2553

**Date of Calibration:** 11 March 2024 Page 2 of 5

**Location:** Chemical Calibration Laboratory, National Food Institute

**Environment Condition:** **Ambient Temperature:** ( 23.4 ± 1.5 ) °C **Relative Humidity:** ( 51 ± 3 ) %

**Condition of Equipment:** Good Condition

**Condition of this Results of Calibration**

1. Calibration Method W-CC-002 : In house method based on direct measurement by using standard voltage calibrator and certified reference material (CRM)
2. Reference Standards / Certified Reference Material

| <u>Instruments</u>                               | <u>Serial / ID No.</u> | <u>Manufacturer</u> | <u>Certificate No.</u> | <u>Due Date</u>    |
|--|------------------------|---------------------|------------------------|--------------------|
| 2.1 DC Voltage Calibrator                        | 2709007                | Fluke               | 23E2003                | 14 June 2024       |
| 2.2 Digital Thermometer                          | 2709007                | Fluke               | CC 660570-01           | 30 October 2024    |
| 2.3 Thermo-Hygro Meter                           | NFI.BTH 014/23         | testo               | CC 660353-01           | 3 April 2024       |
| <u>Certified Reference Material</u>              | <u>Lot. No.</u>        | <u>Manufacturer</u> | <u>Ref N</u>           | <u>Expire Date</u> |
| 2.4 pH buffer 4.008 (Primary pH buffer Solution) | 888842                 | CPAchem             | PH216.L5               | 13 April 2025      |
| 2.5 pH buffer 6.865 (Primary pH buffer Solution) | 888843                 | CPAchem             | PH217.L5               | 13 April 2025      |
| 2.6 pH buffer 10.01 (Primary pH buffer Solution) | 888844                 | CPAchem             | PH220.L5               | 13 April 2024      |
| 2.7 pH buffer 7.00 (Standard pH buffer Solution) | C03109                 | HACH LANGE GmbH     | S11M004                | 16 October 2025    |

3. This certification is traceable to The International System of Unit (SI Unit)
  - 3.1 Instruments No.2.1 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0008
  - 3.2 Instruments No.2.2 and 2.3 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061
  - 3.3 Certified Reference Material No.2.4 to 2.6 traceable to Primary measurement method- Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
  - 3.4 Certified Reference Material No.2.7 traceable to PTB Certificate Nr. PTB-PHOA-563/30504/23 and Certificate Nr. PTB-PHOB-555/30620/22 (PTB: Physikalisch-Technische Bundesanstalt, Braunschweig, Germany)
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.

F-CS-012 Revision: 01 Date: 20-04-65

## Calibration Report

**Certificate No.:** 2401718-001-01

**Equipment:** pH Meter **Resolution:** 0.01 pH ; 1 mV

**Manufacturer:** METTLER TOLEDO **Model:** SevenEasy pH

**Serial No.:** 1231155210 **Type:** Bench top

**ID No.:** UAE.WAT.010/2553

**Date of Calibration:** 11 March 2024

Page 3 of 5

### Calibration Results:

1. Calibration of pH Meter ( Manual Temperature Compensation at 25 °C )  
(offset value before adjust: -0.4 mV)

| Nominal pH | DC Voltage Standard ( mV ) | Average Indicator Reading |       | Uncertainty ( ±mV ) | Coverage Factor ( k ) |
|------------|----------------------------|---------------------------|-------|---------------------|-----------------------|
|            |                            | mV                        | pH    |                     |                       |
| 0          | 414.121                    | 414                       | 0.00  | 0.58                | 2.00                  |
| 2          | 295.814                    | 296                       | 2.00  | 0.58                | 2.00                  |
| 4          | 177.464                    | 178                       | 4.00  | 0.58                | 2.00                  |
| 6          | 59.160                     | 59                        | 6.00  | 0.58                | 2.00                  |
| 7          | 0.001                      | 0                         | 7.00  | 0.58                | 2.00                  |
| 8          | -59.159                    | -59                       | 8.00  | 0.58                | 2.00                  |
| 10         | -177.461                   | -177                      | 10.00 | 0.58                | 2.00                  |
| 12         | -295.811                   | -296                      | 12.00 | 0.58                | 2.00                  |
| 14         | -414.118                   | -414                      | 14.00 | 0.58                | 2.00                  |

2. Calibration of pH Meter with Electrode ( Manual Temperature Compensation at 25 °C )

**Equipment:** pH Electrode **Type:** Combined Electrode

**Manufacturer:** METTLER TOLEDO **Model:** InLab Solids

**Serial No.:** 3065701 **ID.No.:** N/A

**Performance of Electrode system** (Three-Point Calibration at pH 4, 7 and 10)

| Certified Value @25 °C (pH) | Average Indicator Reading |      | Relative Slope (%) | Uncertainty ( ± pH ) | Coverage Factor ( k ) |
|-----------------------------|---------------------------|------|--------------------|----------------------|-----------------------|
|                             | pH                        | mV   |                    |                      |                       |
| 4.008                       | 4.01                      | 188  | -                  | 0.0071               | 2.00                  |
| 7.001                       | 7.00                      | 13   | 98.9               | 0.0086               | 2.00                  |
| 10.010                      | 10.01                     | -160 | 97.2               | 0.0085               | 2.00                  |
| 6.865                       | 6.87                      | 21   | -                  | 0.0074               | 2.00                  |



F-CS-012 Revision: 01 Date: 20-04-65

## Calibration Report

**Certificate No.:** 2401718-001-01

**Equipment:** Digital Thermometer with RTD (pH Meter)

**Resolution:** 0.1 °C **Model:** SevenEasy pH  
**Serial No.:** 1231155210 **ID No.:** UAE.WAT.010/2553  
**Manufacturer:** METTLER TOLEDO

**Date of Calibration:** 11 March 2024

Page 4 of 5

**Location:** Chemical Calibration Laboratory, National Food Institute

**Environment Condition:**  
**Ambient Temperature** 23 °C ± 1 °C  
**Relative Humidity** 51 % ± 2 %

### Condition of this results of Calibration:

1. Calibration Method :
  - In house method: W-TE-025 by comparison with standard thermometer.
  - The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
  - The temperature scale in use at this laboratory is the International Temperature scale of 1990 ( ITS-90 ).

### 2. Reference Standard Instrument :

| Instrument                            | Model | Serial No. | Certificate No. | Due Date  | Through |
|---------------------------------------|-------|------------|-----------------|-----------|---------|
| HANDHELD THERMOMETER                  | 1523  | 2118154    | PSL-T 0877/66   | 06-Jun-24 | TISTR   |
| Platinum Resistance Thermometer (PRT) | 5627A | 877332     |                 |           |         |

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 341592/2

3. This certificate is traceable to International System of Units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.

6. Condition of Calibrated item : Good

7. Result of Calibration : ☒ Without adjustment ☐ After adjustment



F-CS-012 Revision: 01 Date: 20-04-65



## Calibration Report

**Certificate No.:** 2401718-001-01

**Equipment:** Digital Thermometer with RTD (pH Meter)

**Resolution:** 0.1 °C **Model:** SevenEasy pH

**Serial No.:** 1231155210 **ID No.:** UAE.WAT.010/2553

**Manufacturer:** METTLER TOLEDO

**Date of Calibration:** 11 March 2024

Page 5 of 5

**Calibration point:** 15.0, 25.0 and 35.0 °C

**Calibration result:**

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.
- Description of probe, model : N/A S/N : N/A
- Dimension of probe : Diameter 4 mm., Length 120 mm.,
- Sheath material : Stainless Steel

| UUC* Reading (°C) | Standard Temperature (°C) | Correction Value (°C) | Uncertainty ± (°C) |
|-------------------|---------------------------|-----------------------|--------------------|
| 15.1              | 14.998                    | 0.1                   | 0.099              |
| 25.1              | 24.998                    | 0.1                   | 0.099              |
| * 35.1            | 34.997                    | 0.1                   | 0.099              |

### Note

- UUC\* : Unit Under Calibration

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

----- End -----



F-CS-012 Revision: 01 Date: 20-04-65



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



## Certificate of Calibration

Cert.No.: 24MM293

Page.: 1 of 3

**Equipment :** Electronic Balance

**Manufacturer :** Mettler Toledo

**Model :** XSR204

**Serial No. :** C117635043

**ID No. :** UAE.WAS.012/2564

**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260

**Location :** Balance Room (108)

**Received order :** 11 May 2024

**Calibration Date :** 11 May 2024

**Ambient Temperature :** 15 °C to 40 °C

**Relative Humidity :** 30 % to 90 %

**Calibrated by :** Khit Ruttanaprapachai

**Approved by :**   
Approved Signatory

( ) Ponpan Paipim  
( ) Suwit Imjai  
(✓) Kunchit Promprat

**Issue Date :** 15 May 2024

**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.

เอกสารไม่ควบคุม





**Equipment :** Electronic Balance  
**Condition As-Received :** Used Item  
**Reference :** 2405-0166OC-2

**Cert.No.:** 24MM293

**Page:** 2 of 3

**Procedure used :-**

Calibration were conducted using in-house calibration procedure CP-OB01 based on UKAS LAB 14 according to direct measurement method against standard weight.

**Condition of this result of calibration**

1. Reference standard instruments:-

| <u>Instruments</u>          | <u>Model</u> | <u>Serial No.</u> | <u>ID No.</u> | <u>Test report No.</u> | <u>Due date</u> |
|-----------------------------|--------------|-------------------|---------------|------------------------|-----------------|
| 1) Standard Weight Set (E2) | 15884        | 24053             | 70RC007       | MM-0013-24             | 25 Jan 2026     |

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This result of calibration was made on requested at the point specified by customer.
4. This certificate is not certified for any commercial transaction.
5. This certification is traceable to the International System of Unit.

**Result of calibration** ( ) Without Adjustment ( \* ) After Adjustment by Internal Calibration

**Range capacity :** 0 g to 220 g **Resolution** 0.0001 g

**Before Adjustment :**

| <u>Applied Weight</u> | <u>Balance Reading</u> | <u>Correction</u> | <u>Measurement Uncertainty</u> | <u>Coverage Factor</u> |
|-----------------------|------------------------|-------------------|--------------------------------|------------------------|
| ( g )                 | ( g )                  | ( g )             | ( ± mg )                       | ( k )                  |
| 100                   | 100.0000               | 0.0000            | 0.27                           | 2.03                   |
| 200                   | 200.0001               | -0.0001           | 0.31                           | 2                      |

**After Adjustment :**

1. Determination of the standard deviation of weighing machine ( n = 10 )

| <u>Applied Weight</u> | <u>Standard Deviation of Reading ( g )</u> |
|-----------------------|--|
| ( g )                 |  |
| 100                   | 0.00007                                    |
| 200                   | 0.00007                                    |



Equipment : Electronic Balance  
 Condition As-Received : Used Item  
 Reference : 2405-0166OC-2

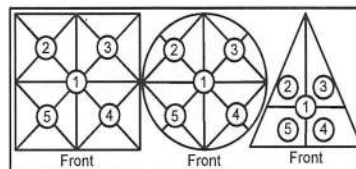
Cert.No.: 24MM293

Page: 3 of 3

### Result of calibration

#### 2. Effect of off center loading

A mass of 100 g was placed to various position on the pan.  
 The weighing machine reading error obtained is given in the table



Maximum difference between  
 off-center and central loading

| Position 1<br>( g ) | Position 2<br>( g ) | Position 3<br>( g ) | Position 4<br>( g ) | Position 5<br>( g ) | ( g )  |
|---------------------|---------------------|---------------------|---------------------|---------------------|--------|
| +0.0002             | -0.0001             | 0.0000              | +0.0002             | 0.0000              | 0.0003 |

#### 3. Departure from nominal value

| Applied Weight<br>( g ) | Balance<br>Reading<br>( g ) | Correction<br>( g ) | Measurement<br>Uncertainty<br>( ± mg ) | Coverage<br>Factor<br>( k ) |
|-------------------------|-----------------------------|---------------------|--|-----------------------------|
| Unload                  | 0.0000                      | 0.0000              | 0.15                                   | 2.13                        |
| 1                       | 1.0000                      | 0.0000              | 0.15                                   | 2.13                        |
| 5                       | 5.0000                      | 0.0000              | 0.15                                   | 2.13                        |
| 10                      | 10.0000                     | 0.0000              | 0.15                                   | 2.11                        |
| 20                      | 20.0000                     | 0.0000              | 0.19                                   | 2.03                        |
| 50                      | 50.0001                     | -0.0001             | 0.19                                   | 2.06                        |
| 60                      | 60.0001                     | -0.0001             | 0.19                                   | 2.04                        |
| 80                      | 80.0001                     | -0.0001             | 0.27                                   | 2                           |
| 100                     | 100.0002                    | -0.0002             | 0.27                                   | 2.03                        |
| 120                     | 120.0001                    | -0.0001             | 0.29                                   | 2                           |
| 200                     | 200.0001                    | -0.0001             | 0.31                                   | 2                           |

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-

## Calibration Certificate

**Certificate No.:** 2402283-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 4

**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** XSR205DU  
**Serial No.:** C009071872  
**ID No.:** UAE.WAO.012/2563  
**Order No.:** 2402283  
**Operation No.:** 2402283-001  
**Date of Receipt:** 2 April 2024  
**Date of Calibration:** 2 April 2024

**Calibrated by** Mr.Jerawut Prapawuttipong  
Scientist

**Approved by**



( Mr.Pheraphat Tuanjit )

Manager, Division of Calibration Laboratory

**Date of Issue:** 9 April 2024

Responsible for the Technical Management Team

**The uncertainties are for a confidence probability of approximately 95%**

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65





# Calibration Report

**Certificate No.:** 2402283-001-01

**Equipment:**

Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Model:** XSR205DU

**Resolution:** 0.00001 g / 0.0001 g

**Serial No.:** C009071872

**ID No.:** UAE.WAO.012/2563

**Capacity:** 220 g

**Date of Calibration:** 2 April 2024

Page 2 of 4

**Environment Condition:** Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 47.5 ± 2.5 %

**Place of Calibration:** Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Condition of Equipment:** Good Condition

**Condition of This Results of Calibration:**

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

| Reference Standard       | Model       | Serial No. | Calibrated By | Certificate No. | Due Date     |
|--------------------------|-------------|------------|---------------|-----------------|--------------|
| Standard Weight Class E2 | 1mg to 200g | B505567572 | TCS           | M2304053S       | 8 April 2024 |

| Instrument         | Model  | Serial No.     | Calibrated By  | Certificate No. | Due Date        |
|--------------------|--------|----------------|----------------|-----------------|-----------------|
| Thermo-Hygro Meter | 608-H1 | NFI.BTH 016/23 | Quality Reborn | QR24-0343       | 9 February 2025 |

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

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

**Calibration Results:**

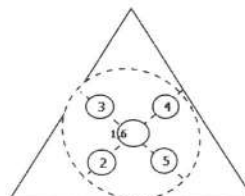
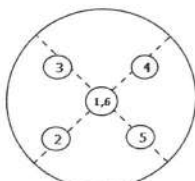
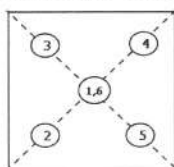
**1. Repeatability of Reading:**

| Nominal Value ( g ) | Standard Deviation of Reading ( g ) |
|---------------------|-------------------------------------|
| 40                  | 0.0000052                           |
| 80                  | 0.0000063                           |
| 100                 | 0.000048                            |
| 200                 | 0.000053                            |

**2. Off-Center Error:**

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



| 1        | 2        | 3        | 4       | 5        | 6        | (Maximum Difference) |
|----------|----------|----------|---------|----------|----------|----------------------|
| ( g )    | ( g )    | ( g )    | ( g )   | ( g )    | ( g )    | ( g )                |
| 100.0002 | 100.0001 | 100.0002 | 99.9999 | 100.0001 | 100.0001 | 0.0003               |



F-CS-012 Revision: 01 Date: 20-04-65

## Calibration Report

**Certificate No.:** 2402283-001-01

**Equipment:**

Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Model:** XSR205DU

**Resolution:** 0.00001 g / 0.0001 g

**Serial No.:** C009071872

**ID No.:** UAE.WAO.012/2563

**Capacity:** 220 g

**Date of Calibration:** 2 April 2024

Page 3 of 4

**Calibration Results:** (Continued)

**Calibration Range:** 0 - 80 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:** (Range: 0 - 80 g ; Resolution: 0.00001 g )

| Nominal Value<br>( g ) | Standard Value<br>( g ) | Average Reading<br>( g ) | Correction<br>( g ) | Uncertainty<br>( ± g ) | Coverage Factor<br>k |
|------------------------|-------------------------|--------------------------|---------------------|------------------------|----------------------|
| Unload                 | 0.000000                | 0.00000                  | 0.00000             | 0.0000088              | 2.00                 |
| 0.001                  | 0.001003                | 0.00101                  | -0.00001            | 0.0000091              | 2.00                 |
| 0.005                  | 0.005003                | 0.00499                  | 0.00001             | 0.0000094              | 2.00                 |
| 0.01                   | 0.010003                | 0.01000                  | 0.00000             | 0.0000091              | 2.00                 |
| 0.05                   | 0.049996                | 0.05000                  | 0.00000             | 0.0000098              | 2.00                 |
| 0.1                    | 0.100011                | 0.10000                  | 0.00001             | 0.000011               | 2.00                 |
| 0.5                    | 0.500016                | 0.50001                  | 0.00001             | 0.000014               | 2.00                 |
| 1                      | 1.000003                | 1.00002                  | -0.00002            | 0.000016               | 2.00                 |
| 2                      | 2.000023                | 2.00001                  | 0.00001             | 0.000017               | 2.00                 |
| 5                      | 5.000017                | 5.00002                  | 0.00000             | 0.000020               | 2.00                 |
| 10                     | 10.000009               | 10.00000                 | 0.00001             | 0.000026               | 2.00                 |
| 20                     | 20.000031               | 20.00002                 | 0.00001             | 0.000037               | 2.00                 |
| 30                     | 30.000040               | 30.00003                 | 0.00001             | 0.000052               | 2.00                 |
| 50                     | 50.000028               | 50.00004                 | -0.00001            | 0.000068               | 2.00                 |
| 80                     | 80.000068               | 80.00005                 | 0.00002             | 0.00011                | 2.00                 |





## Calibration Report

**Certificate No.:** 2402283-001-01

**Equipment:**

Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Model:** XSR205DU

**Resolution:** 0.00001 g / 0.0001 g

**Serial No.:** C009071872

**ID No.:** UAE.WAO.012/2563

**Capacity:** 220 g

**Date of Calibration:** 2 April 2024

Page 4 of 4

**Calibration Results:** (Continued)

**Calibration Range:** 81 - 200 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:** (Range: 81 - 200 g ; Resolution: 0.0001 g )

| Nominal Value<br>( g ) | Standard Value<br>( g ) | Average Reading<br>( g ) | Correction<br>( g ) | Uncertainty<br>( ± g ) | Coverage Factor<br><i>k</i> |
|------------------------|-------------------------|--------------------------|---------------------|------------------------|-----------------------------|
| 90                     | 90.00010                | 90.0000                  | 0.0001              | 0.00015                | 2.00                        |
| 100                    | 100.00006               | 100.0000                 | 0.0001              | 0.00015                | 2.00                        |
| 110                    | 110.00007               | 110.0001                 | 0.0000              | 0.00017                | 2.00                        |
| 120                    | 120.00009               | 120.0000                 | 0.0001              | 0.00018                | 2.00                        |
| 130                    | 130.00010               | 130.0000                 | 0.0001              | 0.00019                | 2.00                        |
| 140                    | 140.00014               | 140.0000                 | 0.0001              | 0.00020                | 2.00                        |
| 150                    | 150.00009               | 150.0001                 | 0.0000              | 0.00020                | 2.00                        |
| 160                    | 160.00010               | 160.0001                 | 0.0000              | 0.00022                | 2.00                        |
| 170                    | 170.00012               | 170.0001                 | 0.0000              | 0.00023                | 2.00                        |
| 200                    | 200.00016               | 200.0000                 | 0.0002              | 0.00028                | 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 %.

----- End -----

F-CS-012 Revision: 01 Date: 20-04-65



## Calibration Certificate

**Certificate No.:** 2400141-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 3

**Equipment:** CHAMBER (Hot Air Oven)

**Manufacturer:** MEMMERT

**Model:** UF 55

**Serial No.:** B216.1666

**ID No.:** UAE.WAO.027/2559


**Order No.:** 2400141

**Operation No.:** 2400141-001

**Date of Receipt:** 11 October 2023

**Date of Calibration:** 11 October 2023

**Calibrated by** Mr.Worapob Sooktong  
Scientist

**Approved by**   
( Mr.Pheraphat Tuanjit )

Manager, Division of Calibration Laboratory

**Date of Issue:** 16 October 2023

Responsible for the Technical Management Team

**The uncertainties are for a confidence probability of approximately 95 %.**

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65



## Calibration Report

**Certificate No.:** 2400141-001-01

**Equipment:** CHAMBER (Hot Air Oven)

Model: UF 55 Serial No.: B216.1666

Resolution: 0.1 °C ID No.: UAE.WAO.027/2559

Manufacturer: MEMMERT

**Date of Calibration:** 11 October 2023

Page 2 of 3

**Location:** Laboratory, Floor 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

**Environment Condition:**  
Ambient Temperature ( 28 ± 1 ) °C  
Relative Humidity ( 63 ± 2 ) %  
Line Voltage ( 228 ± 1 ) Volt

### Condition of this results of Calibration:

- This instrument was calibrated by insert 9 standard thermometer into its chamber and calibration according to W-TE-014 Based on TLAS G-20-1/02-08 (E): Guidelines for Calibration and Checks of Temperature Controlled Enclosures.  
- The temperature scale used was based on ITS - 90.  
- All data show below were final values and the initial data may be obtained upon request.

### 2. Reference Standard Instrument :

| Instrument                      | Model  | Serial No./ID No.       | Certificate No. | Due Date      | Through                 |
|---------------------------------|--------|-------------------------|-----------------|---------------|-------------------------|
| Digital Thermometer with sensor | 34972A | MY49016894              | TE 660380-01    | 22 April 2024 | NATIONAL FOOD INSTITUTE |
|                                 | RTD    | CH#201-209/ RTD#201-209 |                 |               |                         |

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibrated item : Good

### UUC Description :

Time of Record 1 Hour 9 Minute At 104.0, 140.0 and 180.0 °C  
Fresh air Damper ☐ Open Position ☐  
☒ Close  
☐ Not Available

7. Result of Calibration : ☒ Without adjustment ☐ After adjustment






## Calibration Report

**Certificate No.:** 2400141-001-01  
**Equipment:** CHAMBER (Hot Air Oven)  
**Model:** UF 55 **Serial No.:** B216.1666  
**Resolution:** 0.1 °C **ID No.:** UAE.WAO.027/2559  
**Manufacturer:** MEMMERT

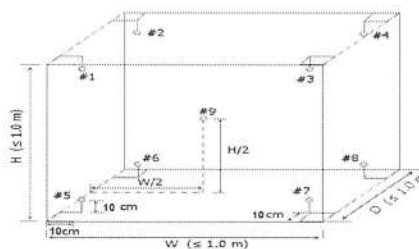
**Date of Calibration:** 11 October 2023

Page 3 of 3

**Calibration point:** 104.0, 140.0 and 180.0 °C

**Calibration result:**

| Calibration Condition | Temperature (°C) | Relative Humidity (%) | Line Voltage (Volt) |
|-----------------------|------------------|-----------------------|---------------------|
| MIN                   | 28.2             | 61.4                  | 227.4               |
| MAX                   | 28.3             | 65.1                  | 229.3               |



**Table1 : Reporting of Temperature**

| Calibration point (°C) | Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF) |        |        |        |        |        |        |        |        | Uncertainty ± (°C) |
|------------------------|---|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
|                        | # 1   | # 2    | # 3    | # 4    | # 5    | # 6    | # 7    | # 8    | # 9    |                    |
| 104.0                  | 104.05  | 103.98 | 104.02 | 104.08 | 104.00 | 104.05 | 103.99 | 104.17 | 104.00 | 0.53               |
| 140.0                  | 140.09  | 139.99 | 139.91 | 140.05 | 139.99 | 139.91 | 139.97 | 140.26 | 139.97 | 0.73               |
| 180.0                  | 180.46  | 180.33 | 180.25 | 180.28 | 180.33 | 179.96 | 180.31 | 180.64 | 180.16 | 0.90               |

**Table 2 : Reporting of Characterization Result**

| UUC* Setting (°C) | UUC* reading (°C) |       |         | Stability ± (°C) | Uniformity (°C) | Overall Variation (°C) |
|-------------------|-------------------|-------|---------|------------------|-----------------|------------------------|
|                   | MIN               | MAX   | Average |                  |                 |                        |
| 104.0             | 104.0             | 104.0 | 104.0   | 0.090            | 0.18            | 0.38                   |
| 140.0             | 140.0             | 140.1 | 140.0   | 0.075            | 0.28            | 0.47                   |
| 180.0             | 180.0             | 180.1 | 180.0   | 0.13             | 0.48            | 0.88                   |

**Note** The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity) "

UUC\* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

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.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.

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

----- End -----

*Handwritten signature*





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.: 24TM303

Page : 1 of 3

## Certificate of Calibration

**Equipment :** BOD Incubator

**Manufacturer :** Arco

**Model :** UC4-1320

**Serial No. :** 13URC4S013201

**ID No. :** UAE.WAO.015/2561

**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260

**Location :** Lab Floor 2

**Received Order :** 10 February 2024

**Calibration Date :** 10 February 2024

**Ambient Temperature :** ( 26 ± 10 ) °C

**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Tawatchai Pama

**Approved by :**

Approved Signatory

- ( ) Pornthippa Tameyakul  
( ☒ ) Unnopphol Harachai  
( ) Suwit Imjai

**Issue Date :** 19 February 2024

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.

เอกสารไม่ควบคุม





Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2402-0234OC-1  
**Result of Calibration :-** ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 24TM303

Page : 3 of 3

| Calibration Point<br>( °C ) | UUC* Setting<br>( °C ) | UUC* Reading<br>( °C ) | Temperature stability<br>( ± °C ) | Temperature uniformity<br>( °C ) | Overall Variation<br>( °C ) | Coverage Factor<br><i>k</i> |
|-----------------------------|------------------------|------------------------|-----------------------------------|----------------------------------|-----------------------------|-----------------------------|
| 20.0                        | 20.1                   | 19.9                   | 0.37                              | 0.72                             | 1.4                         | 2                           |

| Calibration<br>Point<br>( °C ) | Measured Temperature ( °C ) |        |        |        |        |        |        |        |          | Uncertainty<br><br>( ± °C ) |
|--------------------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|----------|-----------------------------|
|                                | Position                    |        |        |        |        |        |        |        |          |                             |
|                                | 1                           | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9 (ref.) |                             |
| 20.0                           | 19.873                      | 19.803 | 20.322 | 19.690 | 19.615 | 19.585 | 19.612 | 19.558 | 19.645   | 0.58                        |

**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-

เอกสารไม่ควบคุม





**Equipment :** BOD Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2402-0234OC-1

**Cert. No.:** 24TM303

**Page :** 2 of 3

**Procedure Used :-**

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 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:-

| <u>Instrument</u>    | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Traceable</u> | <u>Due Date</u> |
|----------------------|-------------------|------------------|------------------|-----------------|
| 1 ) Data Acquisition | MY59003411        | 23LM208          | TPA              | 27 Dec 2024     |

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

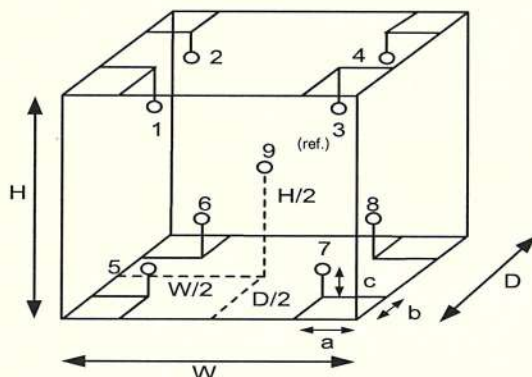
3. This certification is traceable to the International System of Unit.

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

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

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

**Fresh air setting :** Not Available



| Environment during calibration |           |          |
|--------------------------------|-----------|----------|
|                                | Beginning | Finished |
| Temp. ( °C )                   | 28        | 31       |
| REL.Humid. ( % )               | 70        | 65       |
| AC Supply ( Volt )             | 233       | 234      |

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1          | 20RTD-2/1         |
| 2          | 20RTD-2/2         |
| 3          | 20RTD-2/3         |
| 4          | 20RTD-2/4         |
| 5          | 20RTD-2/5         |
| 6          | 20RTD-2/6         |
| 7          | 20RTD-2/7         |
| 8          | 20RTD-2/8         |
| 9 (ref.)   | 20RTD-2/9         |

**Probe Installation Details :**

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

**Dimension of Chamber :**

D = 0.62 m  
W = 1.2 m  
H = 1.2 m  
Capacity = 0.89 m<sup>3</sup>

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Certificate No. : HIT-2413-0434

Page : 1 of 2

**CERTIFICATE OF CALIBRATION**

|                                |  |                                  |              |
|--------------------------------|--|----------------------------------|--------------|
| <b>Equipment :</b>             | COD Test Tube Heater   |                                  |              |
| <b>Meter Model :</b>           | HI839800-02  | <b>Serial No. :</b>              | 06480019101  |
| <b>Tube Heater :</b>           | 25 Vial Capacity   | <b>Resolution :</b>              | 0.1°C        |
| <b>Temperature Range :</b>     | (-10 to 160)°C   | <b>Temperature of Reaction :</b> | 150°C        |
| <b>Manufacturer :</b>          | Hanna Instruments  | <b>Made in :</b>                 | Romania      |
| <b>Condition As-Received :</b> | Used Product   | <b>Reference :</b>               | RE240528     |
| <b>Ambient Temperature :</b>   | (25 ± 2)°C   | <b>Relative Humidity :</b>       | (50 ± 15)%RH |
| <b>Customer name :</b>         | United Analyst and Engineering Consultant Co., Ltd.<br>3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,<br>Phrakhanong, Bangkok 10260    |                                  |              |
| <b>Received date :</b>         | 25 March 2024  |                                  |              |
| <b>Calibrate date :</b>        | 25 March 2024  |                                  |              |
| <b>Issue date :</b>            | 27 March 2024  |                                  |              |
| <b>Calibrated Location :</b>   | Hanna Instruments (Thailand) Ltd.  |                                  |              |
| <b>Calibration Procedure :</b> | This calibrator was conducted by using in-house: calibration procedure<br>CP-04 by using certified reference standard instruments. |                                  |              |

**Calibrated by :** ☒ Mr. Pichit Petthong  
☐ Mr. Channarong Soinak

**Approved by :**   
Mr. Anan Suwanchaisakul  
Authorized Signatory



This certificate was certified only for the instrument we calibrated.

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

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approval of the head of Hanna Instrument (Thailand).

**เอกสารไม่ควบคุม**



**Condition of this calibration result:**

Reference Standard Instruments : This certification is traceable to the international unit of unit maintained through:

| Instruments                  | Model    | Serial No. | Certificate No. | Traceable  |
|------------------------------|----------|------------|-----------------|--|
| Data Acquisition Switch Unit | 34970A   | MY44065265 | WK2307-164-1    | WK Electric Co., Ltd.                              |
| Digital Thermo-Hygrometer    | HT-771SD | AI.07155   | 24H41           | Technology Promotion Association (Thailand-Japan). |

**Calibration Result:**

Measurement Temperature Source Accuracy for COD Reactor.

| Capacity<br>(Vial) | Nominal Value<br>(°C) | Average Value<br>(°C) | Uncertainty of Measurement<br>(±°C) |
|--------------------|-----------------------|-----------------------|-------------------------------------|
| 25 Vial            | 150.0                 | 150.0                 | 0.50                                |

Unit : °C

|         |         |         |         |         |
|---------|---------|---------|---------|---------|
| (1A)    | (2A)    | (3A)    | (4A)    | (5A)    |
| 149.477 | 149.183 | 150.029 | 150.627 | 149.731 |
| (1B)    | (2B)    | (3B)    | (4B)    | (5B)    |
| 149.845 | 150.325 | 150.275 | 149.688 | 150.599 |
| (1C)    | (2C)    | (3C)    | (4C)    | (5C)    |
| 149.869 | 150.077 | 150.571 | 150.217 | 150.409 |
| (1D)    | (2D)    | (3D)    | (4D)    | (5D)    |
| 149.295 | 150.434 | 150.347 | 150.243 | 150.390 |
| (1E)    | (2E)    | (3E)    | (4E)    | (5E)    |
| 149.911 | 149.301 | 150.232 | 150.162 | 149.418 |

Figure: Shows the location of the temperature source.

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

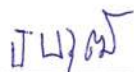
**\*\* End of certificate \*\***

**เอกสารไม่ควบคุม**



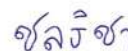
**CERTIFICATE OF CALIBRATION****Certificate No. :** SP24-018

Page 1 of 5

**Customer :** United Analyst and Engineering Consultant Co.,Ltd. (Head Office)**Address :** 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260**Location of calibration :** Laboratory 315**Equipment :** UV-Vis Spectrophotometer**Manufacturer :** Agilent Technologies**Model :** Cary 60**Serial No. :** MY15410009**ID No. :** UAE.WAT.020/2558**Received Date :** 7 May 2024**Calibration Date :** 7 May 2024**Issue Date :** 9 May 2024**Condition Instrument :** Good**Calibrated by :**

( Mr.Tanawut Rittidach )

Technical Manager

**Approved by :**

( Ms. Chonthicha Sangngern )

Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

## REPORT OF CALIBRATION

**Certificate No. :** SP24-018

Page 2 of 5

**Environment Condition :** Ambient Temperature  $25 \pm 5$  °CRelative humidity  $55 \pm 20$  %RH**Calibration method :** In-house method CP-01 Based on ASTM E275-08**Certified Reference Materials :**

| Material                | Serial No. | Certificate No. | Due date        |
|-------------------------|------------|-----------------|-----------------|
| Absorbance Standard set | 25760      | 115663          | 25 October 2025 |
| Absorbance Standard set | 25757      | 115638          | 25 October 2025 |
| Wavelength Standard set | 25806      | 115657          | 25 October 2025 |
| Wavelength Standard set | 25758      | 115665          | 25 October 2025 |

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

Institute of Standards and Technology (NIST) through Sarna Scientific Limited

**Spectral Band Width of UUC :** 1.5 nm.**Scan Speed of UUC :** 60 nm/min**Scan Interval of UUC :** 0.15 nm.**Resolution of UUC :** Photometric 0.0001 Abs.

Wavelength 0.1 nm.

## REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

| Wavelength<br>(nm.) | CRMs Values<br>(Abs) | UUC Reading<br>(Abs) | Correction<br>(Abs) | Uncertainty<br>(Abs) | Coverage factor<br><i>k</i> |
|---------------------|----------------------|----------------------|---------------------|----------------------|-----------------------------|
| 420                 | 0.0000               | 0.0000               | 0.0000              | 0.0028               | 2.00                        |
|                     | 0.5780               | 0.5747               | 0.0033              | 0.0031               | 2.00                        |
|                     | 1.0484               | 1.0438               | 0.0046              | 0.0029               | 2.00                        |
|                     | 2.1876               | 2.1832               | 0.0044              | 0.0080               | 2.00                        |
| 440                 | 0.0000               | 0.0000               | 0.0000              | 0.0028               | 2.00                        |
|                     | 0.5595               | 0.5581               | 0.0014              | 0.0034               | 2.00                        |
|                     | 1.0239               | 1.0231               | 0.0008              | 0.0035               | 2.00                        |
|                     | 2.1230               | 2.1219               | 0.0011              | 0.0080               | 2.00                        |
| 465                 | 0.0000               | 0.0000               | 0.0000              | 0.0028               | 2.00                        |
|                     | 0.5230               | 0.5184               | 0.0046              | 0.0030               | 2.00                        |
|                     | 0.9633               | 0.9614               | 0.0019              | 0.0029               | 2.00                        |
|                     | 1.9753               | 1.9731               | 0.0022              | 0.0070               | 2.00                        |
| 546.1               | 0.0000               | 0.0000               | 0.0000              | 0.0028               | 2.00                        |
|                     | 0.5181               | 0.5150               | 0.0031              | 0.0031               | 2.00                        |
|                     | 1.0002               | 0.9964               | 0.0038              | 0.0033               | 2.00                        |
|                     | 1.9973               | 1.9914               | 0.0059              | 0.0088               | 2.00                        |
| 590                 | 0.0000               | 0.0000               | 0.0000              | 0.0028               | 2.00                        |
|                     | 0.5517               | 0.5485               | 0.0032              | 0.0030               | 2.00                        |
|                     | 1.0803               | 1.0772               | 0.0031              | 0.0030               | 2.00                        |
|                     | 2.0373               | 2.0293               | 0.0080              | 0.0080               | 2.00                        |
| 635                 | 0.0000               | 0.0000               | 0.0000              | 0.0028               | 2.00                        |
|                     | 0.5591               | 0.5565               | 0.0026              | 0.0031               | 2.00                        |
|                     | 1.0518               | 1.0482               | 0.0036              | 0.0030               | 2.00                        |
|                     | 1.9274               | 1.9202               | 0.0072              | 0.0079               | 2.00                        |



## REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 4 of 5

### Photometric Accuracy :

| Wavelength<br>(nm.) | CRMs Values<br>(Abs) | UUC Reading<br>(Abs) | Correction<br>(Abs) | Uncertainty<br>(Abs) | Coverage factor<br><i>k</i> |
|---------------------|----------------------|----------------------|---------------------|----------------------|-----------------------------|
| 235                 | 0.0000               | 0.0000               | 0.0000              | 0.0050               | 2.00                        |
|                     | 0.7469               | 0.7435               | 0.0034              | 0.0057               | 2.00                        |
| 257                 | 0.0000               | 0.0000               | 0.0000              | 0.0050               | 2.00                        |
|                     | 0.8674               | 0.8639               | 0.0035              | 0.0060               | 2.00                        |
| 313                 | 0.0000               | 0.0000               | 0.0000              | 0.0050               | 2.00                        |
|                     | 0.2919               | 0.2907               | 0.0012              | 0.0051               | 2.00                        |
| 350                 | 0.0000               | 0.0000               | 0.0000              | 0.0050               | 2.00                        |
|                     | 0.6430               | 0.6402               | 0.0028              | 0.0055               | 2.00                        |

## REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 5 of 5

### Wavelength Accuracy :

| CRMs Values<br>(nm.) | UUC Reading<br>(nm.) | Correction<br>(nm.) | Uncertainty<br>(nm.) | Coverage factor<br><i>k</i> |
|----------------------|----------------------|---------------------|----------------------|-----------------------------|
| 241.72               | 242.0                | -0.28               | 0.18                 | 2.00                        |
| 279.45               | 279.5                | -0.05               | 0.18                 | 2.00                        |
| 287.81               | 287.9                | -0.09               | 0.18                 | 2.00                        |
| 334.06               | 333.9                | 0.16                | 0.18                 | 2.00                        |
| 360.93               | 360.5                | 0.43                | 0.18                 | 2.00                        |
| 418.59               | 418.1                | 0.49                | 0.18                 | 2.00                        |
| 445.94               | 445.6                | 0.34                | 0.18                 | 2.00                        |
| 453.66               | 453.3                | 0.36                | 0.18                 | 2.00                        |
| 460.02               | 459.8                | 0.22                | 0.18                 | 2.00                        |
| 536.59               | 536.0                | 0.59                | 0.18                 | 2.00                        |
| 637.98               | 638.7                | -0.72               | 0.18                 | 2.00                        |
| 431.38               | 430.8                | 0.58                | 0.18                 | 2.00                        |
| 472.50               | 472.4                | 0.10                | 0.18                 | 2.00                        |
| 513.47               | 513.7                | -0.23               | 0.18                 | 2.00                        |
| 528.88               | 529.1                | -0.22               | 0.18                 | 2.00                        |
| 573.17               | 573.5                | -0.33               | 0.18                 | 2.00                        |
| 585.35               | 585.2                | 0.15                | 0.20                 | 2.00                        |
| 684.40               | 685.1                | -0.70               | 0.18                 | 2.00                        |
| 740.72               | 741.4                | -0.68               | 0.20                 | 2.00                        |
| 748.55               | 749.1                | -0.55               | 0.18                 | 2.00                        |
| 807.03               | 807.3                | -0.27               | 0.18                 | 2.00                        |
| 879.28               | 879.3                | -0.02               | 0.18                 | 2.00                        |

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement  $U$  is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k$ ,

which for a normal distribution corresponds to a coverage probability of approximately 95%

- \* Indicates non TISI accredited

- End of Certificate -

# FOSS

# Customer Service Report

|       |            |
|-------|------------|
| Date: | 8 Feb 2024 |
|-------|------------|

Customer: UAE

Instrument: DT2520

FOSS South East Asia

3388 Sirinrat Building, 25th – 26th Floor, Unit No. 3388/90,  
Rama IV Road, Klongton , Klongtoey, Bangkok, Thailand 10110

**Report No:**

9809

Address: BANGKOK

Serial: 91794469

Hours

### Travel To Customer

**Start**

08:00

## Finish

09:30

**Labour**

12300

16200

2 hrs

Travel From Customer

16: 06

18,000

 $2H_4$ 

| Job Type        |   |                |   |              |   |          |   |
|-----------------|---|----------------|---|--------------|---|----------|---|
| Application     |   | Special        |   | Standard     |   |          |   |
| Normal          | x | Courtesy Visit | x | Installation | x | Training | x |
| Distributor     | x | PMA Onboarding | x | Quote        | x | In House | x |
| Internal        | x | Warranty       | x | Repair       | x | PM       | ✗ |
| Digital Service | x | Sales Support  | x | Remote       | x | Other    | x |

PO/Quote Number:

if applicable

PMA Type

FOSScare if applicable

Contract No.

if applicable

| Details of Work / Test             |  | Condition / Status  |
|------------------------------------|--|---------------------|
| # PM DT2520                        |  |                     |
| - Rhinowarm sensor                 |  | } ok done           |
| - rhinov connection                |  |                     |
| - rhinov cable kit, temp cut off   |  |                     |
| - rhinov meter on go               |  |                     |
| - 300° - 100°C = 10 min            |  |                     |
| - 300° - 420°C = 37 min            |  |                     |
| - instrument 419 °C meter = 419 °C |  |                     |
|                                    |  |                     |
|                                    |  |                     |
|                                    |  |                     |
|                                    |  |                     |
| Instrument Ready for Use           | <input checked="" type="checkbox"/> OK | If not OK - Comment |

| Part No: | Batch      | Description         | Qty |
|----------|------------|---------------------|-----|
| 60079652 | 23.09.2023 | Cable left digester | 1   |
| 10013654 | 03.01.2025 | Temperature control | 1   |
|          |            |                     |     |
|          |            |                     |     |
|          |            |                     |     |
|          |            |                     |     |

I confirm this report is accurate and complete

## Signed FOSS

**Signed Customer**

Name

Name

Would you be willing to participate in a brief survey in order to tell us how we performed?

Email

## เอกสารไม่ควบคุม



# FOSS

## Customer Service Report

FOSS South East Asia  
3388 Sirinrat Building, 25th – 26th Floor, Unit No. 3388/90,  
Rama IV Road, Klongton , Klongtoey, Bangkok, Thailand 10110

Report No:

9810

Date:

9 Feb 2024

Customer:

UAE

Address:

BANGKOK

Instrument:

KT200

Serial:

91790524

Hours

Travel To Customer

Start

08:00

1hr

Finish

09:30

Labour

09:30

12:00

2hrs

Travel From Customer

14:30

16:30

2hrs

### Job Type

| Application     |   | Special        |   | Standard     |   |          |   |
|-----------------|---|----------------|---|--------------|---|----------|---|
| Normal          | x | Courtesy Visit | x | Installation | x | Training | x |
| Distributor     | x | PMA Onboarding | x | Quote        | x | In House | x |
| Internal        | x | Warranty       | x | Repair       | x | PM       | x |
| Digital Service | x | Sales Support  | x | Remote       | x | Other    | x |

PO/Quote Number:

if applicable

PMA Type

FOSScare

if applicable

Contract No.

if applicable

### Details of Work / Test

### Condition / Status

|   |                     |
|---|---------------------|
| # PM KT200                                    |                     |
| - ตรวจสอบการทำงานของ PM                       |                     |
| - ตรวจสอบเวลา 3 min 100 ml                    |                     |
| - Alkaline 30 ml - 80 ml                      |                     |
| - ตรวจสอบ PM kit                              |                     |
| - ตรวจสอบหน้าจอ                               |                     |
|   |                     |
|   |                     |
| # ตรวจสอบ SOLPH Head - ตรวจสอบหน้าจอ 2 หน้าจอ |                     |
| 10000725 SOLPH head complete 1 PC             |                     |
|   |                     |
|   |                     |
| Instrument Ready for Use                      | OK                  |
|   | Not OK              |
|   | If not OK - Comment |

| Part No: | Batch      | Description                             | Qty |
|----------|------------|---|-----|
| 10009965 | 14.12.2020 | FOSS PM kit kt200 lejelit Annalysw 2100 | 1   |
|          |            |   |     |
|          |            |   |     |
|          |            |   |     |
|          |            |   |     |

I confirm this report is accurate and complete

Signed FOSS

[Signature]

Signed Customer

[Signature]

Name

Name

Would you be willing to participate in a brief survey in order to tell us how we performed?

Email

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List of Instruments Certification for Air & Noise Quality Analysis

| No.   | Instrument/Equipment | Parameter   | Manufacturer           | Model/Serial No.      | Calibrator                            | Certification No. | Date of Calibration | Due date of Calibration | Remark |
|-------|----------------------|---|------------------------|-----------------------|---------------------------------------|-------------------|---------------------|-------------------------|--------|
| Stack |                      |   |                        |                       |                                       |                   |                     |                         |        |
| 1     | Pre-Test Console     | Total Suspended Particulate   | Apex Instruments, USA. | XC-572-V<br>1701018   | Envi Equipment Service Co., Ltd.      | E23-12095         | 12 Sep 23           | 11 Sep 24               | -      |
| 2     | Flue gas Analyzer    | Sulphur Dioxide<br>Oxide of Nitrogen as Nitrogen Dioxide<br>Carbon Monoxide | Testo                  | Testo 350<br>60899615 | Entech Industrial Solutioin Co., Ltd. | G 660354          | 20 Jun 23           | 19 Jun 24               | -      |

List of Opacity Training Certification for Opacity Mesurement

| No. | Name                  | Training Couse | Train                        | Date                | Remark |
|-----|-----------------------|----------------|------------------------------|---------------------|--------|
| 1   | Mr.Pongthep Laokajorn | Opacity        | Pollution Control Department | 12-13 March 2015    | -      |
| 2   | Mr.Watcharin San-Ngam | Opacity        | Pollution Control Department | 22-23 December 2022 | -      |

List of Instruments Certification for Air & Noise Quality Analysis

| No.     | Instrument/Equipment                            | Parameter   | Manufacturer                    | Model/Serial No.      | Calibrator   | Certification No. | Date of Calibration | Due date of Calibration | Remark |
|---------|---|---|---------------------------------|-----------------------|--|-------------------|---------------------|-------------------------|--------|
| Ambient |   |   |                                 |                       |  |                   |                     |                         |        |
| 1       | Orifice Transfer Standard Calibrator            | Total Suspended Particulate (TSP)<br>Particulate Matter < 10 µm (PM <sub>10</sub> ) | Tisch EnvironmentalJnc.         | TE-5025A<br>3393      | Jiranatee Associates Co., Ltd.                       | CL-004-65         | 26 Jul 22           | 25 Jul 24               | -      |
| 2       | U-Tube Manometer                                | Total Suspended Particulate (TSP)<br>Particulate Matter < 10 µm (PM <sub>10</sub> ) | Dwyer                           | 1221-36-W/M<br>-      | Technology Promotion Association<br>(Thailand-Japan) | 23P1403           | 9 May 23            | 8 May 24                | -      |
| 3       | Aneroid Barometer                               | Total Suspended Particulate (TSP)<br>Particulate Matter < 10 µm (PM <sub>10</sub> ) | Barigo, Germany                 | -                     | Technology Promotion Association<br>(Thailand-Japan) | 23P1857           | 2 Jun 23            | 1 Jun 24                | -      |
| 4       | Dial Thermo-Hygrometer                          | Total Suspended Particulate (TSP)<br>Particulate Matter < 10 µm (PM <sub>10</sub> ) | Barigo, Germany                 | -                     | Technology Promotion Association<br>(Thailand-Japan) | 23H1201           | 5 Jun 23            | 5 Jun 24                | -      |
| 5       | Nitrogen Dioxide Analyzer                       | Nitrogen Dioxide  | Thermo Environmental Instrument | 42C<br>42C-67174-356  | UAE Consultant Co.,Ltd.                              | 01112023          | 1 Nov 23            | 31 Oct 24               | -      |
| 6       | Nitrogen Dioxide Analyzer                       | Nitrogen Dioxide  | Thermo Environmental Instrument | 42C<br>42C-78933-390  | UAE Consultant Co.,Ltd.                              | 13112023          | 13 Nov 23           | 12 Nov 24               | -      |
| 7       | Standard Gases (Mixture)                        | Nitrogen Dioxide  | Airgas                          | EB0143262<br>2015PSIG | Airgas an Air Liquide company                        | E04NI99E15A01D3   | 21 Jun 21           | 21 Jun 24               | -      |
| 8       | Sulphur Dioxide Analyzer                        | Sulphur Dioxide   | Thermo Scientific               | 43i<br>1180540065     | UAE Consultant Co.,Ltd.                              | 03112023          | 3 Nov 23            | 2 Nov 24                | -      |
| 9       | Sulphur Dioxide Analyzer                        | Sulphur Dioxide   | Thermo Scientific               | 43i<br>1180540066     | UAE Consultant Co.,Ltd.                              | 09112023          | 9 Nov 23            | 8 Nov 24                | -      |
| 10      | Standard Gases (Mixture)                        | Sulphur Dioxide   | Airgas                          | EB0143262<br>2015PSIG | Airgas an Air Liquide company                        | E04NI99E15A01D3   | 21 Jun 21           | 21 Jun 24               | -      |
| 11      | Sound Level Calibrator<br>(Acoustic Calibrator) | Calibrate Sound Level Meter   | 01dB                            | CAL31<br>82795        | Innovative Instrument Co.,Ltd.                       | 23-ACT-109        | 27 Jun 23           | 26 Jun 24               | -      |
| 12      | Sound Level Meter                               | $L_{Aeq} 24\text{ hrs}$ $L_{A90}$ $L_{Amax}$ $L_{Ain}$<br>ระดับเสียงรบกวน           | Larson Davis                    | LxT1<br>0007301       | Larson Davis-A PCB Piezotronics Div.                 | 2023003657        | 22 Mar 23           | 21 Mar 24               | -      |
| 13      | Sound Level Meter                               | $L_{Aeq} 24\text{ hrs}$ $L_{A90}$ $L_{Amax}$ $L_{Ain}$<br>ระดับเสียงรบกวน           | Larson Davis                    | LxT1<br>0007302       | Larson Davis-A PCB Piezotronics Div.                 | 2023003659        | 22 Mar 23           | 21 Mar 24               | -      |
| 14      | Sound Level Meter                               | $L_{Aeq} 24\text{ hrs}$ $L_{A90}$ $L_{Amax}$ $L_{Ain}$<br>ระดับเสียงรบกวน           | Larson Davis                    | LxT1<br>0007303       | Larson Davis-A PCB Piezotronics Div.                 | 2023003660        | 22 Mar 23           | 21 Mar 24               | -      |

List of Instruments Certification for Air & Noise Quality Analysis

| No.     | Instrument/Equipment | Parameter  | Manufacturer | Model/Serial No. | Calibrator                           | Certification No. | Date of Calibration | Due date of Calibration | Remark |
|---------|----------------------|--|--------------|------------------|--------------------------------------|-------------------|---------------------|-------------------------|--------|
| Ambient |                      |  |              |                  |                                      |                   |                     |                         |        |
| 15      | Sound Level Meter    | $L_{Aeq} 24\text{ hr}$ , $L_{A90}$ , $L_{Amax}$ , $L_{Ain}$<br>ระดับเสียงรบกวน | Larson Davis | LxT1<br>0007306  | Larson Davis-A PCB Piezotronics Div. | 2023003664        | 22 Mar 23           | 21 Mar 24               | -      |
| 16      | Sound Level Meter    | $L_{Aeq} 24\text{ hr}$ , $L_{A90}$ , $L_{Amax}$ , $L_{Ain}$<br>ระดับเสียงรบกวน | Larson Davis | LxT1<br>0007308  | Larson Davis-A PCB Piezotronics Div. | 2023003666        | 22 Mar 23           | 21 Mar 24               | -      |
| 17      | Sound Level Meter    | $L_{Aeq} 24\text{ hr}$ , $L_{A90}$ , $L_{Amax}$ , $L_{Ain}$<br>ระดับเสียงรบกวน | Larson Davis | LxT1<br>0007309  | Larson Davis-A PCB Piezotronics Div. | 2023003671        | 22 Mar 23           | 21 Mar 24               | -      |

List of Instruments Certification for Water Quality Analysis

| No.   | Instrument/Equipment | Parameter    | Manufacturer | Model/Serial No.     | Calibrator   | Certification No. | Date of Calibration | Due date of Calibration | Remark |
|-------|----------------------|--------------|--------------|----------------------|--|-------------------|---------------------|-------------------------|--------|
| Water |                      |              |              |                      |  |                   |                     |                         |        |
| 1     | pH Meter             | pH           | YSI          | pH100A<br>JC03354    | Technology Promotion Association<br>(Thailand-Japan) | 23CH1487          | 22 Dec 23           | 21 Dec 24               | -      |
| 2     | DO Meter             | DO           | YSI          | Pro 20i<br>18H110495 | Technology Promotion Association<br>(Thailand-Japan) | 23TW174           | 26 Jul 23           | 25 Jul 24               | -      |
| 3     | Conductivity Meter   | Conductivity | YSI          | Pro30<br>17A102921   | Technology Promotion Association<br>(Thailand-Japan) | 23CH1228          | 28 Sep 23           | 27 Sep 24               | -      |

List of Instruments Certification for Air & Noise Quality Analysis

| No.       | Instrument/Equipment                            | Parameter                          | Manufacturer    | Model/Serial No.         | Calibrator   | Certification No. | Date of Calibration | Due date of Calibration | Remark |
|-----------|---|------------------------------------|-----------------|--------------------------|--|-------------------|---------------------|-------------------------|--------|
| Workplace |   |                                    |                 |                          |  |                   |                     |                         |        |
| 1         | Thermal Environment Monitor                     | Heat Meter                         | 3M              | QuesTemp 32<br>TPQ020025 | Innovative Instrument<br>Co.,Ltd.                    | 23-TPM-253        | 12 May 23           | 11 May 24               | -      |
| 2         | Thermal Environment Monitor                     | Heat Meter                         | 3M              | QuesTemp 32<br>TPS030005 | Innovative Instrument<br>Co.,Ltd.                    | 24-TPM-045        | 23 Jan 24           | 22 Jan 25               | -      |
| 3         | Thermal Environment Monitor                     | Heat Meter                         | 3M              | QuesTemp 32<br>TPT060015 | Innovative Instrument<br>Co.,Ltd.                    | 24-TPM-046        | 23 Jan 24           | 22 Jan 25               | -      |
| 4         | Thermal Environment Monitor                     | Heat Meter                         | 3M              | QuesTemp 32<br>TPS030004 | Innovative Instrument<br>Co.,Ltd.                    | 23-TPM-484        | 17 Oct 23           | 16 Oct 24               | -      |
| 5         | Primary Flow Calibrator                         | Calibrate personal pump            | TSUnc           | 4146<br>41461922007      | Innovative Instrument<br>Co., Ltd.                   | 23-AFM-221 Rev.1  | 25 Oct 23           | 24 Oct 24               | -      |
| 6         | Dial Thermo-Hygrometer                          | Total Dust<br>Respirable Dust      | Barigo, Germany | -                        | Technology Promotion Association<br>(Thailand-Japan) | 23H1200           | 6 Jun 23            | 5 Jun 24                | -      |
| 7         | Digital Thermo - Hygrometer                     | Total Dust<br>Respirable Dust      | Digicon         | TH-02<br>395034175       | Technology Promotion Association<br>(Thailand-Japan) | 23H1101           | 24 May 23           | 23 May 24               | -      |
| 8         | Sound Level Calibrator<br>(Acoustic Calibrator) | Calibrate Sound Level Meter        | 01dB            | CAL31<br>82795           | Innovative Instrument<br>Co.,Ltd.                    | 23-ACT-109        | 27 Jun 23           | 26 Jun 24               | -      |
| 9         | Sound Level Meter                               | $L_{Aeq} 8\text{ hr}$ , $L_{Amax}$ | Rion, Japan     | NL-42<br>00321441        | Sithipom Associates Co., Ltd.                        | ACL23111          | 11 Apr 23           | 10 Apr 24               | -      |
| 10        | Sound Level Meter                               | $L_{Aeq} 8\text{ hr}$ , $L_{Amax}$ | Rion, Japan     | NL-42<br>01010780        | Sithipom Associates Co., Ltd.                        | ACL23119          | 11 Apr 23           | 10 Apr 24               | -      |
| 11        | Sound Level Meter                               | $L_{Aeq} 8\text{ hr}$ , $L_{Amax}$ | Rion, Japan     | NL-42<br>00409178        | Sithipom Associates Co., Ltd.                        | ACL23131          | 26 Apr 23           | 25 Apr 24               | -      |
| 12        | Noise Dosimeter                                 | Noise Dosimeter                    | Svantek         | SV 104<br>143231         | Innovative Instrument<br>Co.,Ltd.                    | 23-NDM-185        | 7 Aug 23            | 6 Aug 24                | -      |
| 13        | Noise Dosimeter                                 | Noise Dosimeter                    | Svantek         | SV 104<br>143225         | Innovative Instrument<br>Co.,Ltd.                    | 23-NDM-179        | 7 Aug 23            | 6 Aug 24                | -      |



Envi Equipment Service Co., Ltd.

110/254 Moo 3, Tumbon Bang Rak Phatthana, Amphur Bang Bua Thong, Nonthaburi 11110

Tel. 098 362 9152, 089 478 7885

E-mail: sales@envi-ees.com

Certificate No. : E23-12095

Page : 1 of 6

**CERTIFICATE OF CALIBRATION**

**Customer** : United Analyst and Engineering Consultant Co., Ltd.

**Address** : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

**Description of Equipment** : Console meter

**Manufacturer** : Apex Instrument

**Model Number** : XC-572-V

**Serial Number** : 1701018

**ID./Control No.** : -

**Environment Conditions** : **Temperature** (25 ± 2) °C  
: **Humidity** (50 ± 15) % RH

**Cal. Date** : 09/12/2023

**Issue Date** : 09/12/2023

**Calibration Method or Calibration Procedure Used**

US EPA Method (United State Environmental Protection Agency)


This certificate is traceable to national standard, which realize the units of measurement according to the International System of Units (IS).

**Result of Calibration**

This certificate may not be reproduced other than in full except with prior Written approval of the Technical Manager, Envi Equipment Service Company Limited.

These reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level

Calibrated by : Mr. Sanya Sangnil

Approved by :   
(Mr. Mana Fuekhud)  
Technical Manger



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**METHOD 5 CONSOLE CALIBRATION  
USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425  
5-POINT METRIC UNIT**

| Meter Console Information |          | Calibration Conditions    |      |             |          | Factors/Conversions |       |       |
|---------------------------|----------|---------------------------|------|-------------|----------|---------------------|-------|-------|
| Console Model Number      | XC-572-V | Date                      | Time | 09/12/2023  | 11:40 AM | Std Temp            | 293   | K     |
| Console Serial Number     | 1701018  | Calibration Reference No. |      | SER23-12095 |          | Std Press           | 760   | mm Hg |
| DGM Model Number          | SK25EX   | Barometric Pressure       |      | 759.66      | mmHg     | K <sub>1</sub>      | 0.386 |       |
| DGM Serial Number         | 00002030 | Calibration Meter Gamma   |      | 0.999       |          | Console Leak Check  |       | PASS  |

| Calibration Data |                     |                    |                    |                     |                    |                    |                    |                     |                    |
|------------------|---------------------|--------------------|--------------------|---------------------|--------------------|--------------------|--------------------|---------------------|--------------------|
| Run Time         | Metering Console    |                    |                    |                     |                    | Calibration Meter  |                    |                     |                    |
| Elapsed          | DGM Orifice DH      | Volume Initial     | Volume Final       | Outlet Temp Initial | Outlet Temp Final  | Volume Initial     | Volume Final       | Outlet Temp Initial | Outlet Temp Final  |
| (Q)              | (P <sub>m</sub> )   | (V <sub>mi</sub> ) | (V <sub>mf</sub> ) | (t <sub>mi</sub> )  | (t <sub>mf</sub> ) | (V <sub>wi</sub> ) | (V <sub>wf</sub> ) | (t <sub>wi</sub> )  | (t <sub>wf</sub> ) |
| min              | mm H <sub>2</sub> O | m <sup>3</sup>     | m <sup>3</sup>     | °C                  | °C                 | m <sup>3</sup>     | m <sup>3</sup>     | °C                  | °C                 |
| 12.48            | 13.0                | 2395.552           | 2395.692           | 29                  | 29                 | 184.31872          | 184.46072          | 28                  | 28                 |
| 12.48            | 13.0                | 2395.692           | 2395.832           | 29                  | 29                 | 184.46072          | 184.60178          | 28                  | 28                 |
| 8.70             | 26.0                | 2395.839           | 2395.979           | 30                  | 30                 | 184.60924          | 184.75154          | 28                  | 28                 |
| 8.72             | 26.0                | 2395.979           | 2396.119           | 30                  | 30                 | 184.75154          | 184.89358          | 28                  | 28                 |
| 14.52            | 40.0                | 2396.133           | 2396.413           | 31                  | 31                 | 184.90784          | 185.19162          | 28                  | 28                 |
| 14.47            | 40.0                | 2396.413           | 2396.693           | 32                  | 32                 | 185.19162          | 185.47356          | 27                  | 27                 |
| 10.77            | 70.0                | 2396.701           | 2396.981           | 32                  | 32                 | 185.48168          | 185.76272          | 27                  | 27                 |
| 10.73            | 70.0                | 2396.981           | 2397.261           | 32                  | 32                 | 185.76272          | 186.04256          | 27                  | 27                 |
| 9.43             | 90.0                | 2397.272           | 2397.552           | 33                  | 33                 | 186.05334          | 186.33194          | 27                  | 27                 |
| 9.42             | 90.0                | 2397.552           | 2397.832           | 33                  | 33                 | 186.33194          | 186.60946          | 27                  | 27                 |



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**METHOD 5 CONSOLE CALIBRATION**  
**USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425**  
**5-POINT METRIC UNIT**

| Meter Console Information |          | Calibration Conditions    |      |             |          | Factors/Conversions |       |       |
|---------------------------|----------|---------------------------|------|-------------|----------|---------------------|-------|-------|
| Console Model Number      | XC-572-V | Date                      | Time | 09/12/2023  | 11:40 AM | Std Temp            | 293   | K     |
| Console Serial Number     | 1701018  | Calibration Reference No. |      | SER23-12095 |          | Std Press           | 760   | mm Hg |
| DGM Model Number          | SK25EX   | Barometric Pressure       |      | 759.66      | mmHg     | K <sub>1</sub>      | 0.386 |       |
| DGM Serial Number         | 00002030 | Calibration Meter Gamma   |      | 0.999       |          | Console Leak Check  |       | PASS  |

| Calibration Data       |                        |                        |                        |                    |           |                              |  |                            |
|------------------------|------------------------|------------------------|------------------------|--------------------|-----------|------------------------------|--|----------------------------|
| Results                |                        |                        |                        |                    |           |                              |  |                            |
| Standardized Data      |                        |                        |                        | Dry Gas Meter      |           |                              |  |                            |
| Dry Gas Meter          |                        | Calibration Meter      |                        | Calibration Factor |           | Flowrate                     |  |                            |
| (V <sub>m(std)</sub> ) | (Q <sub>m(std)</sub> ) | (V <sub>w(std)</sub> ) | (Q <sub>w(std)</sub> ) | Value              | Variation | Std & Corr                   | .0212 m <sup>3</sup> <sub>std</sub> /min | Variation                  |
| m <sup>3</sup>         | m <sup>3</sup> /min    | m <sup>3</sup>         | m <sup>3</sup> /min    | (Y)                | (ΔY)      | (Q <sub>m(std)</sub> )(corr) | (ΔH <sub>@</sub> )                       | (ΔH <sub>@</sub> )         |
|                        |                        |                        |                        |                    |           | m <sup>3</sup> /min          | mm H <sub>2</sub> O                      |                            |
| 0.136                  | 0.011                  | 0.138                  | 0.011                  | 1.012              | 0.011     | 0.011                        | 46.771                                   | -0.951                     |
| 0.136                  | 0.011                  | 0.137                  | 0.011                  | 1.005              | 0.005     | 0.011                        | 47.396                                   | -0.325                     |
| 0.137                  | 0.016                  | 0.138                  | 0.016                  | 1.013              | 0.012     | 0.016                        | 45.356                                   | -2.365                     |
| 0.137                  | 0.016                  | 0.138                  | 0.016                  | 1.011              | 0.010     | 0.016                        | 45.697                                   | -2.024                     |
| 0.273                  | 0.019                  | 0.276                  | 0.019                  | 1.009              | 0.008     | 0.019                        | 48.982                                   | 1.261                      |
| 0.274                  | 0.019                  | 0.275                  | 0.019                  | 1.002              | 0.001     | 0.019                        | 49.119                                   | 1.398                      |
| 0.275                  | 0.026                  | 0.274                  | 0.025                  | 0.996              | -0.005    | 0.025                        | 48.195                                   | 0.473                      |
| 0.275                  | 0.026                  | 0.273                  | 0.025                  | 0.992              | -0.009    | 0.025                        | 48.308                                   | 0.587                      |
| 0.276                  | 0.029                  | 0.272                  | 0.029                  | 0.985              | -0.015    | 0.029                        | 48.591                                   | 0.869                      |
| 0.276                  | 0.029                  | 0.271                  | 0.029                  | 0.982              | -0.019    | 0.029                        | 48.797                                   | 1.076                      |
|                        |                        |                        |                        | 1.001              | Y Average |                              | 47.721                                   | ΔH <sub>@</sub><br>Average |

**Note:** For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is  $\pm 0.02$ .

For  $\Delta H_{@}$ , orifice pressure differential that equates to 0.75 cfm (0.0212 m<sup>3</sup>/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is  $\pm 0.2$  inches (5.1mm) H<sub>2</sub>O



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| Meter Console Information |          |
|---------------------------|----------|
| Console Model Number      | XC-572-V |
| Console Serial Number     | 1701018  |
| DGM Model Number          | SK25EX   |
| DGM Serial Number         | 00002030 |

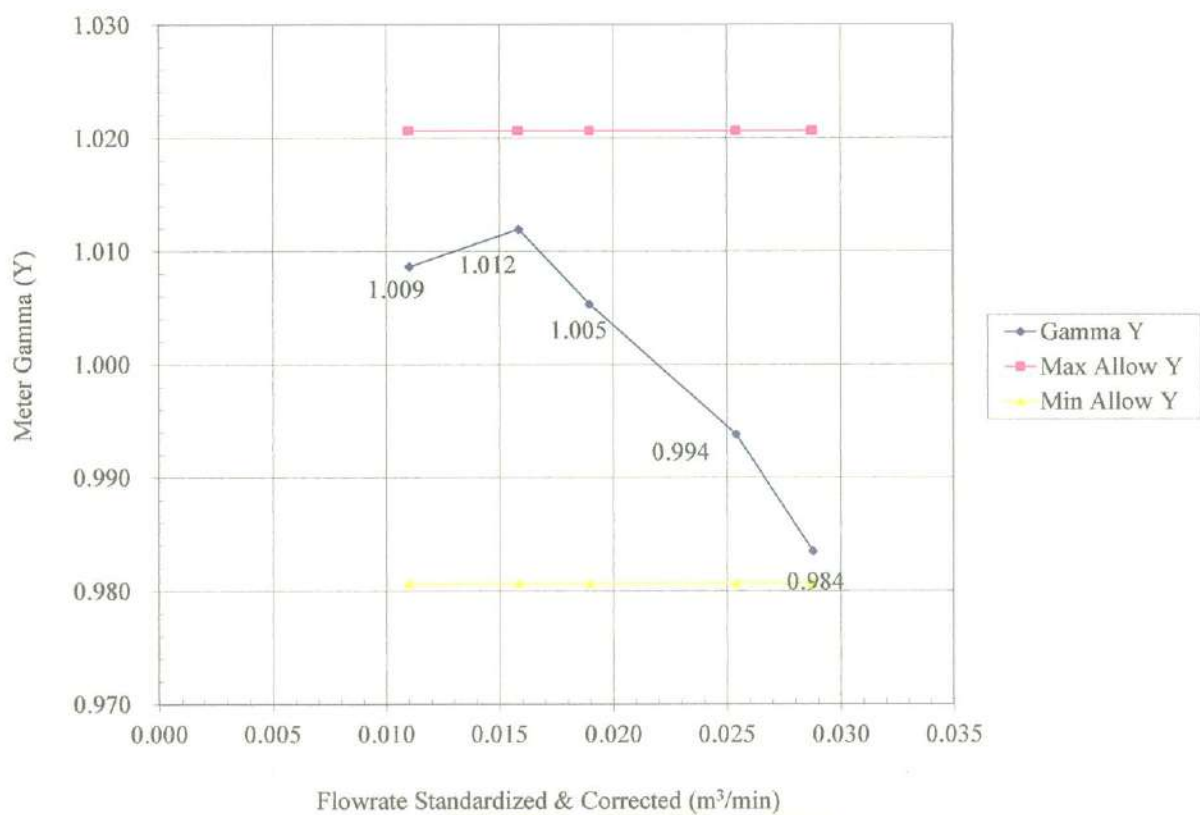
| Calibration Conditions    |      |             |          |
|---------------------------|------|-------------|----------|
| Date                      | Time | 09/12/2023  | 11:40 AM |
| Calibration Reference No. |      | SER23-12095 |          |
| Barometric Pressure       |      | 759.66      | mmHg     |
| Calibration Meter Gamma   |      | 0.999       |          |

| Factors/Conversions |       |       |
|---------------------|-------|-------|
| Std Temp            | 293   | K     |
| Std Press           | 760   | mm Hg |
| K <sub>1</sub>      | 0.386 |       |
| Console Leak Check  |       | PASS  |

Calibration Date: 9-12-2023

Calibration Reference No: SER23-12038

Meter Gamma vs Flowrate



Console Serial: 1701018

Console Model: XC-572-V



เอกสารไม่ควบคุม

| Meter Console Information |          |
|---------------------------|----------|
| Console Model Number      | XC-572-V |
| Console Serial Number     | 1701018  |
| DGM Model Number          | SK25EX   |
| DGM Serial Number         | 00002030 |

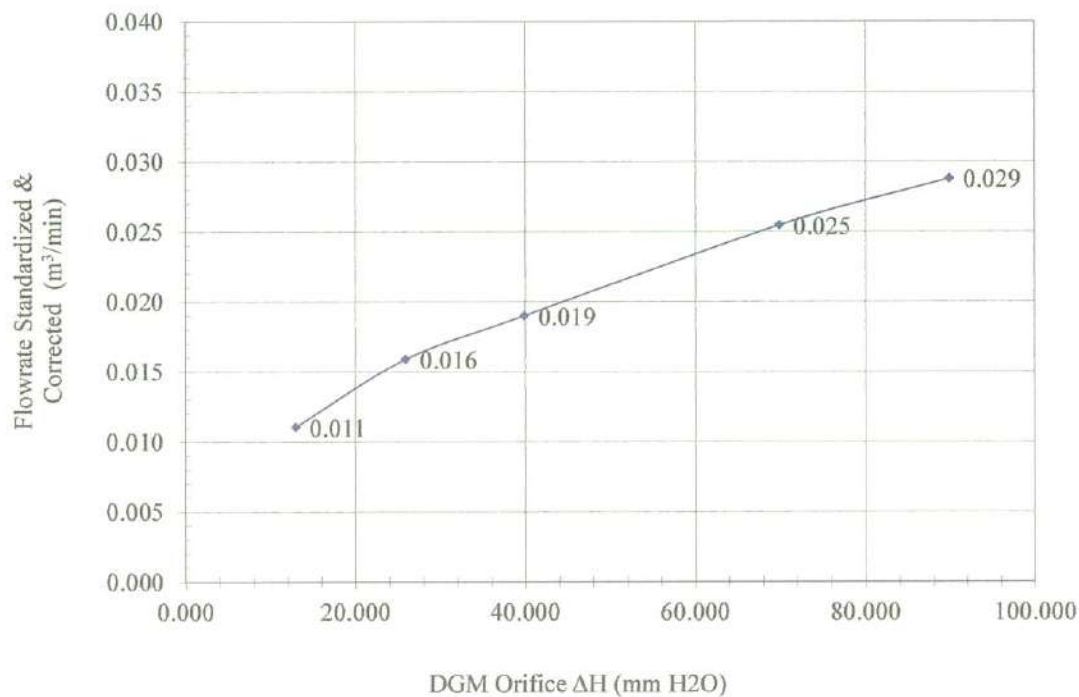
| Calibration Conditions    |      |             |          |
|---------------------------|------|-------------|----------|
| Date                      | Time | 09/12/2023  | 11:40 AM |
| Calibration Reference No. |      | SER23-12095 |          |
| Barometric Pressure       |      | 759.66      | mmHg     |
| Calibration Meter Gamma   |      | 0.999       |          |

| Factors/Conversions |       |       |
|---------------------|-------|-------|
| Std Temp            | 293   | K     |
| Std Press           | 760   | mm Hg |
| K <sub>1</sub>      | 0.386 |       |
| Console Leak Check  |       | PASS  |

Calibration Date: 9-12-2023

Calibration Reference No: SER23-12038

Meter Pressure vs Flowrate



Console Serial: 1701018

Console Model: XC-572-V



เอกสารไม่ควบคุม

## THERMOCOUPLES SYSTEM CALIBRATION

| Sampling System Equipment Information |              |
|---------------------------------------|--------------|
| Console Model Number                  | XC-572-V     |
| Console Serial Number                 | 1701018      |
| DGM Model Number                      | SK25EX       |
| DGM Serial Number                     | 00002030     |
| Meter Box Model Number                | JENCO 765 KF |
| Meter Box Serial Number               | JC 16103     |

| Calibration Conditions    |      |             |          |
|---------------------------|------|-------------|----------|
| Date                      | Time | 09/12/2023  | 01:45 PM |
| Calibration Reference No. |      | SER23-12095 |          |
| Reference Thermometer     |      | DIGICON     |          |
| Serial Number             |      | 183169105   |          |
|                           |      |             |          |
|                           |      |             |          |

| Results                        |  |      |      |      |       |       |       |       |       |       |        |
|--------------------------------|--|------|------|------|-------|-------|-------|-------|-------|-------|--------|
| Console Thermocouple Simulator |  |      |      |      |       |       |       |       |       |       |        |
| Channel and test point         | Meter Box Channel Temperature Reading ( °C ) |      |      |      |       |       |       |       |       |       |        |
|                                | -18.0  | 25.0 | 38.0 | 93.0 | 149.0 | 260.0 | 371.0 | 482.0 | 593.0 | 816.0 | 1038.0 |
| Stack                          | -17.0  | 25.0 | 38.0 | 94.0 | 150.0 | 259.0 | 372.0 | 482.0 | 593.0 | 815.0 | 1037.0 |
| Aux                            | -17.0  | 25.0 | 38.0 | 94.0 | 150.0 |       |       |       |       |       |        |
| Probe                          | -17.0  | 25.0 | 38.0 | 94.0 | 150.0 |       |       |       |       |       |        |
| Filter                         | -17.0  | 25.0 | 39.0 | 94.0 | 150.0 |       |       |       |       |       |        |
| Oven                           | -17.0  | 25.0 | 38.0 | 94.0 | 150.0 |       |       |       |       |       |        |
| Exit                           | -17.0  | 26.0 | 39.0 |      |       |       |       |       |       |       |        |

Tolerance Range

Stack      ± 1.50%      Absolute  
 Probe      ± 3.0 °C  
 Filter      ± 3.0 °C

Meter      ± 3.0 °C  
 Exit        ± 2.0 °C



เอกสารไม่ควบคุม



**Certificate No:** G 660354

**Date of issue :** 20-Jun-23

**Instrument description :** Flue gas Analyzer  
**Instrument model :** Testo 350 New  
**Instrument serial no. :** 60899615  
**ID no. or control no. :** UAE.EFM. 006/2560  
**Manufacturer :** Testo SE & Co. KGaA  
**Probe description :** -  
**Probe model :** -  
**Probe serial :** -  
**Customer name :** United Analyst and Engineering Consultant Co., Ltd.  
**Customer address :** 81 Soi Udomsuk 41, Sukhumvit Rd., Bangchak, Phrakhanong, Bangkok 10260

**Total pages of certificate :** 3 Pages  
**Receiving no. :** L-231754  
**Receiving date. :** 20-Jun-23  
**Parameter of calibration :** Gas Calibration(Oxygen 2.498,10.04,21.02 %vol, Carbon Monoxide 80.14,309.9,1003 ppm, Nitrogen Dioxide 30.34,80.96,202.2 ppm, Nitric Oxide 30.01,151.5,320.6 ppm, Sulphur Dioxide 50.04,100.8,601.1 ppm)  
**Condition of UUC. :** Used  
**Ambient condition :** All of the Measurement were carried out the stabilized laboratory  
 Temperature : 23 ± 5 °C  
 Humidity : 55 ± 15 %RH  
**Calibration place :** 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210  
**Calibration procedure no. :** This instrument was calibrated by comparison with Standard gas mixture according to calibration work instruction no. WI-CL-28-C

*The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.*

*This certificate is applied only to item under test Environmental condition.*

*This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid and The results relate only to the items tested/calibrated.*

*This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).*

**Date of calibration :** 20-Jun-23



Mr. Kwanchai Khamdoun  
Calibration Technician



Mrs. Nongluck Wongsettee  
Technical Manager

**Standard References (Table 1)**

| Standard                                       | Certificate No. | Vendor | Due date  |
|--|-----------------|--------|-----------|
| Oxygen ( O <sub>2</sub> ) 2.498 % Vol          | 4219/21         | Linde  | 30-Sep-25 |
| Oxygen ( O <sub>2</sub> ) 10.04 % Vol          | CG-0153-21      | Nimt   | 18-Nov-26 |
| Oxygen ( O <sub>2</sub> ) 21.02 % Vol          | CG-0041-22      | Nimt   | 10-Feb-27 |
| Carbon monoxide ( CO ) 80.14 ppm               | CG-0040-22      | Nimt   | 14-Feb-27 |
| Carbon monoxide ( CO ) 309.9 ppm               | 2803/21         | Linde  | 22-Jun-23 |
| Carbon monoxide ( CO ) 1003 ppm                | 45513           | Linde  | 09-Aug-24 |
| Nitrogen Dioxide ( NO <sub>2</sub> ) 30.34 ppm | 2703/22         | Nimt   | 22-Aug-24 |
| Nitrogen Dioxide ( NO <sub>2</sub> ) 80.96 ppm | 3240/21         | Linde  | 26-Jun-24 |
| Nitrogen Dioxide ( NO <sub>2</sub> ) 202.2 ppm | 3239/21         | Linde  | 20-Jul-23 |
| Nitric Oxide ( NO ) 30.01 ppm                  | CG-0014-23      | Nimt   | 19-Feb-25 |
| Nitric Oxide ( NO ) 151.5 ppm                  | 0161/23         | Linde  | 22-Jan-25 |
| Nitric Oxide ( NO ) 320.6 ppm                  | 2944/21         | Linde  | 02-Jul-23 |
| Sulphur Dioxide ( SO <sub>2</sub> ) 50.04 ppm  | 3205/21         | Linde  | 25-Jul-23 |
| Sulphur Dioxide ( SO <sub>2</sub> ) 100.8 ppm  | 3507/22         | Linde  | 09-Nov-24 |
| Sulphur Dioxide ( SO <sub>2</sub> ) 601.1 ppm  | 3204/21         | Linde  | 20-Jul-23 |

**Measured room conditions**

Temperature : 22.7 °C Humidity : 67.8 %RH Pressure : 1005.1 mbar

**Calibration conditions**

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1020.2 mbar

**Calibration Results (before adjustment) (Table 2)**

| Parameter of Standard | Standard Values | Mean of UUC | Error | Uncertainty (±) |
|-----------------------|-----------------|-------------|-------|-----------------|
| O <sub>2</sub> (%Vol) | 2.498           | 2.56        | 0.062 | 0.15            |
| O <sub>2</sub> (%Vol) | 10.04           | 10.11       | 0.07  | 0.20            |
| O <sub>2</sub> (%Vol) | 21.02           | 21.10       | 0.08  | 0.30            |
| CO (ppm)              | 80.14           | 78          | -2.14 | 3.0             |
| CO (ppm)              | 309.9           | 297         | -12.9 | 6.0             |
| CO (ppm)              | 1003            | 965         | -38   | 12              |
| NO <sub>2</sub> (ppm) | 30.34           | 27.9        | -2.44 | 8.0             |
| NO <sub>2</sub> (ppm) | 80.96           | 81.3        | 0.34  | 8.0             |
| NO <sub>2</sub> (ppm) | 202.2           | 205.3       | 3.1   | 12              |
| NO (ppm)              | 30.01           | 27          | -3.01 | 8.0             |
| NO (ppm)              | 151.5           | 143         | -8.5  | 8.0             |
| NO (ppm)              | 320.6           | 294         | -26.6 | 12              |
| SO <sub>2</sub> (ppm) | 50.04           | 53          | 2.96  | 6.0             |
| SO <sub>2</sub> (ppm) | 100.8           | 111         | 10.2  | 6.0             |
| SO <sub>2</sub> (ppm) | 601.1           | 665         | 63.9  | 13              |

Calibration Results (after adjustment) (Table 3)

| Parameter of Standard | Standard Values | Mean of UUC | Error | Uncertainty (±) |
|-----------------------|-----------------|-------------|-------|-----------------|
| O2 (%Vol)             | 2.498           | 2.56        | 0.062 | 0.15            |
| O2 (%Vol)             | 10.04           | 10.11       | 0.07  | 0.20            |
| O2 (%Vol)             | 21.02           | 21.10       | 0.08  | 0.30            |
| CO (ppm)              | 80.14           | 81          | 0.86  | 3.0             |
| CO (ppm)              | 309.9           | 309         | -0.9  | 6.0             |
| CO (ppm)              | 1003            | 1001        | -2    | 12              |
| NO2 (ppm)             | 30.34           | 27.9        | -2.44 | 8.0             |
| NO2 (ppm)             | 80.96           | 81.3        | 0.34  | 8.0             |
| NO2 (ppm)             | 202.2           | 205.3       | 3.1   | 12              |
| NO (ppm)              | 30.01           | 32          | 1.99  | 8.0             |
| NO (ppm)              | 151.5           | 155         | 3.5   | 8.0             |
| NO (ppm)              | 320.6           | 318         | -2.6  | 12              |
| SO2 (ppm)             | 50.04           | 50          | -0.04 | 6.0             |
| SO2 (ppm)             | 100.8           | 100         | -0.8  | 6.0             |
| SO2 (ppm)             | 601.1           | 598         | -3.1  | 13              |

Remark : 1 cmol/mol = 1 %vol. , 1 µmol/mol = 1 ppm.

## End of Report





JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd  
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E-mail: jnac-calibration@jiranatee.com  
Web site: www.jiranatee.com

Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TISI-TIS 17025  
CALIBRATION 0367

Flow measurement laboratory  
Calibration services department.

## CERTIFICATE OF CALIBRATION

Certificate No. : CL-004-65

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice  
MANUFACTURER : Tisch Environmental, Inc.  
MODEL/TYPE : TE-5025A  
SERIAL NUMBER : 3393  
ID NUMBER : UAE.EFM.064/2560  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : United Analyst and Engineering Consultant Co.,Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong,  
Bangkok 10260

RECEIVED DATE : 15 Jul 2022  
MEASUREMENT DATE : 25 Jul 2022  
ISSUE DATE : 26 Jul 2022

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

|                      |               |     |
|----------------------|---------------|-----|
| Temperature          | : 23.0 ± 3.0  | °C  |
| Relative Humidity    | : 55.0 ± 15.0 | %RH |
| Atmospheric Pressure | : 1010 ± 10   | hPa |

### CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.  
Measurement Condition : The average values during measurement are 24.7 °C and 52.1 %RH.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibration procedure:

The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/IMC/VW2-dp. The WI-CL-004 was used as a calibration guideline.

### Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the VSL (National Metrology Institute of Netherlands) via Certificate number: G2211901

### Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor  $k=2$ , Which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'

Calibrated by:

- ☐ Mr. Sorawit Thachalad  
☒ Miss Jittrapoln Lertsomphol



Approved signatory: .....

Mr. Parinya Booncharoen  
Calibration Department Manager

**MEASUREMENT RESULTS:**

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The Humid air was used as a medium in the system. The standard conditions are 25°C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

**Table 1:** The results of  $Q$  Standard calibration data

| Plate | Flow rate<br>$m^3/min$ | Pressure<br>[Pa]<br>mmHg | Temperature<br>[Ta]<br>°C | Temperature<br>[Tm]<br>°C | $\Delta p_{meter}$<br>mmHg | $\Delta p_{Orifice}$<br>inH <sub>2</sub> O | $\gamma$ | Standard Flow [ $Q_s$ ]<br>$m^3/min$ |
|-------|------------------------|--------------------------|---------------------------|---------------------------|----------------------------|--|----------|--------------------------------------|
| 1     | 0.699                  | 756.468                  | 24.680                    | 23.730                    | 55.667                     | 1.705                                      | 1.303    | 0.647                                |
| 2     | 1.001                  | 756.479                  | 24.910                    | 24.180                    | 61.363                     | 3.454                                      | 1.855    | 0.918                                |
| 3     | 1.114                  | 756.494                  | 24.550                    | 23.970                    | 41.751                     | 4.535                                      | 2.126    | 1.051                                |
| 4     | 1.166                  | 756.510                  | 24.470                    | 23.900                    | 30.652                     | 5.138                                      | 2.264    | 1.118                                |
| 5     | 1.416                  | 756.534                  | 24.400                    | 24.150                    | 30.200                     | 7.619                                      | 2.757    | 1.357                                |

Slope ( $m$ ): 2.04689  
 Intercept ( $b$ ): -0.02301  
 Correlation coefficient ( $r$ ): 0.99987  
 Uncertainty ( $k=2$ ): 0.010  $m^3/min$

**Table 2:** The results of  $Q$  actual calibration data

| Plate | Flow rate<br>$m^3/min$ | Pressure<br>[Pa]<br>mmHg | Temperature<br>[Ta]<br>°C | Temperature<br>[Tm]<br>°C | $\Delta p_{meter}$<br>mmHg | $\Delta p_{Orifice}$<br>inH <sub>2</sub> O | $\gamma$ | Standard Flow [ $Q_s$ ]<br>$m^3/min$ |
|-------|------------------------|--------------------------|---------------------------|---------------------------|----------------------------|--|----------|--------------------------------------|
| 1     | 0.699                  | 756.468                  | 24.680                    | 23.730                    | 55.667                     | 1.705                                      | 0.819    | 0.649                                |
| 2     | 1.001                  | 756.479                  | 24.910                    | 24.180                    | 61.363                     | 3.454                                      | 1.167    | 0.922                                |
| 3     | 1.114                  | 756.494                  | 24.550                    | 23.970                    | 41.751                     | 4.535                                      | 1.336    | 1.054                                |
| 4     | 1.166                  | 756.510                  | 24.470                    | 23.900                    | 30.652                     | 5.138                                      | 1.422    | 1.121                                |
| 5     | 1.416                  | 756.534                  | 24.400                    | 24.150                    | 30.200                     | 7.619                                      | 1.731    | 1.360                                |

Slope ( $m$ ): 1.28208  
 Intercept ( $b$ ): -0.01449  
 Correlation coefficient ( $r$ ): 0.99987  
 Uncertainty ( $k = 2$ ): 0.011  $m^3/min$

\*\*\*End of Certificate of Calibration\*\*\*



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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. : 23P1403

Page : 1 of 2

Equipment : U-Tube Manometer

Manufacturer: Dwyer

Model : 1221-36-W/M

Serial No.: -

ID No.: UAE.EFM.181/2561

Condition As-Received: Used Item

Received Date: 26 April 2023

Calibration Date: 09 May 2023

Reference: 2304-0703WSC

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

Ambient Temperature: ( 23 ± 2 ) °C

Relative Humidity: ( 50 ± 15 ) %

Atmospheric Pressure: 1010 mbar

81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260

**Procedure used:** The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P04, using " DKD-R 6-1 ; Calibration of Pressure Gauges, Edition 03/2014 " as a guidelines.

### Condition of this result of calibration

1.Reference standards instruments :

| <u>Instrument</u>      | <u>Model</u> | <u>Serial No.</u> | <u>Certificate No.</u> | <u>Due Date</u> |
|------------------------|--------------|-------------------|------------------------|-----------------|
| 1) Pressure Calibrator | PC106P       | 1189              | MP-0137-22             | 24 Aug 2023     |

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

3.Scale and conversion factor is 1 kPa = 4.0146293 inH<sub>2</sub>O

4.This instrument was used clean air as pressure media.

5.This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.

6.This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.

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

8.This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Aussarree

Issue Date : 11 May 2023

Approved Signatory :

Attapol P.  
[ ] Phalinee Prabpaipal  
[ ] Sura Suwannasri  
✓ Attapol Panurach

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B 0314243





Cert.No.: 23P1403

Page: 2 of 2

Result of calibration:- Without adjustmentFunction:- Pressure MeasurementIncreasing PressureRange : 0 inH<sub>2</sub>O to 36 inH<sub>2</sub>OScale Interval : 0.1 inH<sub>2</sub>O ( The Fifth Estimate )

| <u>Applied Pressure</u><br>(inH <sub>2</sub> O) | <u>UUC Indication</u>                         |  | <u>ΔP</u><br>(inH <sub>2</sub> O) | <u>Error</u><br>(inH <sub>2</sub> O) |
|---|---|--|-----------------------------------|--------------------------------------|
|   | <u>High-port side</u><br>(inH <sub>2</sub> O) | <u>Low-port side</u><br>(inH <sub>2</sub> O) |                                   |                                      |
| 0.00  | 0.00  | 0.00   | 0.00                              | 0.00                                 |
| 2.00  | 1.00  | -1.00  | 2.00                              | 0.00                                 |
| 4.00  | 2.00  | -2.00  | 4.00                              | 0.00                                 |
| 6.00  | 3.00  | -3.00  | 6.00                              | 0.00                                 |
| 8.00  | 4.00  | -4.02  | 8.02                              | 0.02                                 |
| 10.00   | 5.00  | -5.02  | 10.02                             | 0.02                                 |
| 12.00   | 6.00  | -6.02  | 12.02                             | 0.02                                 |
| 14.00   | 6.98  | -7.00  | 13.98                             | -0.02                                |
| 16.00   | 7.98  | -8.00  | 15.98                             | -0.02                                |
| 18.00   | 8.98  | -9.00  | 17.98                             | -0.02                                |
| 20.00   | 9.98  | -10.00                                       | 19.98                             | -0.02                                |
| 22.00   | 11.00   | -11.02                                       | 22.02                             | 0.02                                 |
| 24.00   | 12.00   | -12.02                                       | 24.02                             | 0.02                                 |
| 26.00   | 13.00   | -13.04                                       | 26.04                             | 0.04                                 |
| 28.00   | 14.00   | -14.04                                       | 28.04                             | 0.04                                 |
| 30.00   | 15.00   | -15.02                                       | 30.02                             | 0.02                                 |
| 32.00   | 16.00   | -16.02                                       | 32.02                             | 0.02                                 |
| 34.00   | 16.96   | -17.00                                       | 33.96                             | -0.04                                |
| 35.80   | 17.96   | -18.00                                       | 35.96                             | 0.16                                 |

The uncertainty of measurement was  $\pm 0.11$  inH<sub>2</sub>O

\* UUC = Unit Under Calibration

\* ΔP = High-port side - Low-port side

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 %.

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Attapol P.

เอกสารไม่ควบคุม  
a 1160342



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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TEL. 0-2717-3000-24 FAX. 0-2719-9484



## Certificate of Calibration

Certificate No. : 23P1857

Page : 1 of 2

Equipment : Aneroid Barometer  
Manufacturer: Barigo  
Model : -  
Serial No.: -  
ID No.: UAE.ANV.151/2550

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Corporate Services 3: Equipment Calibration and Testing Services.

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 02 June 2023

Reference: 2305-0919WSC

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

Ambient Temperature: ( 23  $\pm$  2 ) °C

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

81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

Atmospheric Pressure: 1007 mbar

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P10, using " DKD-R 6-1 ; Calibration of Pressure Gauges, Edition 03/2014 " as a guidelines.

### Condition of this result of calibration

1.Reference standards instruments :

| <u>Instrument</u>     | <u>Model</u> | <u>Serial No.</u> | <u>Certificate No.</u> | <u>Due Date</u> |
|-----------------------|--------------|-------------------|------------------------|-----------------|
| 1) Standard Barometer | DPI142       | 1422505046        | MP-0094-23             | 03 May 2024     |

2.This instrument was installed in vertical orientation and center of the dial was used as the reference level.

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

4.This result of calibration instrument was in absolute pressure.

5.This instrument was used clean air as pressure media.

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

7.This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew  
Issue Date : 08 June 2023

Approved Signatory :

Attapol P.  
[ ] Phalinee Prabpaipal  
[ ] Sura Suwannasri  
[x] Attapol Panurach

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B 0316957



Cert.No.: 23P1857

Page: 2 of 2

Result of calibration:- Without adjustment

Range : 960 hPa to 1030 hPa

Function:- Absolute Pressure Measurement

Scale Interval : 1 hPa ( The Fifth Estimate )

Increasing Pressure

|                        |        |        |        |        |         |         |         |         |
|------------------------|--------|--------|--------|--------|---------|---------|---------|---------|
| Applied Pressure (hPa) | 960.27 | 971.66 | 982.37 | 994.32 | 1001.76 | 1010.97 | 1020.99 | 1030.52 |
| UUC* Indication (hPa)  | 960.0  | 970.0  | 980.0  | 990.0  | 1000.0  | 1010.0  | 1020.0  | 1030.0  |
| Error (hPa)            | -0.27  | -1.66  | -2.37  | -4.32  | -1.76   | -0.97   | -0.99   | -0.52   |

Decreasing Pressure

|                        |         |         |         |         |        |        |        |        |
|------------------------|---------|---------|---------|---------|--------|--------|--------|--------|
| Applied Pressure (hPa) | 1030.52 | 1021.07 | 1011.30 | 1001.83 | 992.38 | 982.43 | 971.77 | 960.50 |
| UUC* Indication (hPa)  | 1030.0  | 1020.0  | 1010.0  | 1000.0  | 990.0  | 980.0  | 970.0  | 960.0  |
| Error (hPa)            | -0.52   | -1.07   | -1.30   | -1.83   | -2.38  | -2.43  | -1.77  | -0.50  |

The uncertainty of measurement was  $\pm 0.30$  hPa

\* UUC = Unit Under Calibration

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

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Attapol P.

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a 1165501





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. : 23H1201

Page : 1 of 2

Equipment : Dial Thermo-Hygrometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: UAE.EMA2.014/2555

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 30 May 2023  
to 06 June 2023

Reference: 2305-0919WSC

Ambient Temperature: ( 25 ± 3 ) °C

Relative Humidity: ( 50 ± 20 ) %

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Corporate Services 3: Equipment Calibration and Testing Services.

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

**Procedure used:** Calibration were conducted using in-house calibration procedure CP-H02 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

### Condition of this result of calibration

1.Reference standards instruments :

| <u>Instrument</u>                   | <u>Model</u> | <u>Serial No.</u> | <u>Certificate No.</u> | <u>Due Date</u> |
|-------------------------------------|--------------|-------------------|------------------------|-----------------|
| 1) Hygro-M2 Dew Point Monitor       | 5112         | 2360195           | 20703                  | 02 Aug 2023     |
| 2) Handheld Thermometer With Sensor | 1523         | 3240076           | 231305                 | 15 Mar 2024     |


2.The 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 maintained through:-

- National Institute of Standards and Technology (NIST) , The United States of America
- Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

Calibrated by : Somchai Dumwor  
Issue Date : 07 June 2023

Approved Signatory :

  
[✓] Chakrit Waewwanjua  
[ ] Pornthippa Tameyakul  
[ ] Viporn Tantiyawutti

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Cert. No.: 23H1201

Page.: 2 of 2

**Result of Calibration:-**

Before Adjustment

Function:

Humidity Measurement

| <u>Reference</u><br><u>Temperature</u><br>(°C) | <u>Standard</u><br><u>Humidity</u><br>(%R.H.) | <u>UUC*</u><br><u>Reading</u><br>(%R.H.) | <u>Error</u><br>(%R.H.) | <u>Uncertainty</u><br><u>of Measurement</u><br>(±%R.H.) |
|--|---|--|-------------------------|---|
| 25.0   | 40.1  | 55                                       | 14.9                    | 1.6   |
| 25.0   | 60.0  | 66                                       | 6.0                     | 1.7   |
| 25.0   | 80.0  | 78                                       | -2.0                    | 1.9   |

**Result of Calibration:-**

After Adjustment

Function:

Humidity Measurement

| <u>Reference</u><br><u>Temperature</u><br>(°C) | <u>Standard</u><br><u>Humidity</u><br>(%R.H.) | <u>UUC*</u><br><u>Reading</u><br>(%R.H.) | <u>Error</u><br>(%R.H.) | <u>Uncertainty</u><br><u>of Measurement</u><br>(±%R.H.) |
|--|---|--|-------------------------|---|
| 25.0   | 40.1  | 46                                       | 5.9                     | 1.6   |
| 25.0   | 60.0  | 60                                       | 0.0                     | 1.7   |
| 25.0   | 80.0  | 72                                       | -8.0                    | 1.9   |

**Result of Calibration:-**

Without Adjustment

Function:

Temperature Measurement

| <u>Standard</u><br><u>Temperature</u><br>(°C) | <u>UUC*</u><br><u>Reading</u><br>(°C) | <u>Error</u><br>(°C) | <u>Uncertainty</u><br><u>of Measurement</u><br>(±°C) |
|---|---------------------------------------|----------------------|--|
| 19.987  | 20.0                                  | 0.013                | 0.72   |
| 30.016  | 30.0                                  | -0.016               | 0.72   |
| 39.944  | 39.0                                  | -0.944               | 0.72   |

UUC\* : Unit Under Calibration

The reported uncertainty of measurement was base on standard uncertainty multiplied by coverage factor  $k = 2.00$ , providing confidence level approximately 95%.

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### MULTI-POINT GAS TEST REPORT

**Test Date** : Nov 1, 2023

**Equipment** : Gas Analyzer (NO<sub>2</sub>)

**Model** : 42C

**Manufacturer** : Thermo Environmental Instruments

**Serial Number** : 42C- 67174-356

#### Standard Gas Concentration

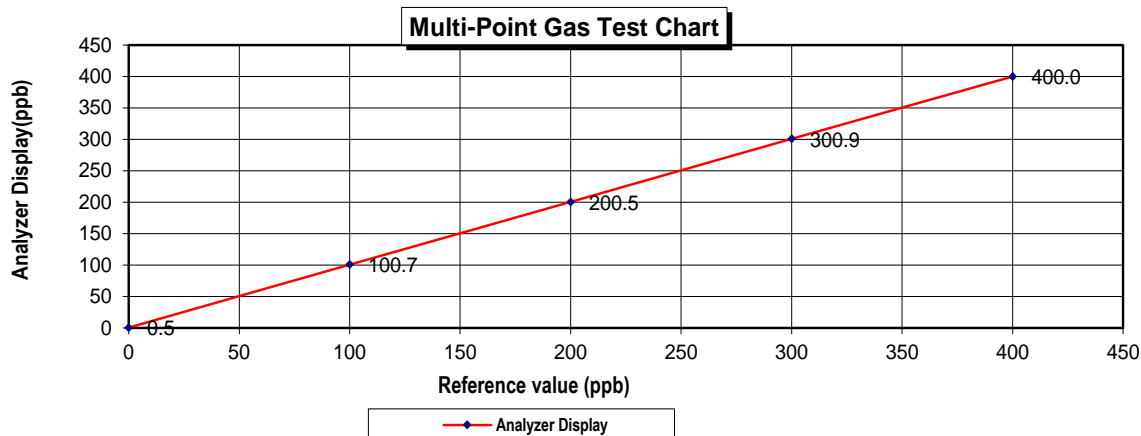
|                                    |              |
|------------------------------------|--------------|
| Sulphur Dioxide (SO <sub>2</sub> ) | 44.68        |
| Nitric Oxide (NO)                  | 45.94        |
| Methane (CH <sub>4</sub> )         | -            |
| Carbon Monoxide (CO)               | 984.8        |
| Cylinder No. :                     | EB0143262    |
| Expiration Date :                  | Jun 21, 2024 |

#### Dilutor Detail

|                 |                   |
|-----------------|-------------------|
| Manufacturer :  | Thermo Scientific |
| Model :         | 146i              |
| Serial Number : | 1180540071        |

#### Multi-point gas test data

| Reference Value (ppb)    |        |       | Analyzer Display (ppb) | Difference Error       | Percent Error | [% Error ] |
|--------------------------|--------|-------|------------------------|------------------------|---------------|------------|
| Level 1                  | Zero   | 0.0   | 0.5                    | 0.50                   | 0.50          | 0.50       |
| Level 2                  | 20.00% | 100.0 | 100.7                  | 0.70                   | 0.70          | 0.70       |
| Level 3                  | 40.00% | 200.0 | 200.5                  | 0.50                   | 0.25          | 0.25       |
| Level 4                  | 60.00% | 300.0 | 300.9                  | 0.90                   | 0.30          | 0.30       |
| Level 5                  | 80.00% | 400.0 | 400.0                  | 0.00                   | 0.00          | 0.00       |
| Remark : Measuring Range |        |       | 500.0 ppb              | Average Difference (%) |               | 0.35       |



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### MULTI-POINT GAS TEST REPORT

**Test Date** : Nov 13, 2023

**Equipment** : Gas Analyzer (NO<sub>2</sub>)

**Model** : 42C

**Manufacturer** : Thermo Environmental Instruments

**Serial Number** : 42C-78933-390

#### Standard Gas Concentration

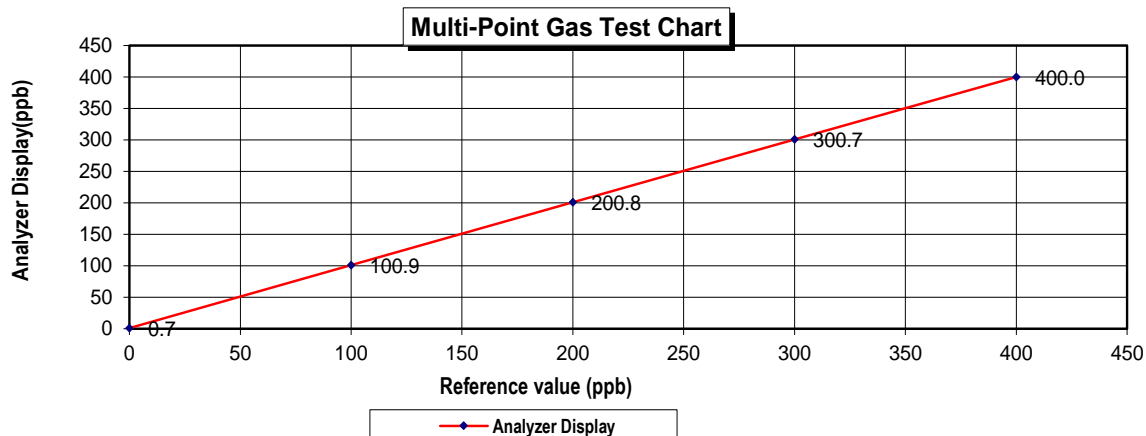
|                                    |              |
|------------------------------------|--------------|
| Sulphur Dioxide (SO <sub>2</sub> ) | 44.68        |
| Nitric Oxide (NO)                  | 45.94        |
| Methane (CH <sub>4</sub> )         | -            |
| Carbon Monoxide (CO)               | 984.8        |
| Cylinder No. :                     | EB0143262    |
| Expiration Date :                  | Jun 21, 2024 |

#### Dilutor Detail

|                 |                   |
|-----------------|-------------------|
| Manufacturer :  | Thermo Scientific |
| Model :         | 146i              |
| Serial Number : | 1180540071        |

#### Multi-point gas test data

| Reference Value (ppb)              |        |       | Analyzer Display (ppb) | Difference Error       | Percent Error | [% Error ] |
|------------------------------------|--------|-------|------------------------|------------------------|---------------|------------|
| Level 1                            | Zero   | 0.0   | 0.7                    | 0.70                   | 0.70          | 0.70       |
| Level 2                            | 20.00% | 100.0 | 100.9                  | 0.90                   | 0.89          | 0.89       |
| Level 3                            | 40.00% | 200.0 | 200.8                  | 0.80                   | 0.40          | 0.40       |
| Level 4                            | 60.00% | 300.0 | 300.7                  | 0.70                   | 0.23          | 0.23       |
| Level 5                            | 80.00% | 400.0 | 400.0                  | 0.00                   | 0.00          | 0.00       |
| Remark : Measuring Range 500.0 ppb |        |       |                        | Average Difference (%) |               | 0.44       |



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*Grichai. y*  
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13 / Nov / 2023

Approve by

*Pattana b.*  
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13 / Nov / 2023

# CERTIFICATE OF ANALYSIS

## Grade of Product: EPA Protocol

|                  |                         |                     |                 |
|------------------|-------------------------|---------------------|-----------------|
| Part Number:     | E04NI99E15A01D3         | Reference Number:   | 122-402135167-1 |
| Cylinder Number: | EB0143262               | Cylinder Volume:    | 144.4 CF        |
| Laboratory:      | 124 - Durham (SAP) - NC | Cylinder Pressure:  | 2015 PSIG       |
| PGVP Number:     | B22021                  | Valve Outlet:       | 660             |
| Gas Code:        | CO,NO,NOX,SO2,BALN      | Certification Date: | Jun 21, 2021    |

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

| ANALYTICAL RESULTS |                         |                      |                 |                            |                        |
|--------------------|-------------------------|----------------------|-----------------|----------------------------|------------------------|
| Component          | Requested Concentration | Actual Concentration | Protocol Method | Total Relative Uncertainty | Assay Dates            |
| NOX                | 45.00 PPM               | 45.96 PPM            | G1              | +/- 1.4% NIST Traceable    | 06/14/2021, 06/21/2021 |
| NITRIC OXIDE       | 45.00 PPM               | 45.94 PPM            | G1              | +/- 1.4% NIST Traceable    | 06/14/2021, 06/21/2021 |
| SULFUR DIOXIDE     | 45.00 PPM               | 44.68 PPM            | G1              | +/- 1.0% NIST Traceable    | 06/14/2021, 06/21/2021 |
| CARBON MONOXIDE    | 1000 PPM                | 984.8 PPM            | G1              | +/- 0.7% NIST Traceable    | 06/14/2021             |
| NITROGEN           | Balance                 |                      |                 |                            |                        |

| CALIBRATION STANDARDS |              |             |                                     |             |                 |
|-----------------------|--------------|-------------|-------------------------------------|-------------|-----------------|
| Type                  | Lot ID       | Cylinder No | Concentration                       | Uncertainty | Expiration Date |
| NTRM                  | 20081120     | CC708068    | 49.82 PPM NITRIC OXIDE/NITROGEN     | +/- 1.0%    | Feb 02, 2025    |
| PRM                   | 12386        | D885025     | 9.91 PPM NITROGEN DIOXIDE/AIR       | +/- 2.0%    | Feb 20, 2020    |
| GMIS                  | 401423838102 | CC505581    | 4.348 PPM NITROGEN DIOXIDE/NITROGEN | +/- 2.1     | Feb 18, 2023    |
| NTRM                  | 16011043     | CC473277    | 49.02 PPM SULFUR DIOXIDE/NITROGEN   | +/- 0.8%    | Jun 17, 2022    |
| NTRM                  | 14060119     | CC434277    | 990.9 PPM CARBON MONOXIDE/NITROGEN  | +/-0.6%     | Nov 15, 2025    |

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

| ANALYTICAL EQUIPMENT        |                      |                             |
|-----------------------------|----------------------|-----------------------------|
| Instrument/Make/Model       | Analytical Principle | Last Multipoint Calibration |
| Nicolet 6700 AHR0801333 CO  | FTIR                 | Jun 03, 2021                |
| Nicolet 6700 AHR0801333 NO  | FTIR                 | Jun 03, 2021                |
| Nicolet 6700 AHR0801333 NO2 | FTIR                 | Jun 03, 2021                |
| Nicolet 6700 AHR0801333 SO2 | FTIR                 | Jun 03, 2021                |

Triad Data Available Upon Request

NOTES:PO #5221002607

GROSS WT: 28.40kg

NET WT: 4.73kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

*[Signature]*

Approved for Release



CERT 3082.01

เอกสารไม่ควบคุม

### MULTI-POINT GAS TEST REPORT

**Test Date** : Nov 3, 2023

**Equipment** : Gas Analyzer (SO<sub>2</sub>)

**Model** : 43i

**Manufacturer** : Thermo SCIENTIFIC

**Serial Number** : 1180540065

#### Standard Gas Concentration

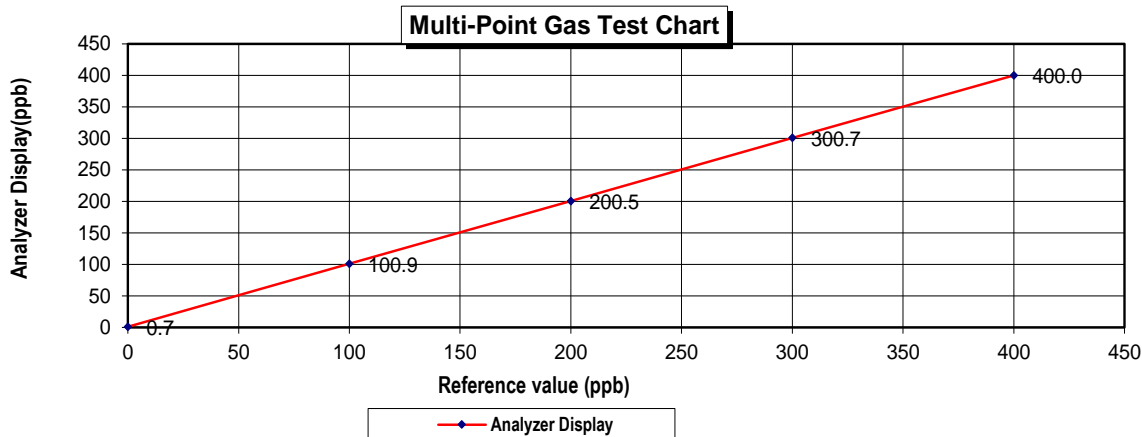
|                                    |              |
|------------------------------------|--------------|
| Sulphur Dioxide (SO <sub>2</sub> ) | 44.68        |
| Nitric Oxide (NO)                  | 45.94        |
| Methane (CH <sub>4</sub> )         | -            |
| Carbon Monoxide (CO)               | 984.8        |
| Cylinder No. :                     | EB0143262    |
| Expiration Date :                  | Jun 24, 2024 |

#### Dilutor Detail

|                 |                   |
|-----------------|-------------------|
| Manufacturer :  | Thermo SCIENTIFIC |
| Model :         | 146i              |
| Serial Number : | 1180540071        |

#### Multi-point gas test data

| Reference Value (ppb)              |        |       | Analyzer Display (ppb) | Difference Error       | Percent Error | [% Error ] |
|------------------------------------|--------|-------|------------------------|------------------------|---------------|------------|
| Level 1                            | Zero   | 0.0   | 0.7                    | 0.70                   | 0.70          | 0.70       |
| Level 2                            | 20.00% | 100.0 | 100.9                  | 0.90                   | 0.89          | 0.89       |
| Level 3                            | 40.00% | 200.0 | 200.5                  | 0.50                   | 0.25          | 0.25       |
| Level 4                            | 60.00% | 300.0 | 300.7                  | 0.70                   | 0.23          | 0.23       |
| Level 5                            | 80.00% | 400.0 | 400.0                  | 0.00                   | 0.00          | 0.00       |
| Remark : Measuring Range 500.0 ppb |        |       |                        | Average Difference (%) |               | 0.41       |



Calculate by

*Girchari G.*

03 / Nov / 2023

Approve by

*Pattana B.*

03 / Nov / 2023



### MULTI-POINT GAS TEST REPORT

**Test Date** : Nov 9, 2023

**Equipment** : Gas Analyzer (SO<sub>2</sub>)

**Model** : 43i

**Manufacturer** : Thermo SCIENTIFIC

**Serial Number** : 1180540066

#### Standard Gas Concentration

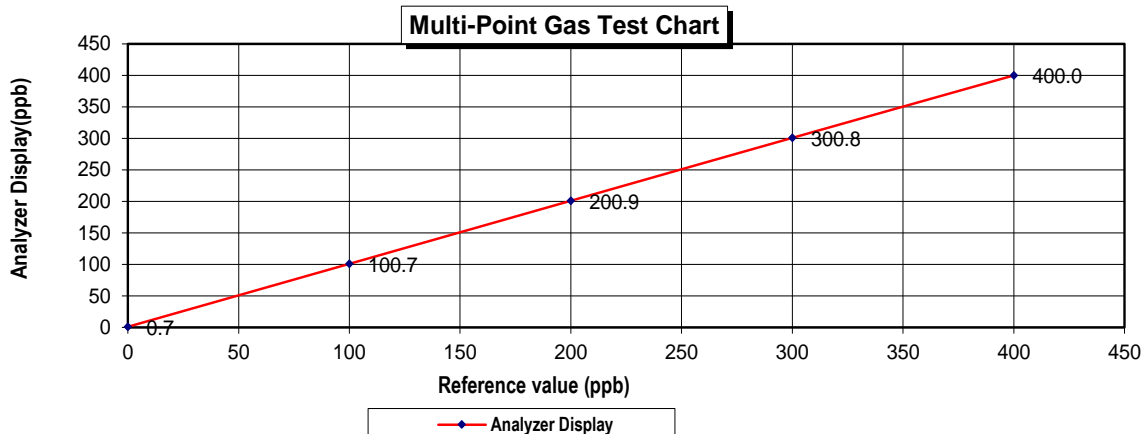
|                                    |              |
|------------------------------------|--------------|
| Sulphur Dioxide (SO <sub>2</sub> ) | 44.68        |
| Nitric Oxide (NO)                  | 45.94        |
| Methane (CH <sub>4</sub> )         | -            |
| Carbon Monoxide (CO)               | 984.8        |
| Cylinder No. :                     | EB0143262    |
| Expiration Date :                  | Jun 24, 2024 |

#### Dilutor Detail

|                 |                   |
|-----------------|-------------------|
| Manufacturer :  | Thermo SCIENTIFIC |
| Model :         | 146i              |
| Serial Number : | 1180540071        |

#### Multi-point gas test data

|                          | Reference Value (ppb) |       | Analyzer Display (ppb)      | Difference Error       | Percent Error | [% Error] |
|--------------------------|-----------------------|-------|-----------------------------|------------------------|---------------|-----------|
| Level 1                  | Zero                  | 0.0   | 0.7                         | 0.70                   | 0.70          | 0.70      |
| Level 2                  | 20.00%                | 100.0 | 100.7                       | 0.70                   | 0.70          | 0.70      |
| Level 3                  | 40.00%                | 200.0 | 200.9                       | 0.90                   | 0.45          | 0.45      |
| Level 4                  | 60.00%                | 300.0 | 300.8                       | 0.80                   | 0.27          | 0.27      |
| Level 5                  | 80.00%                | 400.0 | 400.0                       | 0.00                   | 0.00          | 0.00      |
| Remark : Measuring Range |                       |       | 500.0 ppb                   | Average Difference (%) |               | 0.42      |
|                          |                       |       | :Acceptable Limit $\pm 5\%$ |                        |               |           |



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Approve by

*Signature*  
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9 / Nov / 2023

# CERTIFICATE OF ANALYSIS

## Grade of Product: EPA Protocol

|                  |                         |                     |                 |
|------------------|-------------------------|---------------------|-----------------|
| Part Number:     | E04NI99E15A01D3         | Reference Number:   | 122-402135167-1 |
| Cylinder Number: | EB0143262               | Cylinder Volume:    | 144.4 CF        |
| Laboratory:      | 124 - Durham (SAP) - NC | Cylinder Pressure:  | 2015 PSIG       |
| PGVP Number:     | B22021                  | Valve Outlet:       | 660             |
| Gas Code:        | CO,NO,NOX,SO2,BALN      | Certification Date: | Jun 21, 2021    |

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

| ANALYTICAL RESULTS |                         |                      |                 |                            |                        |
|--------------------|-------------------------|----------------------|-----------------|----------------------------|------------------------|
| Component          | Requested Concentration | Actual Concentration | Protocol Method | Total Relative Uncertainty | Assay Dates            |
| NOX                | 45.00 PPM               | 45.96 PPM            | G1              | +/- 1.4% NIST Traceable    | 06/14/2021, 06/21/2021 |
| NITRIC OXIDE       | 45.00 PPM               | 45.94 PPM            | G1              | +/- 1.4% NIST Traceable    | 06/14/2021, 06/21/2021 |
| SULFUR DIOXIDE     | 45.00 PPM               | 44.68 PPM            | G1              | +/- 1.0% NIST Traceable    | 06/14/2021, 06/21/2021 |
| CARBON MONOXIDE    | 1000 PPM                | 984.8 PPM            | G1              | +/- 0.7% NIST Traceable    | 06/14/2021             |
| NITROGEN           | Balance                 |                      |                 |                            |                        |

| CALIBRATION STANDARDS |              |             |                                     |             |                 |
|-----------------------|--------------|-------------|-------------------------------------|-------------|-----------------|
| Type                  | Lot ID       | Cylinder No | Concentration                       | Uncertainty | Expiration Date |
| NTRM                  | 20081120     | CC708068    | 49.82 PPM NITRIC OXIDE/NITROGEN     | +/- 1.0%    | Feb 02, 2025    |
| PRM                   | 12386        | D885025     | 9.91 PPM NITROGEN DIOXIDE/AIR       | +/- 2.0%    | Feb 20, 2020    |
| GMIS                  | 401423838102 | CC505581    | 4.348 PPM NITROGEN DIOXIDE/NITROGEN | +/- 2.1     | Feb 18, 2023    |
| NTRM                  | 16011043     | CC473277    | 49.02 PPM SULFUR DIOXIDE/NITROGEN   | +/- 0.8%    | Jun 17, 2022    |
| NTRM                  | 14060119     | CC434277    | 990.9 PPM CARBON MONOXIDE/NITROGEN  | +/-0.6%     | Nov 15, 2025    |

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

| ANALYTICAL EQUIPMENT        |                      |                             |
|-----------------------------|----------------------|-----------------------------|
| Instrument/Make/Model       | Analytical Principle | Last Multipoint Calibration |
| Nicolet 6700 AHR0801333 CO  | FTIR                 | Jun 03, 2021                |
| Nicolet 6700 AHR0801333 NO  | FTIR                 | Jun 03, 2021                |
| Nicolet 6700 AHR0801333 NO2 | FTIR                 | Jun 03, 2021                |
| Nicolet 6700 AHR0801333 SO2 | FTIR                 | Jun 03, 2021                |

Triad Data Available Upon Request

NOTES:PO #5221002607

GROSS WT: 28.40kg

NET WT: 4.73kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

*[Signature]*

Approved for Release



CERT 3082.01

เอกสารไม่ควบคุม

## Certificate of Calibration

### Customer

Name : UNITED ANALYST AND ENGINEERING  
CONSULTANT CO.,LTD.  
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Prakanong, Bangkok 10260

Certificate No : 23-ACT-109  
Request No : Req-2023-1406

### Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 1  
Manufacturer : 01dB Range : 94 dB / 1000 Hz  
Model : CAL31 Intrument Status : Used  
Serial Number : 82795  
ID : UAE.EFM.113/2560

### Calibration Environment and Details

Temperature : ( 23  $\pm$ 2  $^{\circ}$ C )  
Humidity : ( 50  $\pm$  20 %RH )  
Barometric Pressure : ( 1013  $\pm$ 10.0 hPa )  
Received Date : 26 June 2023  
Calibration Date : 27 June 2023  
Location of Calibration : LAB 1 Acoustic  
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

| Reference Standard | Model  | Serial Number | Traceable | Due Calibration |
|--------------------|--------|---------------|-----------|-----------------|
| Sound Calibrator   | SV 35A | 58079         | EEI       | 31 May 2024     |
| THD Multimeter     | 2015   | 1047765       | NIMT      | 31 January 2024 |

**Traceability** : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

### Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor  $k=2$ , providing a level of confidence approximately 95 %.

Calibrated By : me  
Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By : ปณิ  
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor

Issue Date : 27 June 2023



Certificate No : 23-ACT-109

Request No : Req-2023-1406

**Sound pressure level**

**Calibration Results : Without Adjustment**

| Calibration Range<br>(dB) | Without Adjustment (dB) |       | Adjustment (dB) |       | Uncertainty<br>( ± dB) | Acceptance limit<br>Class 1 ( ± dB) |
|---------------------------|-------------------------|-------|-----------------|-------|------------------------|-------------------------------------|
|                           | Measured                | Error | Measured        | Error |                        |                                     |
| 94 dB / 1000 Hz           | 94.11                   | 0.11  | -               | -     | 0.13                   | 0.25                                |

**Frequency of Sound pressure level**

| Calibration Range<br>(Hz) | Without Adjustment |           | Adjustment    |           | Uncertainty<br>( ± %) | Acceptance limit<br>Class 1 ( ± %) |
|---------------------------|--------------------|-----------|---------------|-----------|-----------------------|------------------------------------|
|                           | Measured (Hz)      | Error (%) | Measured (Hz) | Error (%) |                       |                                    |
| 94 dB / 1000 Hz           | 1000.00            | 0.00      | -             | -         | 0.01                  | 0.70                               |

**Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)**

| Calibration Range<br>(Hz) | Without Adjustment | Adjustment   | Uncertainty<br>( ± %) | Acceptance limit<br>Class 1 ( ± %) |
|---------------------------|--------------------|--------------|-----------------------|------------------------------------|
|                           | Measured (%)       | Measured (%) |                       |                                    |
| 94 dB / 1000 Hz           | 0.08               | -            | 0.40                  | 2.5                                |

**Note :**

- Acceptance limit was IEC60942:2017 Class 1
- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

**End of Calibration**

# Calibration Certificate

Certificate Number 2023003657

**Customer:**

United Analyst and Engineering Consultant Co Ltd  
No. 81 Soi Udonsuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong,  
Bangkok, 10260, Thailand

**Model Number** LxT1  
**Serial Number** 0007301  
**Test Results** **Pass**  
**Initial Condition** As Manufactured  
**Description** SoundTrack LxT Class 1  
Class 1 Sound Level Meter  
Firmware Revision: 2.404

**Procedure Number** D0001.8384  
**Technician** Jacob Cannon  
**Calibration Date** 23 Mar 2023  
**Calibration Due**  
**Temperature** 23.56 °C ± 0.25 °C  
**Humidity** 49.4 %RH ± 2.0 %RH  
**Static Pressure** 86.02 kPa ± 0.13 kPa

**Evaluation Method** **Tested with:** **Data reported in dB re 20 µPa.**

Larson Davis CAL291. S/N 0108  
Larson Davis PRMLxT1. S/N 077636  
PCB 377B02. S/N 344263  
Larson Davis CAL200. S/N 9079

**Compliance Standards** Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

|                        |                            |
|------------------------|----------------------------|
| IEC 60651:2001 Type 1  | ANSI S1.4-2014 Class 1     |
| IEC 60804:2000 Type 1  | ANSI S1.4 (R2006) Type 1   |
| IEC 61252:2002         | ANSI S1.11 (R2009) Class 1 |
| IEC 61260:2001 Class 1 | ANSI S1.25 (R2007)         |
| IEC 61672:2013 Class 1 | ANSI S1.43 (R2007) Type 1  |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

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1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014/Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1; the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

#### Standards Used

| Description  | Cal Date   | Cal Due    | Cal Standard |
|--|------------|------------|--------------|
| Larson Davis CAL291 Residual Intensity Calibrator    | 2022-09-09 | 2023-09-09 | 001250       |
| Hart Scientific 2626-H Temperature Probe             | 2021-08-25 | 2023-05-25 | 006798       |
| Larson Davis CAL200 Acoustic Calibrator              | 2022-07-21 | 2023-07-21 | 007027       |
| Larson Davis Model 831                               | 2023-02-22 | 2024-02-22 | 007182       |
| PCB 377A13 1/2 inch Prepolarized Pressure Microphone | 2023-03-06 | 2024-03-06 | 007185       |
| SRS DS360 Ultra Low Distortion Generator             | 2022-03-29 | 2023-03-29 | 007635       |
| Larson Davis 1/2" Preamplifier for Model 831 Type 1  | 2022-09-28 | 2023-09-28 | PCB0004783   |

#### Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

| Measurement | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|-------------|------------------|------------------|------------------|---------------------------|--------|
| 1000 Hz     | 114.01           | 113.80           | 114.20           | 0.14                      | Pass   |

#### Loaded Circuit Sensitivity

| Measurement | Test Result [dB re 1 V / Pa] | Lower Limit [dB re 1 V / Pa] | Upper Limit [dB re 1 V / Pa] | Expanded Uncertainty [dB] | Result |
|-------------|------------------------------|------------------------------|------------------------------|---------------------------|--------|
| 1000 Hz     | -49.52                       | -52.44                       | -48.33                       | 0.14                      | Pass   |

-- End of measurement results--

#### Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Expected [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|---------------|------------------|------------------|---------------------------|--------|
| 125            | -0.17            | -0.20         | -1.20            | 0.80             | 0.23                      | Pass   |
| 1000           | 0.18             | 0.00          | -0.70            | 0.70             | 0.23                      | Pass   |
| 8000           | -3.84            | -3.00         | -5.50            | -1.50            | 0.32                      | Pass   |

-- End of measurement results--

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## Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement

Test Result [dB]

A-weighted

40.35

-- End of measurement results--

-- End of Report--

Signatory: Jacob Cannon

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2023-3-23T16:57:14



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# Calibration Certificate

Certificate Number 2023003632

**Customer:**

United Analyst and Engineering Consultant Co Ltd  
No. 81 Soi Udonsuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong,  
Bangkok, 10260, Thailand

**Model Number** LxT1  
**Serial Number** 0007301  
**Test Results** Pass  
**Initial Condition** As Manufactured  
**Description** SoundTrack LxT Class 1  
Class 1 Sound Level Meter  
Firmware Revision: 2.404

**Procedure Number** D0001.8378  
**Technician** Jacob Cannon  
**Calibration Date** 23 Mar 2023  
**Calibration Due**  
**Temperature** 23.58 °C ± 0.25 °C  
**Humidity** 49.3 %RH ± 2.0 %RH  
**Static Pressure** 86.12 kPa ± 0.13 kPa

**Evaluation Method** Tested electrically using Larson Davis PRMLxT1 S/N 077636 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

**Compliance Standards** Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

|                        |                            |
|------------------------|----------------------------|
| IEC 60651:2001 Type 1  | ANSI S1.4-2014 Class 1     |
| IEC 60804:2000 Type 1  | ANSI S1.4 (R2006) Type 1   |
| IEC 61252:2002         | ANSI S1.25 (R2007)         |
| IEC 61672:2013 Class 1 | ANSI S1.43 (R2007) Type 1  |
| IEC 61260:2001 Class 1 | ANSI S1.11 (R2009) Class 1 |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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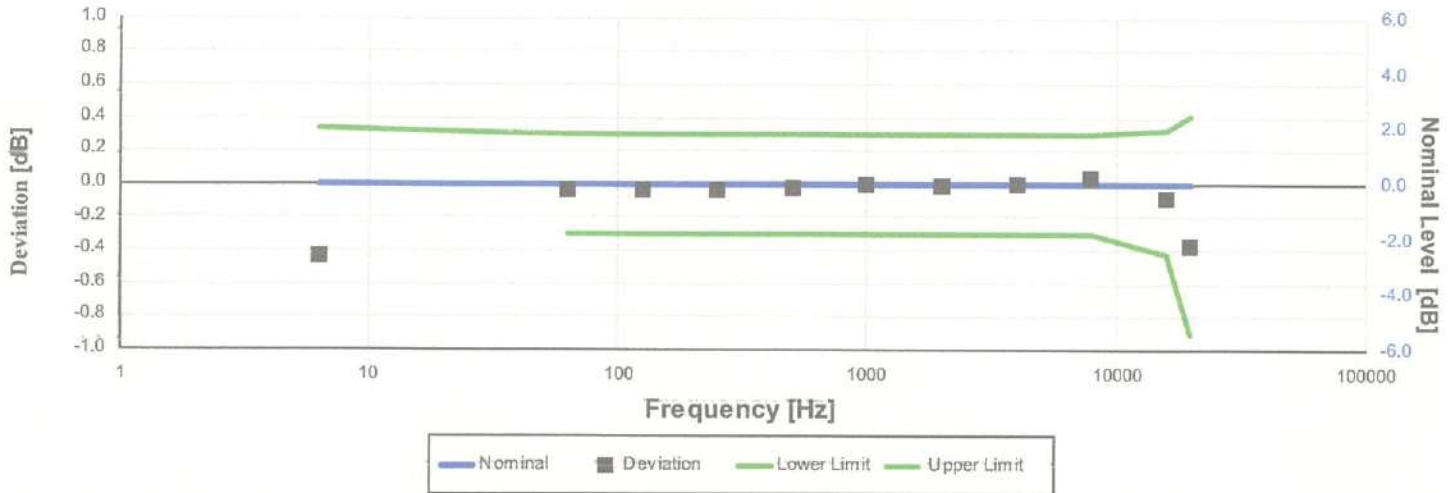
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| Description                              | Standards Used |            |              |
|--|----------------|------------|--------------|
|  | Cal Date       | Cal Due    | Cal Standard |
| Hart Scientific 2626-H Temperature Probe | 2021-08-25     | 2023-05-25 | 006798       |
| SRS DS360 Ultra Low Distortion Generator | 2022-03-29     | 2023-03-29 | 007635       |



## Z-weight Filter Response

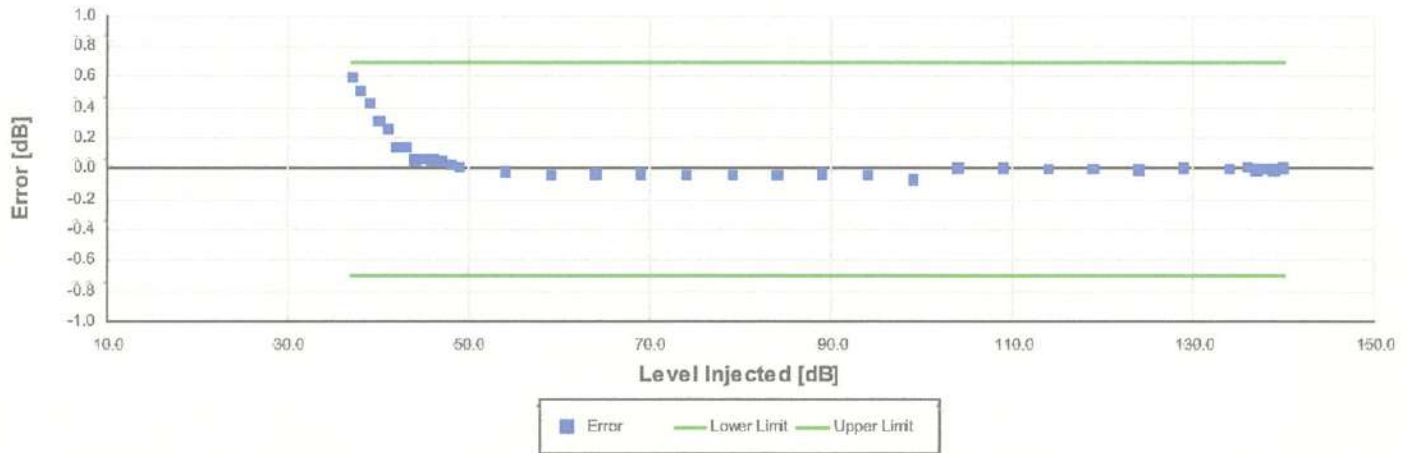


Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Deviation [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|----------------|------------------|------------------|---------------------------|--------|
| 6.31           | -0.44            | -0.44          | -1.11            | 0.33             | 0.15                      | Pass   |
| 63.10          | -0.04            | -0.04          | -0.30            | 0.30             | 0.15                      | Pass   |
| 125.89         | -0.04            | -0.04          | -0.30            | 0.30             | 0.15                      | Pass   |
| 251.19         | -0.04            | -0.04          | -0.30            | 0.30             | 0.15                      | Pass   |
| 501.19         | -0.02            | -0.02          | -0.30            | 0.30             | 0.15                      | Pass   |
| 1,000.00       | 0.00             | 0.00           | -0.30            | 0.30             | 0.15                      | Pass   |
| 1,995.26       | -0.02            | -0.02          | -0.30            | 0.30             | 0.15                      | Pass   |
| 3,981.07       | 0.00             | 0.00           | -0.30            | 0.30             | 0.15                      | Pass   |
| 7,943.28       | 0.03             | 0.03           | -0.30            | 0.30             | 0.15                      | Pass   |
| 15,848.93      | -0.09            | -0.09          | -0.42            | 0.32             | 0.15                      | Pass   |
| 19,952.62      | -0.37            | -0.37          | -0.91            | 0.41             | 0.15                      | Pass   |

— End of measurement results—

## A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

| Level [dB] | Error [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|------------|------------|------------------|------------------|---------------------------|--------|
| 37.00      | 0.60       | -0.70            | 0.70             | 0.16                      | Pass   |
| 38.00      | 0.51       | -0.70            | 0.70             | 0.16                      | Pass   |
| 39.00      | 0.43       | -0.70            | 0.70             | 0.16                      | Pass   |
| 40.00      | 0.31       | -0.70            | 0.70             | 0.16                      | Pass   |
| 41.00      | 0.26       | -0.70            | 0.70             | 0.16                      | Pass   |
| 42.00      | 0.14       | -0.70            | 0.70             | 0.16                      | Pass   |
| 43.00      | 0.14       | -0.70            | 0.70             | 0.16                      | Pass   |
| 44.00      | 0.06       | -0.70            | 0.70             | 0.17                      | Pass   |
| 45.00      | 0.07       | -0.70            | 0.70             | 0.16                      | Pass   |
| 46.00      | 0.06       | -0.70            | 0.70             | 0.16                      | Pass   |
| 47.00      | 0.05       | -0.70            | 0.70             | 0.16                      | Pass   |
| 48.00      | 0.02       | -0.70            | 0.70             | 0.16                      | Pass   |
| 49.00      | 0.01       | -0.70            | 0.70             | 0.16                      | Pass   |
| 54.00      | -0.02      | -0.70            | 0.70             | 0.16                      | Pass   |
| 59.00      | -0.04      | -0.70            | 0.70             | 0.16                      | Pass   |
| 64.00      | -0.03      | -0.70            | 0.70             | 0.16                      | Pass   |
| 69.00      | -0.03      | -0.70            | 0.70             | 0.16                      | Pass   |
| 74.00      | -0.04      | -0.70            | 0.70             | 0.16                      | Pass   |
| 79.00      | -0.04      | -0.70            | 0.70             | 0.16                      | Pass   |
| 84.00      | -0.04      | -0.70            | 0.70             | 0.16                      | Pass   |
| 89.00      | -0.03      | -0.70            | 0.70             | 0.16                      | Pass   |
| 94.00      | -0.04      | -0.70            | 0.70             | 0.16                      | Pass   |
| 99.00      | -0.07      | -0.70            | 0.70             | 0.15                      | Pass   |
| 104.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 109.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 114.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 119.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 124.00     | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 129.00     | 0.01       | -0.70            | 0.70             | 0.15                      | Pass   |
| 134.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 136.00     | 0.01       | -0.70            | 0.70             | 0.15                      | Pass   |
| 137.00     | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 138.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 139.00     | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 140.00     | 0.01       | -0.70            | 0.70             | 0.15                      | Pass   |

— End of measurement results—

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## Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

| Amplitude [dB] | Duration [μs] |                | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|---------------|----------------|------------------|------------------|------------------|---------------------------|--------|
| 137.85         | 40            | Negative Pulse | 134.70           | 133.26           | 135.26           | 0.15                      | Pass   |
|                |               | Positive Pulse | 134.70           | 133.25           | 135.25           | 0.15                      | Pass   |
|                | 30            | Negative Pulse | 133.75           | 133.26           | 135.26           | 0.15                      | Pass   |
|                |               | Positive Pulse | 133.71           | 133.25           | 135.25           | 0.15                      | Pass   |

-- End of measurement results--

## Positive Pulse Crest Factor

## 200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|----------------|--------------|------------------|-------------|---------------------------|--------|
| 136.85         | 3            | OVLD             | ± 0.50      | 0.15 ±                    | Pass   |
|                | 5            | OVLD             | ± 1.00      | 0.15 ±                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ±                    | Pass   |
| 126.85         | 3            | -0.14            | ± 0.50      | 0.15 ±                    | Pass   |
|                | 5            | -0.12            | ± 1.00      | 0.16 ±                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ±                    | Pass   |
| 116.85         | 3            | -0.14            | ± 0.50      | 0.15 ±                    | Pass   |
|                | 5            | -0.13            | ± 1.00      | 0.15 ±                    | Pass   |
|                | 10           | -0.18            | ± 1.50      | 0.15 ±                    | Pass   |
| 106.85         | 3            | -0.14            | ± 0.50      | 0.15 ±                    | Pass   |
|                | 5            | -0.13            | ± 1.00      | 0.15 ±                    | Pass   |
|                | 10           | -0.07            | ± 1.50      | 0.15 ±                    | Pass   |

-- End of measurement results--

## Negative Pulse Crest Factor

## 200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|----------------|--------------|------------------|-------------|---------------------------|--------|
| 136.85         | 3            | OVLD             | ± 0.50      | 0.15 ±                    | Pass   |
|                | 5            | OVLD             | ± 1.00      | 0.15 ±                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ±                    | Pass   |
| 126.85         | 3            | -0.12            | ± 0.50      | 0.15 ±                    | Pass   |
|                | 5            | -0.12            | ± 1.00      | 0.15 ±                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ±                    | Pass   |
| 116.85         | 3            | -0.14            | ± 0.50      | 0.15 ±                    | Pass   |
|                | 5            | -0.11            | ± 1.00      | 0.15 ±                    | Pass   |
|                | 10           | -0.17            | ± 1.50      | 0.15 ±                    | Pass   |
| 106.85         | 3            | -0.13            | ± 0.50      | 0.15 ±                    | Pass   |
|                | 5            | -0.12            | ± 1.00      | 0.15 ±                    | Pass   |
|                | 10           | -0.07            | ± 1.50      | 0.15 ±                    | Pass   |

-- End of measurement results--



**Gain**

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

| Measurement          | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------------|------------------|------------------|------------------|---------------------------|--------|
| 0 dB Gain            | 93.96            | 93.90            | 94.10            | 0.15                      | Pass   |
| 0 dB Gain, Linearity | 41.13            | 40.30            | 41.70            | 0.16                      | Pass   |
| OBA Low Range        | 94.00            | 93.90            | 94.10            | 0.15                      | Pass   |
| OBA Normal Range     | 94.00            | 93.20            | 94.80            | 0.15                      | Pass   |

-- End of measurement results--

**Broadband Noise Floor**

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

| Measurement          | Test Result [dB] | Upper limit [dB] | Result |
|----------------------|------------------|------------------|--------|
| A-weight Noise Floor | 27.07            | 36.00            | Pass   |
| C-weight Noise Floor | 26.76            | 35.00            | Pass   |
| Z-weight Noise Floor | 32.72            | 39.00            | Pass   |

-- End of measurement results--

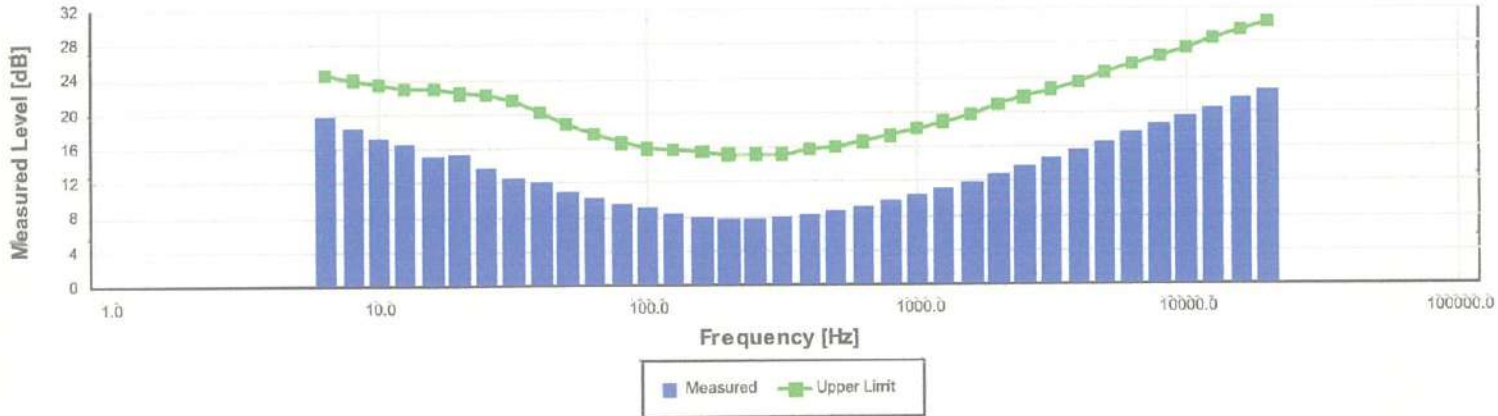
**Total Harmonic Distortion**

Measured using 1/3-Octave filters

| Measurement  | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|--------------|------------------|------------------|------------------|---------------------------|--------|
| 10 Hz Signal | 135.30           | 135.05           | 136.65           | 0.15                      | Pass   |
| THD          | -66.99           |                  | -58.00           | 0.00 ‡                    | Pass   |
| THD+N        | -62.96           |                  | -58.00           | 0.00 ‡                    | Pass   |

-- End of measurement results--

## 1/3-Octave Self-Generated Noise



The SLM is set to low range.

| Frequency [Hz] | Test Result [dB] | Upper limit [dB] | Result |
|----------------|------------------|------------------|--------|
| 6.30           | 19.71            | 24.60            | Pass   |
| 8.00           | 18.39            | 24.00            | Pass   |
| 10.00          | 17.27            | 23.50            | Pass   |
| 12.50          | 16.38            | 23.00            | Pass   |
| 16.00          | 15.17            | 22.90            | Pass   |
| 20.00          | 15.37            | 22.40            | Pass   |
| 25.00          | 13.75            | 22.30            | Pass   |
| 31.50          | 12.63            | 21.50            | Pass   |
| 40.00          | 12.07            | 20.20            | Pass   |
| 50.00          | 10.80            | 18.80            | Pass   |
| 63.00          | 10.30            | 17.60            | Pass   |
| 80.00          | 9.46             | 16.60            | Pass   |
| 100.00         | 8.97             | 15.90            | Pass   |
| 125.00         | 8.47             | 15.70            | Pass   |
| 160.00         | 7.89             | 15.50            | Pass   |
| 200.00         | 7.72             | 15.20            | Pass   |
| 250.00         | 7.61             | 15.20            | Pass   |
| 315.00         | 7.89             | 15.20            | Pass   |
| 400.00         | 8.05             | 15.70            | Pass   |
| 500.00         | 8.56             | 16.00            | Pass   |
| 630.00         | 9.04             | 16.60            | Pass   |
| 800.00         | 9.65             | 17.30            | Pass   |
| 1,000.00       | 10.40            | 18.10            | Pass   |
| 1,250.00       | 11.21            | 18.90            | Pass   |
| 1,600.00       | 11.94            | 19.80            | Pass   |
| 2,000.00       | 12.87            | 20.80            | Pass   |
| 2,500.00       | 13.75            | 21.70            | Pass   |
| 3,150.00       | 14.69            | 22.60            | Pass   |
| 4,000.00       | 15.58            | 23.50            | Pass   |
| 5,000.00       | 16.56            | 24.50            | Pass   |
| 6,300.00       | 17.54            | 25.50            | Pass   |
| 8,000.00       | 18.55            | 26.50            | Pass   |
| 10,000.00      | 19.51            | 27.40            | Pass   |
| 12,500.00      | 20.51            | 28.50            | Pass   |
| 16,000.00      | 21.47            | 29.50            | Pass   |
| 20,000.00      | 22.48            | 30.40            | Pass   |

-- End of measurement results--

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เอกสารไม่ควบคุม

-- End of Report--

Signatory: Jacob Cannon

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Provo, UT 84601, United States  
716-684-0001

2023-3-23T13:44:36





# Calibration Certificate

Certificate Number 2023003659

**Customer:**

United Analyst and Engineering Consultant Co Ltd  
No. 81 Soi Udonsuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong,  
Bangkok, 10260, Thailand

**Model Number** LxT1  
**Serial Number** 0007302  
**Test Results** Pass  
**Initial Condition** As Manufactured  
**Description** SoundTrack LxT Class 1  
Class 1 Sound Level Meter  
Firmware Revision: 2.404

**Procedure Number** D0001.8384  
**Technician** Jacob Cannon  
**Calibration Date** 23 Mar 2023  
**Calibration Due**  
**Temperature** 23.49 °C ± 0.25 °C  
**Humidity** 49.6 %RH ± 2.0 %RH  
**Static Pressure** 86.01 kPa ± 0.13 kPa

**Evaluation Method** **Tested with:** **Data reported in dB re 20 µPa.**  
PCB 377B02, S/N 344896  
Larson Davis PRMLxT1, S/N 077637  
Larson Davis CAL291, S/N 0108  
Larson Davis CAL200, S/N 9079

**Compliance Standards** Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

|                        |                            |
|------------------------|----------------------------|
| IEC 60651:2001 Type 1  | ANSI S1.4-2014 Class 1     |
| IEC 60804:2000 Type 1  | ANSI S1.4 (R2006) Type 1   |
| IEC 61252:2002         | ANSI S1.11 (R2009) Class 1 |
| IEC 61260:2001 Class 1 | ANSI S1.25 (R2007)         |
| IEC 61672:2013 Class 1 | ANSI S1.43 (R2007) Type 1  |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

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**Certificate Number 2023003659**

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014/Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1; the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

**Standards Used**

| Description  | Cal Date   | Cal Due    | Cal Standard |
|--|------------|------------|--------------|
| Larson Davis CAL291 Residual Intensity Calibrator    | 2022-09-09 | 2023-09-09 | 001250       |
| Hart Scientific 2626-H Temperature Probe             | 2021-08-25 | 2023-05-25 | 006798       |
| Larson Davis CAL200 Acoustic Calibrator              | 2022-07-21 | 2023-07-21 | 007027       |
| Larson Davis Model 831                               | 2023-02-22 | 2024-02-22 | 007182       |
| PCB 377A13 1/2 inch Prepolarized Pressure Microphone | 2023-03-06 | 2024-03-06 | 007185       |
| SRS DS360 Ultra Low Distortion Generator             | 2022-03-29 | 2023-03-29 | 007635       |
| Larson Davis 1/2" Preamplifier for Model 831 Type I  | 2022-09-28 | 2023-09-28 | PCB0004783   |

**Acoustic Calibration**

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

| Measurement | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|-------------|------------------|------------------|------------------|---------------------------|--------|
| 1000 Hz     | 114.01           | 113.80           | 114.20           | 0.14                      | Pass   |

**Loaded Circuit Sensitivity**

| Measurement | Test Result [dB re 1 V / Pa] | Lower Limit [dB re 1 V / Pa] | Upper Limit [dB re 1 V / Pa] | Expanded Uncertainty [dB] | Result |
|-------------|------------------------------|------------------------------|------------------------------|---------------------------|--------|
| 1000 Hz     | -50.14                       | -52.44                       | -48.33                       | 0.14                      | Pass   |

-- End of measurement results--

**Acoustic Signal Tests, C-weighting**

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Expected [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|---------------|------------------|------------------|---------------------------|--------|
| 125            | -0.24            | -0.20         | -1.20            | 0.80             | 0.23                      | Pass   |
| 1000           | 0.15             | 0.00          | -0.70            | 0.70             | 0.23                      | Pass   |
| 8000           | -2.72            | -3.00         | -5.50            | -1.50            | 0.32                      | Pass   |

-- End of measurement results--

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Certificate Number 2023003659

## Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

| Measurement | Test Result [dB] |
|-------------|------------------|
|-------------|------------------|

|            |       |
|------------|-------|
| A-weighted | 40.88 |
|------------|-------|

-- End of measurement results--

-- End of Report--

Signatory: Jacob Cannon

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D0001.8406 Rev G

เอกสารไม่ควบคุม



# Calibration Certificate

Certificate Number 2023003635

**Customer:**

United Analyst and Engineering Consultant Co Ltd  
No. 81 Soi Udonsuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong,  
Bangkok, 10260, Thailand

**Model Number** LxT1  
**Serial Number** 0007302  
**Test Results** Pass

**Initial Condition** As Manufactured

**Description** SoundTrack LxT Class 1  
Class 1 Sound Level Meter  
Firmware Revision: 2.404

**Procedure Number** D0001.8378  
**Technician** Jacob Cannon  
**Calibration Date** 23 Mar 2023  
**Calibration Due**  
**Temperature** 23.62 °C ± 0.25 °C  
**Humidity** 50.3 %RH ± 2.0 %RH  
**Static Pressure** 86.12 kPa ± 0.13 kPa

**Evaluation Method** Tested electrically using Larson Davis PRMLxT1 S/N 077637 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

**Compliance Standards** Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

|                        |                            |
|------------------------|----------------------------|
| IEC 60651:2001 Type 1  | ANSI S1.4-2014 Class 1     |
| IEC 60804:2000 Type 1  | ANSI S1.4 (R2006) Type 1   |
| IEC 61252:2002         | ANSI S1.25 (R2007)         |
| IEC 61672:2013 Class 1 | ANSI S1.43 (R2007) Type 1  |
| IEC 61260:2001 Class 1 | ANSI S1.11 (R2009) Class 1 |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

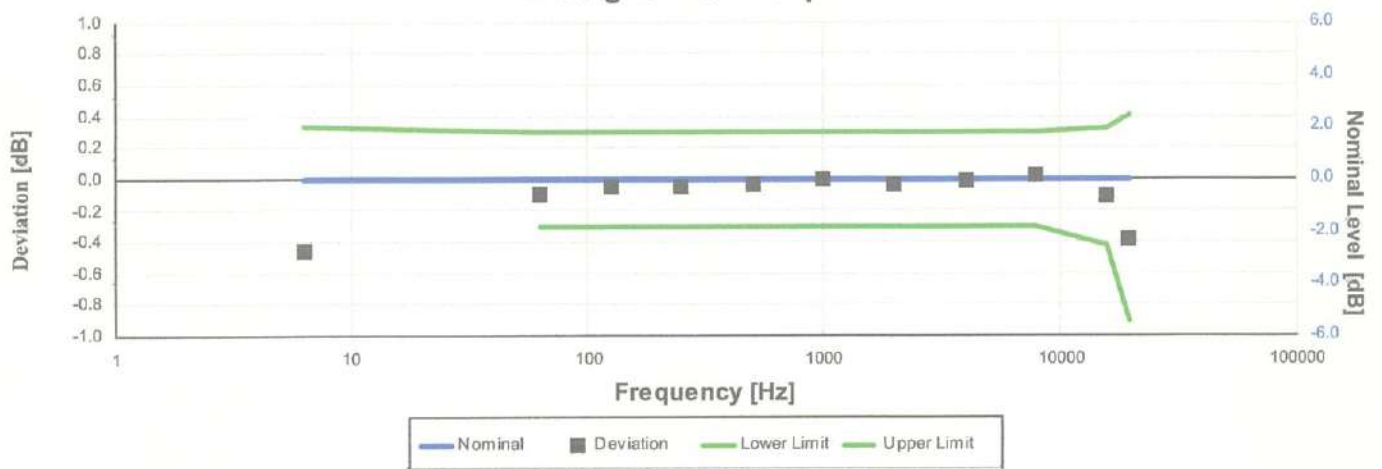
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| Description                              | Standards Used |            |              |
|--|----------------|------------|--------------|
|  | Cal Date       | Cal Due    | Cal Standard |
| Hart Scientific 2626-H Temperature Probe | 2021-08-25     | 2023-05-25 | 006798       |
| SRS DS360 Ultra Low Distortion Generator | 2022-09-02     | 2023-09-02 | 007167       |

## Z-weight Filter Response



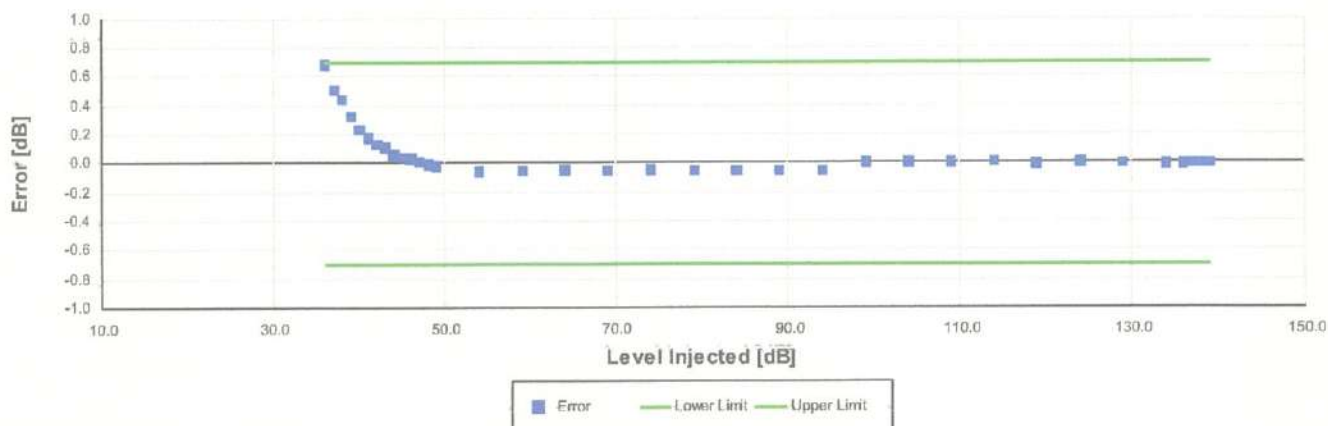
Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Deviation [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|----------------|------------------|------------------|---------------------------|--------|
| 6.31           | -0.45            | -0.45          | -1.11            | 0.33             | 0.15                      | Pass   |
| 63.10          | -0.09            | -0.09          | -0.30            | 0.30             | 0.15                      | Pass   |
| 125.89         | -0.05            | -0.05          | -0.30            | 0.30             | 0.15                      | Pass   |
| 251.19         | -0.05            | -0.05          | -0.30            | 0.30             | 0.15                      | Pass   |
| 501.19         | -0.04            | -0.04          | -0.30            | 0.30             | 0.15                      | Pass   |
| 1,000.00       | 0.00             | 0.00           | -0.30            | 0.30             | 0.15                      | Pass   |
| 1,995.26       | -0.04            | -0.04          | -0.30            | 0.30             | 0.15                      | Pass   |
| 3,981.07       | -0.02            | -0.02          | -0.30            | 0.30             | 0.15                      | Pass   |
| 7,943.28       | 0.02             | 0.02           | -0.30            | 0.30             | 0.15                      | Pass   |
| 15,848.93      | -0.11            | -0.11          | -0.42            | 0.32             | 0.15                      | Pass   |
| 19,952.62      | -0.39            | -0.39          | -0.91            | 0.41             | 0.15                      | Pass   |

— End of measurement results—



## A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

| Level [dB] | Error [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|------------|------------|------------------|------------------|---------------------------|--------|
| 36.00      | 0.69       | -0.70            | 0.70             | 0.16                      | Pass   |
| 37.00      | 0.51       | -0.70            | 0.70             | 0.16                      | Pass   |
| 38.00      | 0.45       | -0.70            | 0.70             | 0.16                      | Pass   |
| 39.00      | 0.33       | -0.70            | 0.70             | 0.16                      | Pass   |
| 40.00      | 0.23       | -0.70            | 0.70             | 0.16                      | Pass   |
| 41.00      | 0.18       | -0.70            | 0.70             | 0.16                      | Pass   |
| 42.00      | 0.13       | -0.70            | 0.70             | 0.16                      | Pass   |
| 43.00      | 0.11       | -0.70            | 0.70             | 0.17                      | Pass   |
| 44.00      | 0.06       | -0.70            | 0.70             | 0.17                      | Pass   |
| 45.00      | 0.04       | -0.70            | 0.70             | 0.16                      | Pass   |
| 46.00      | 0.03       | -0.70            | 0.70             | 0.16                      | Pass   |
| 47.00      | 0.02       | -0.70            | 0.70             | 0.16                      | Pass   |
| 48.00      | -0.01      | -0.70            | 0.70             | 0.16                      | Pass   |
| 49.00      | -0.02      | -0.70            | 0.70             | 0.16                      | Pass   |
| 54.00      | -0.06      | -0.70            | 0.70             | 0.16                      | Pass   |
| 59.00      | -0.05      | -0.70            | 0.70             | 0.16                      | Pass   |
| 64.00      | -0.05      | -0.70            | 0.70             | 0.16                      | Pass   |
| 69.00      | -0.05      | -0.70            | 0.70             | 0.16                      | Pass   |
| 74.00      | -0.05      | -0.70            | 0.70             | 0.16                      | Pass   |
| 79.00      | -0.06      | -0.70            | 0.70             | 0.16                      | Pass   |
| 84.00      | -0.05      | -0.70            | 0.70             | 0.16                      | Pass   |
| 89.00      | -0.05      | -0.70            | 0.70             | 0.16                      | Pass   |
| 94.00      | -0.05      | -0.70            | 0.70             | 0.16                      | Pass   |
| 99.00      | 0.01       | -0.70            | 0.70             | 0.15                      | Pass   |
| 104.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 109.00     | 0.01       | -0.70            | 0.70             | 0.15                      | Pass   |
| 114.00     | 0.01       | -0.70            | 0.70             | 0.15                      | Pass   |
| 119.00     | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 124.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 129.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 134.00     | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 136.00     | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 137.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 138.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 139.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |

-- End of measurement results--

## Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

| Amplitude [dB] | Duration [μs] |                | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|---------------|----------------|------------------|------------------|------------------|---------------------------|--------|
| 137.85         | 40            | Negative Pulse | 135.39           | 133.91           | 135.91           | 0.15                      | Pass   |
|                |               | Positive Pulse | 135.36           | 133.88           | 135.88           | 0.15                      | Pass   |
|                | 30            | Negative Pulse | 134.11           | 133.91           | 135.91           | 0.15                      | Pass   |
|                |               | Positive Pulse | 134.04           | 133.88           | 135.88           | 0.15                      | Pass   |

-- End of measurement results--

## Positive Pulse Crest Factor

## 200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|----------------|--------------|------------------|-------------|---------------------------|--------|
| 136.85         | 3            | OVLD             | ± 0.50      | 0.15 ±                    | Pass   |
|                | 5            | OVLD             | ± 1.00      | 0.15 ±                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ±                    | Pass   |
| 126.85         | 3            | -0.13            | ± 0.50      | 0.15 ±                    | Pass   |
|                | 5            | -0.13            | ± 1.00      | 0.16 ±                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ±                    | Pass   |
| 116.85         | 3            | -0.12            | ± 0.50      | 0.15 ±                    | Pass   |
|                | 5            | -0.13            | ± 1.00      | 0.15 ±                    | Pass   |
|                | 10           | -0.25            | ± 1.50      | 0.15 ±                    | Pass   |
| 106.85         | 3            | -0.13            | ± 0.50      | 0.15 ±                    | Pass   |
|                | 5            | -0.13            | ± 1.00      | 0.15 ±                    | Pass   |
|                | 10           | -0.22            | ± 1.50      | 0.15 ±                    | Pass   |

-- End of measurement results--

## Negative Pulse Crest Factor

## 200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|----------------|--------------|------------------|-------------|---------------------------|--------|
| 136.85         | 3            | OVLD             | ± 0.50      | 0.15 ±                    | Pass   |
|                | 5            | OVLD             | ± 1.00      | 0.15 ±                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ±                    | Pass   |
| 126.85         | 3            | -0.10            | ± 0.50      | 0.15 ±                    | Pass   |
|                | 5            | -0.10            | ± 1.00      | 0.15 ±                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ±                    | Pass   |
| 116.85         | 3            | -0.11            | ± 0.50      | 0.15 ±                    | Pass   |
|                | 5            | -0.10            | ± 1.00      | 0.15 ±                    | Pass   |
|                | 10           | -0.23            | ± 1.50      | 0.15 ±                    | Pass   |
| 106.85         | 3            | -0.11            | ± 0.50      | 0.15 ±                    | Pass   |
|                | 5            | -0.11            | ± 1.00      | 0.15 ±                    | Pass   |
|                | 10           | -0.16            | ± 1.50      | 0.15 ±                    | Pass   |

-- End of measurement results--

**Gain**

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

| Measurement          | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------------|------------------|------------------|------------------|---------------------------|--------|
| 0 dB Gain            | 93.95            | 93.90            | 94.10            | 0.15                      | Pass   |
| 0 dB Gain, Linearity | 41.17            | 40.30            | 41.70            | 0.16                      | Pass   |
| OBA Low Range        | 94.00            | 93.90            | 94.10            | 0.15                      | Pass   |
| OBA Normal Range     | 94.00            | 93.20            | 94.80            | 0.15                      | Pass   |

-- End of measurement results--

**Broadband Noise Floor**

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

| Measurement          | Test Result [dB] | Upper limit [dB] | Result |
|----------------------|------------------|------------------|--------|
| A-weight Noise Floor | 27.13            | 36.00            | Pass   |
| C-weight Noise Floor | 26.92            | 35.00            | Pass   |
| Z-weight Noise Floor | 33.10            | 39.00            | Pass   |

-- End of measurement results--

**Total Harmonic Distortion**

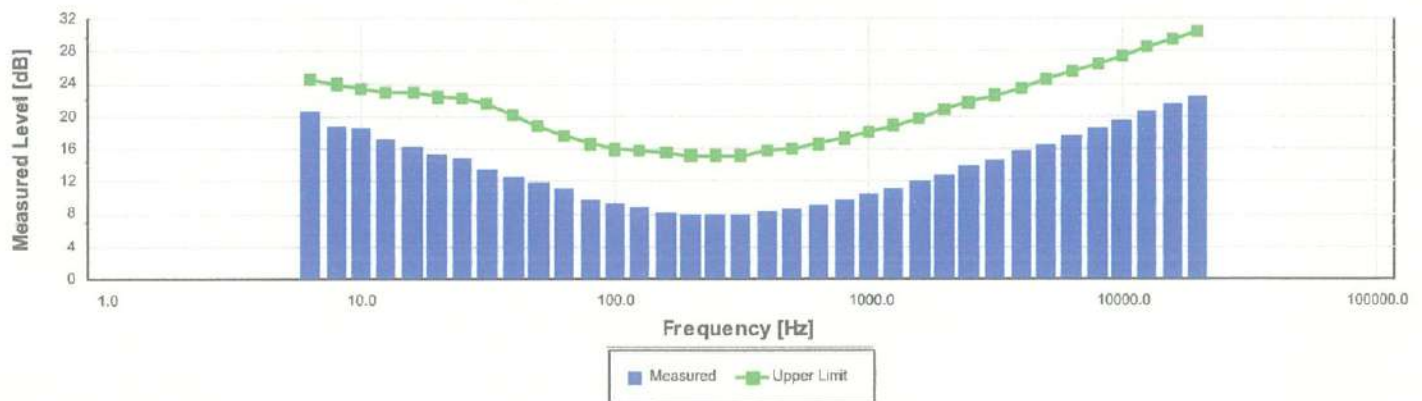
Measured using 1/3-Octave filters

| Measurement  | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|--------------|------------------|------------------|------------------|---------------------------|--------|
| 10 Hz Signal | 135.91           | 135.05           | 136.65           | 0.15                      | Pass   |
| THD          | -66.52           |                  | -58.00           | 0.01 ‡                    | Pass   |
| THD+N        | -62.48           |                  | -58.00           | 0.01 ‡                    | Pass   |

-- End of measurement results--



## 1/3-Octave Self-Generated Noise



The SLM is set to low range.

| Frequency [Hz] | Test Result [dB] | Upper limit [dB] | Result |
|----------------|------------------|------------------|--------|
| 6.30           | 20.62            | 24.60            | Pass   |
| 8.00           | 18.88            | 24.00            | Pass   |
| 10.00          | 18.67            | 23.50            | Pass   |
| 12.50          | 17.18            | 23.00            | Pass   |
| 16.00          | 16.16            | 22.90            | Pass   |
| 20.00          | 15.32            | 22.40            | Pass   |
| 25.00          | 14.76            | 22.30            | Pass   |
| 31.50          | 13.47            | 21.50            | Pass   |
| 40.00          | 12.44            | 20.20            | Pass   |
| 50.00          | 11.87            | 18.80            | Pass   |
| 63.00          | 11.05            | 17.60            | Pass   |
| 80.00          | 9.80             | 16.60            | Pass   |
| 100.00         | 9.37             | 15.90            | Pass   |
| 125.00         | 8.84             | 15.70            | Pass   |
| 160.00         | 8.20             | 15.50            | Pass   |
| 200.00         | 7.91             | 15.20            | Pass   |
| 250.00         | 7.88             | 15.20            | Pass   |
| 315.00         | 7.97             | 15.20            | Pass   |
| 400.00         | 8.31             | 15.70            | Pass   |
| 500.00         | 8.70             | 16.00            | Pass   |
| 630.00         | 9.13             | 16.60            | Pass   |
| 800.00         | 9.77             | 17.30            | Pass   |
| 1,000.00       | 10.47            | 18.10            | Pass   |
| 1,250.00       | 11.13            | 18.90            | Pass   |
| 1,600.00       | 11.99            | 19.80            | Pass   |
| 2,000.00       | 12.85            | 20.80            | Pass   |
| 2,500.00       | 13.82            | 21.70            | Pass   |
| 3,150.00       | 14.73            | 22.60            | Pass   |
| 4,000.00       | 15.68            | 23.50            | Pass   |
| 5,000.00       | 16.59            | 24.50            | Pass   |
| 6,300.00       | 17.58            | 25.50            | Pass   |
| 8,000.00       | 18.61            | 26.50            | Pass   |
| 10,000.00      | 19.55            | 27.40            | Pass   |
| 12,500.00      | 20.58            | 28.50            | Pass   |
| 16,000.00      | 21.55            | 29.50            | Pass   |
| 20,000.00      | 22.54            | 30.40            | Pass   |

-- End of measurement results--

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-- End of Report--

Signatory: Jacob Cannon

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# Calibration Certificate

Certificate Number 2023003660

**Customer:**

United Analyst and Engineering Consultant Co Ltd  
No. 81 Soi Udonsuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong,  
Bangkok, 10260, Thailand

**Model Number** LxT1  
**Serial Number** 0007303  
**Test Results** **Pass**  
**Initial Condition** As Manufactured  
**Description** SoundTrack LxT Class 1  
Class 1 Sound Level Meter  
Firmware Revision: 2.404

**Procedure Number** D0001.8384  
**Technician** Jacob Cannon  
**Calibration Date** 23 Mar 2023  
**Calibration Due**  
**Temperature** 23.58 °C ± 0.25 °C  
**Humidity** 49.4 %RH ± 2.0 %RH  
**Static Pressure** 86 kPa ± 0.13 kPa

**Evaluation Method** **Tested with:** **Data reported in dB re 20 µPa.**  
Larson Davis PRMLxT1. S/N 077638  
PCB 377B02. S/N 345232  
Larson Davis CAL291. S/N 0108  
Larson Davis CAL200. S/N 9079

**Compliance Standards** Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

|                        |                            |
|------------------------|----------------------------|
| IEC 60651:2001 Type 1  | ANSI S1.4-2014 Class 1     |
| IEC 60804:2000 Type 1  | ANSI S1.4 (R2006) Type 1   |
| IEC 61252:2002         | ANSI S1.11 (R2009) Class 1 |
| IEC 61260:2001 Class 1 | ANSI S1.25 (R2007)         |
| IEC 61672:2013 Class 1 | ANSI S1.43 (R2007) Type 1  |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

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**Certificate Number 2023003660**

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014/Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1; the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

**Standards Used**

| Description  | Cal Date   | Cal Due    | Cal Standard |
|--|------------|------------|--------------|
| Larson Davis CAL291 Residual Intensity Calibrator    | 2022-09-09 | 2023-09-09 | 001250       |
| Hart Scientific 2626-H Temperature Probe             | 2021-08-25 | 2023-05-25 | 006798       |
| Larson Davis CAL200 Acoustic Calibrator              | 2022-07-21 | 2023-07-21 | 007027       |
| Larson Davis Model 831                               | 2023-02-22 | 2024-02-22 | 007182       |
| PCB 377A13 1/2 inch Prepolarized Pressure Microphone | 2023-03-06 | 2024-03-06 | 007185       |
| SRS DS360 Ultra Low Distortion Generator             | 2022-03-29 | 2023-03-29 | 007635       |
| Larson Davis 1/2" Preamplifier for Model 831 Type 1  | 2022-09-28 | 2023-09-28 | PCB0004783   |

**Acoustic Calibration**

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

| Measurement | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|-------------|------------------|------------------|------------------|---------------------------|--------|
| 1000 Hz     | 114.01           | 113.80           | 114.20           | 0.14                      | Pass   |

**Loaded Circuit Sensitivity**

| Measurement | Test Result [dB re 1 V / Pa] | Lower Limit [dB re 1 V / Pa] | Upper Limit [dB re 1 V / Pa] | Expanded Uncertainty [dB] | Result |
|-------------|------------------------------|------------------------------|------------------------------|---------------------------|--------|
| 1000 Hz     | -49.56                       | -52.44                       | -48.33                       | 0.14                      | Pass   |

-- End of measurement results--

**Acoustic Signal Tests, C-weighting**

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Expected [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|---------------|------------------|------------------|---------------------------|--------|
| 125            | -0.23            | -0.20         | -1.20            | 0.80             | 0.23                      | Pass   |
| 1000           | 0.17             | 0.00          | -0.70            | 0.70             | 0.23                      | Pass   |
| 8000           | -3.19            | -3.00         | -5.50            | -1.50            | 0.32                      | Pass   |

-- End of measurement results--

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## Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

| Measurement | Test Result [dB] |
|-------------|------------------|
|-------------|------------------|

|            |       |
|------------|-------|
| A-weighted | 42.55 |
|------------|-------|

-- End of measurement results--

-- End of Report--

Signatory: Jacob Cannon

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D0001.8406 Rev G

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# Calibration Certificate

Certificate Number 2023003636

**Customer:**

United Analyst and Engineering Consultant Co Ltd  
No. 81 Soi Udonsuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong,  
Bangkok, 10260, Thailand

**Model Number** LxT1  
**Serial Number** 0007303  
**Test Results** Pass

**Initial Condition** As Manufactured

**Description** SoundTrack LxT Class 1  
Class 1 Sound Level Meter  
Firmware Revision: 2.404

**Procedure Number** D0001.8378  
**Technician** Jacob Cannon  
**Calibration Date** 23 Mar 2023  
**Calibration Due**  
**Temperature** 23.66 °C ± 0.25 °C  
**Humidity** 50.2 %RH ± 2.0 %RH  
**Static Pressure** 86.12 kPa ± 0.13 kPa

**Evaluation Method** Tested electrically using Larson Davis PRMLxT1 S/N 077638 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

**Compliance Standards** Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

|                        |                            |
|------------------------|----------------------------|
| IEC 60651:2001 Type 1  | ANSI S1.4-2014 Class 1     |
| IEC 60804:2000 Type 1  | ANSI S1.4 (R2006) Type 1   |
| IEC 61252:2002         | ANSI S1.25 (R2007)         |
| IEC 61672:2013 Class 1 | ANSI S1.43 (R2007) Type 1  |
| IEC 61260:2001 Class 1 | ANSI S1.11 (R2009) Class 1 |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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D0001.8407 Rev G

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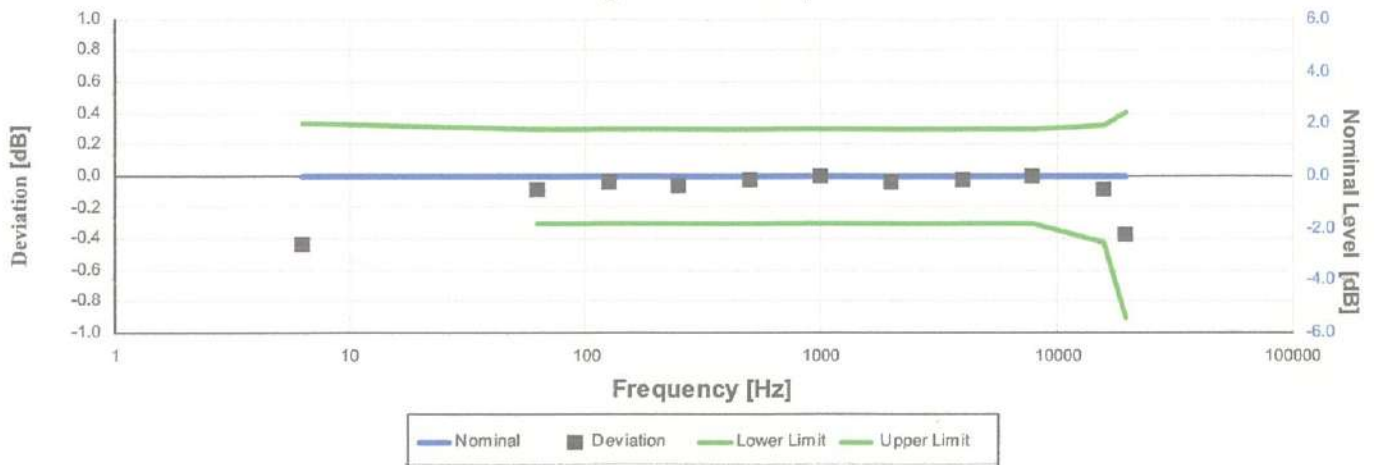
| Description                              | Standards Used |            |              |
|--|----------------|------------|--------------|
|  | Cal Date       | Cal Due    | Cal Standard |
| Hart Scientific 2626-H Temperature Probe | 2021-08-25     | 2023-05-25 | 006798       |
| SRS DS360 Ultra Low Distortion Generator | 2022-12-29     | 2023-12-29 | 007118       |

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## Z-weight Filter Response

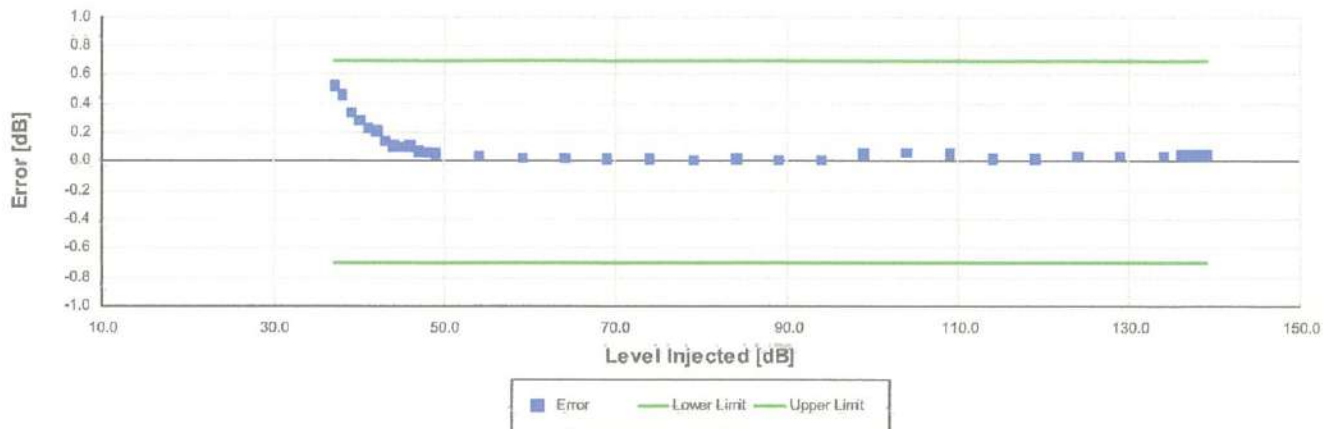


Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Deviation [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|----------------|------------------|------------------|---------------------------|--------|
| 6.31           | -0.43            | -0.43          | -1.11            | 0.33             | 0.15                      | Pass   |
| 63.10          | -0.08            | -0.08          | -0.30            | 0.30             | 0.15                      | Pass   |
| 125.89         | -0.04            | -0.04          | -0.30            | 0.30             | 0.15                      | Pass   |
| 251.19         | -0.06            | -0.06          | -0.30            | 0.30             | 0.15                      | Pass   |
| 501.19         | -0.03            | -0.03          | -0.30            | 0.30             | 0.15                      | Pass   |
| 1,000.00       | 0.00             | 0.00           | -0.30            | 0.30             | 0.15                      | Pass   |
| 1,995.26       | -0.03            | -0.03          | -0.30            | 0.30             | 0.15                      | Pass   |
| 3,981.07       | -0.02            | -0.02          | -0.30            | 0.30             | 0.15                      | Pass   |
| 7,943.28       | 0.00             | 0.00           | -0.30            | 0.30             | 0.15                      | Pass   |
| 15,848.93      | -0.08            | -0.08          | -0.42            | 0.32             | 0.15                      | Pass   |
| 19,952.62      | -0.37            | -0.37          | -0.91            | 0.41             | 0.15                      | Pass   |

-- End of measurement results--

## A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

| Level [dB] | Error [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|------------|------------|------------------|------------------|---------------------------|--------|
| 37.00      | 0.53       | -0.70            | 0.70             | 0.16                      | Pass   |
| 38.00      | 0.46       | -0.70            | 0.70             | 0.16                      | Pass   |
| 39.00      | 0.33       | -0.70            | 0.70             | 0.16                      | Pass   |
| 40.00      | 0.29       | -0.70            | 0.70             | 0.16                      | Pass   |
| 41.00      | 0.23       | -0.70            | 0.70             | 0.16                      | Pass   |
| 42.00      | 0.22       | -0.70            | 0.70             | 0.16                      | Pass   |
| 43.00      | 0.15       | -0.70            | 0.70             | 0.17                      | Pass   |
| 44.00      | 0.11       | -0.70            | 0.70             | 0.17                      | Pass   |
| 45.00      | 0.10       | -0.70            | 0.70             | 0.16                      | Pass   |
| 46.00      | 0.11       | -0.70            | 0.70             | 0.16                      | Pass   |
| 47.00      | 0.07       | -0.70            | 0.70             | 0.16                      | Pass   |
| 48.00      | 0.06       | -0.70            | 0.70             | 0.16                      | Pass   |
| 49.00      | 0.06       | -0.70            | 0.70             | 0.16                      | Pass   |
| 54.00      | 0.04       | -0.70            | 0.70             | 0.16                      | Pass   |
| 59.00      | 0.02       | -0.70            | 0.70             | 0.16                      | Pass   |
| 64.00      | 0.02       | -0.70            | 0.70             | 0.16                      | Pass   |
| 69.00      | 0.02       | -0.70            | 0.70             | 0.16                      | Pass   |
| 74.00      | 0.02       | -0.70            | 0.70             | 0.16                      | Pass   |
| 79.00      | 0.01       | -0.70            | 0.70             | 0.16                      | Pass   |
| 84.00      | 0.02       | -0.70            | 0.70             | 0.16                      | Pass   |
| 89.00      | 0.01       | -0.70            | 0.70             | 0.16                      | Pass   |
| 94.00      | 0.01       | -0.70            | 0.70             | 0.16                      | Pass   |
| 99.00      | 0.06       | -0.70            | 0.70             | 0.15                      | Pass   |
| 104.00     | 0.06       | -0.70            | 0.70             | 0.15                      | Pass   |
| 109.00     | 0.06       | -0.70            | 0.70             | 0.15                      | Pass   |
| 114.00     | 0.02       | -0.70            | 0.70             | 0.15                      | Pass   |
| 119.00     | 0.02       | -0.70            | 0.70             | 0.15                      | Pass   |
| 124.00     | 0.04       | -0.70            | 0.70             | 0.15                      | Pass   |
| 129.00     | 0.04       | -0.70            | 0.70             | 0.15                      | Pass   |
| 134.00     | 0.04       | -0.70            | 0.70             | 0.15                      | Pass   |
| 136.00     | 0.04       | -0.70            | 0.70             | 0.15                      | Pass   |
| 137.00     | 0.04       | -0.70            | 0.70             | 0.15                      | Pass   |
| 138.00     | 0.05       | -0.70            | 0.70             | 0.15                      | Pass   |
| 139.00     | 0.04       | -0.70            | 0.70             | 0.15                      | Pass   |

-- End of measurement results--

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## Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

| Amplitude [dB] | Duration [ $\mu$ s] |                | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|---------------------|----------------|------------------|------------------|------------------|---------------------------|--------|
| 137.85         | 40                  | Negative Pulse | 135.21           | 133.74           | 135.74           | 0.15                      | Pass   |
|                |                     | Positive Pulse | 135.21           | 133.73           | 135.73           | 0.15                      | Pass   |
|                | 30                  | Negative Pulse | 134.28           | 133.74           | 135.74           | 0.15                      | Pass   |
|                |                     | Positive Pulse | 134.23           | 133.73           | 135.73           | 0.15                      | Pass   |

-- End of measurement results--

## Positive Pulse Crest Factor

200  $\mu$ s pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|----------------|--------------|------------------|-------------|---------------------------|--------|
| 136.85         | 3            | OVLD             | $\pm 0.50$  | 0.15 $\pm$                | Pass   |
|                | 5            | OVLD             | $\pm 1.00$  | 0.15 $\pm$                | Pass   |
|                | 10           | OVLD             | $\pm 1.50$  | 0.15 $\pm$                | Pass   |
| 126.85         | 3            | -0.13            | $\pm 0.50$  | 0.15 $\pm$                | Pass   |
|                | 5            | -0.14            | $\pm 1.00$  | 0.16 $\pm$                | Pass   |
|                | 10           | OVLD             | $\pm 1.50$  | 0.15 $\pm$                | Pass   |
| 116.85         | 3            | -0.13            | $\pm 0.50$  | 0.15 $\pm$                | Pass   |
|                | 5            | -0.14            | $\pm 1.00$  | 0.15 $\pm$                | Pass   |
|                | 10           | -0.05            | $\pm 1.50$  | 0.15 $\pm$                | Pass   |
| 106.85         | 3            | -0.15            | $\pm 0.50$  | 0.15 $\pm$                | Pass   |
|                | 5            | -0.13            | $\pm 1.00$  | 0.15 $\pm$                | Pass   |
|                | 10           | -0.17            | $\pm 1.50$  | 0.15 $\pm$                | Pass   |

-- End of measurement results--

## Negative Pulse Crest Factor

200  $\mu$ s pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|----------------|--------------|------------------|-------------|---------------------------|--------|
| 136.85         | 3            | OVLD             | $\pm 0.50$  | 0.15 $\pm$                | Pass   |
|                | 5            | OVLD             | $\pm 1.00$  | 0.15 $\pm$                | Pass   |
|                | 10           | OVLD             | $\pm 1.50$  | 0.15 $\pm$                | Pass   |
| 126.85         | 3            | -0.13            | $\pm 0.50$  | 0.15 $\pm$                | Pass   |
|                | 5            | -0.13            | $\pm 1.00$  | 0.15 $\pm$                | Pass   |
|                | 10           | OVLD             | $\pm 1.50$  | 0.15 $\pm$                | Pass   |
| 116.85         | 3            | -0.14            | $\pm 0.50$  | 0.15 $\pm$                | Pass   |
|                | 5            | -0.14            | $\pm 1.00$  | 0.15 $\pm$                | Pass   |
|                | 10           | 0.00             | $\pm 1.50$  | 0.15 $\pm$                | Pass   |
| 106.85         | 3            | -0.15            | $\pm 0.50$  | 0.15 $\pm$                | Pass   |
|                | 5            | -0.14            | $\pm 1.00$  | 0.15 $\pm$                | Pass   |
|                | 10           | -0.17            | $\pm 1.50$  | 0.15 $\pm$                | Pass   |

-- End of measurement results--

**Gain**

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

| Measurement          | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------------|------------------|------------------|------------------|---------------------------|--------|
| 0 dB Gain            | 93.95            | 93.90            | 94.10            | 0.15                      | Pass   |
| 0 dB Gain, Linearity | 41.13            | 40.30            | 41.70            | 0.16                      | Pass   |
| OBA Low Range        | 94.00            | 93.90            | 94.10            | 0.15                      | Pass   |
| OBA Normal Range     | 94.00            | 93.20            | 94.80            | 0.15                      | Pass   |

-- End of measurement results--

**Broadband Noise Floor**

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

| Measurement          | Test Result [dB] | Upper limit [dB] | Result |
|----------------------|------------------|------------------|--------|
| A-weight Noise Floor | 27.01            | 36.00            | Pass   |
| C-weight Noise Floor | 26.70            | 35.00            | Pass   |
| Z-weight Noise Floor | 32.84            | 39.00            | Pass   |

-- End of measurement results--

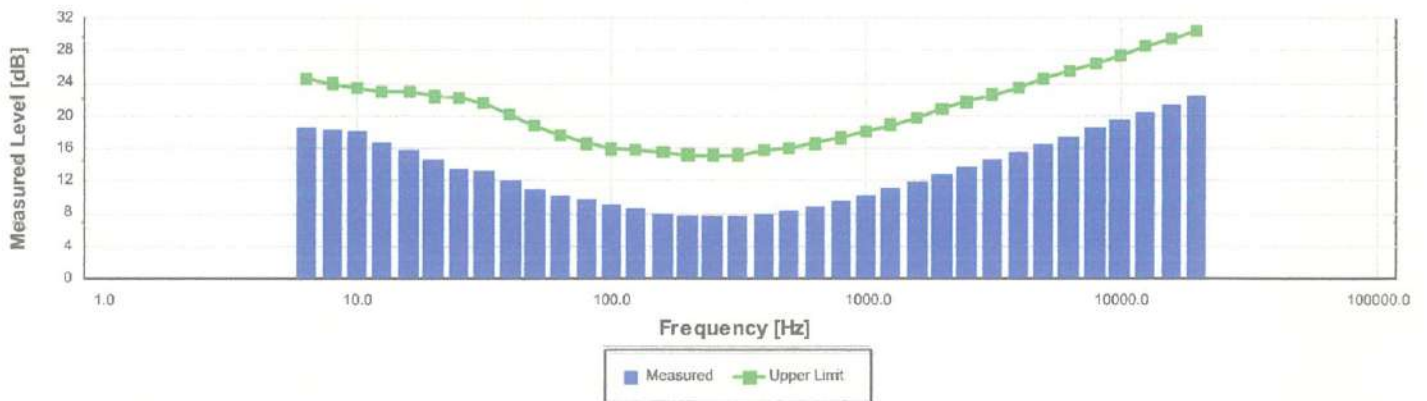
**Total Harmonic Distortion**

Measured using 1/3-Octave filters

| Measurement  | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|--------------|------------------|------------------|------------------|---------------------------|--------|
| 10 Hz Signal | 135.78           | 135.05           | 136.65           | 0.15                      | Pass   |
| THD          | -67.22           |                  | -58.00           | 0.01 ‡                    | Pass   |
| THD+N        | -62.91           |                  | -58.00           | 0.01 ‡                    | Pass   |

-- End of measurement results--

## 1/3-Octave Self-Generated Noise



The SLM is set to low range.

| Frequency [Hz] | Test Result [dB] | Upper limit [dB] | Result |
|----------------|------------------|------------------|--------|
| 6.30           | 18.55            | 24.60            | Pass   |
| 8.00           | 18.33            | 24.00            | Pass   |
| 10.00          | 18.11            | 23.50            | Pass   |
| 12.50          | 16.77            | 23.00            | Pass   |
| 16.00          | 15.74            | 22.90            | Pass   |
| 20.00          | 14.70            | 22.40            | Pass   |
| 25.00          | 13.54            | 22.30            | Pass   |
| 31.50          | 13.13            | 21.50            | Pass   |
| 40.00          | 12.18            | 20.20            | Pass   |
| 50.00          | 10.89            | 18.80            | Pass   |
| 63.00          | 10.30            | 17.60            | Pass   |
| 80.00          | 9.65             | 16.60            | Pass   |
| 100.00         | 9.08             | 15.90            | Pass   |
| 125.00         | 8.51             | 15.70            | Pass   |
| 160.00         | 7.86             | 15.50            | Pass   |
| 200.00         | 7.66             | 15.20            | Pass   |
| 250.00         | 7.66             | 15.20            | Pass   |
| 315.00         | 7.68             | 15.20            | Pass   |
| 400.00         | 7.98             | 15.70            | Pass   |
| 500.00         | 8.38             | 16.00            | Pass   |
| 630.00         | 8.87             | 16.60            | Pass   |
| 800.00         | 9.56             | 17.30            | Pass   |
| 1,000.00       | 10.29            | 18.10            | Pass   |
| 1,250.00       | 11.10            | 18.90            | Pass   |
| 1,600.00       | 11.90            | 19.80            | Pass   |
| 2,000.00       | 12.78            | 20.80            | Pass   |
| 2,500.00       | 13.70            | 21.70            | Pass   |
| 3,150.00       | 14.55            | 22.60            | Pass   |
| 4,000.00       | 15.46            | 23.50            | Pass   |
| 5,000.00       | 16.50            | 24.50            | Pass   |
| 6,300.00       | 17.50            | 25.50            | Pass   |
| 8,000.00       | 18.46            | 26.50            | Pass   |
| 10,000.00      | 19.44            | 27.40            | Pass   |
| 12,500.00      | 20.45            | 28.50            | Pass   |
| 16,000.00      | 21.46            | 29.50            | Pass   |
| 20,000.00      | 22.43            | 30.40            | Pass   |

-- End of measurement results--

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-- End of Report--

Signatory: Jacob Cannon

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# Calibration Certificate

Certificate Number 2023003664

**Customer:**

United Analyst and Engineering Consultant Co Ltd  
No. 81 Soi Udonsuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong,  
Bangkok, 10260, Thailand

**Model Number** LxT1  
**Serial Number** 0007306  
**Test Results** Pass  
**Initial Condition** As Manufactured  
**Description** SoundTrack LxT Class 1  
Class 1 Sound Level Meter  
Firmware Revision: 2.404

**Procedure Number** D0001.8384  
**Technician** Jacob Cannon  
**Calibration Date** 23 Mar 2023  
**Calibration Due**  
**Temperature** 23.44 °C ± 0.25 °C  
**Humidity** 50.2 %RH ± 2.0 %RH  
**Static Pressure** 85.97 kPa ± 0.13 kPa

**Evaluation Method** Tested with: Data reported in dB re 20 µPa.  
Larson Davis CAL291, S/N 0108  
PCB 377B02, S/N 345235  
Larson Davis PRMLxT1, S/N 077641  
Larson Davis CAL200, S/N 9079

**Compliance Standards** Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

|                        |                            |
|------------------------|----------------------------|
| IEC 60651:2001 Type 1  | ANSI S1.4-2014 Class 1     |
| IEC 60804:2000 Type 1  | ANSI S1.4 (R2006) Type 1   |
| IEC 61252:2002         | ANSI S1.11 (R2009) Class 1 |
| IEC 61260:2001 Class 1 | ANSI S1.25 (R2007)         |
| IEC 61672:2013 Class 1 | ANSI S1.43 (R2007) Type 1  |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

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**Certificate Number 2023003664**

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014/Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1; the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

| Standards Used                                       |            |            |              |
|--|------------|------------|--------------|
| Description  | Cal Date   | Cal Due    | Cal Standard |
| Larson Davis CAL291 Residual Intensity Calibrator    | 2022-09-09 | 2023-09-09 | 001250       |
| Hart Scientific 2626-H Temperature Probe             | 2021-08-25 | 2023-05-25 | 006798       |
| Larson Davis CAL200 Acoustic Calibrator              | 2022-07-21 | 2023-07-21 | 007027       |
| Larson Davis Model 831                               | 2023-02-22 | 2024-02-22 | 007182       |
| PCB 377A13 1/2 inch Prepolarized Pressure Microphone | 2023-03-06 | 2024-03-06 | 007185       |
| SRS DS360 Ultra Low Distortion Generator             | 2022-03-29 | 2023-03-29 | 007635       |
| Larson Davis 1/2" Preamplifier for Model 831 Type 1  | 2022-09-28 | 2023-09-28 | PCB0004783   |

**Acoustic Calibration**

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

| Measurement | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|-------------|------------------|------------------|------------------|---------------------------|--------|
| 1000 Hz     | 114.01           | 113.80           | 114.20           | 0.14                      | Pass   |

**Loaded Circuit Sensitivity**

| Measurement | Test Result [dB re 1 V / Pa] | Lower Limit [dB re 1 V / Pa] | Upper Limit [dB re 1 V / Pa] | Expanded Uncertainty [dB] | Result |
|-------------|------------------------------|------------------------------|------------------------------|---------------------------|--------|
| 1000 Hz     | -49.94                       | -52.44                       | -48.33                       | 0.14                      | Pass   |

-- End of measurement results--

**Acoustic Signal Tests, C-weighting**

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Expected [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|---------------|------------------|------------------|---------------------------|--------|
| 125            | -0.22            | -0.20         | -1.20            | 0.80             | 0.23                      | Pass   |
| 1000           | 0.14             | 0.00          | -0.70            | 0.70             | 0.23                      | Pass   |
| 8000           | -3.28            | -3.00         | -5.50            | -1.50            | 0.32                      | Pass   |

-- End of measurement results--

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Certificate Number 2023003664

### Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

| Measurement | Test Result [dB] |
|-------------|------------------|
| A-weighted  | 40.44            |

-- End of measurement results--

-- End of Report--

Signatory: Jacob Cannon

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D0001.8406 Rev G

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# Calibration Certificate

Certificate Number 2023003641

**Customer:**

United Analyst and Engineering Consultant Co Ltd  
No. 81 Soi Udonsuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong,  
Bangkok, 10260, Thailand

**Model Number** LxT1  
**Serial Number** 0007306  
**Test Results** Pass  
**Initial Condition** As Manufactured  
**Description** SoundTrack LxT Class 1  
Class 1 Sound Level Meter  
Firmware Revision: 2.404

**Procedure Number** D0001.8378  
**Technician** Jacob Cannon  
**Calibration Date** 23 Mar 2023  
**Calibration Due**  
**Temperature** 23.62 °C ± 0.25 °C  
**Humidity** 49.1 %RH ± 2.0 %RH  
**Static Pressure** 86.13 kPa ± 0.13 kPa

**Evaluation Method** Tested electrically using Larson Davis PRMLxT1 S/N 077641 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

**Compliance Standards** Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

|                        |                            |
|------------------------|----------------------------|
| IEC 60651:2001 Type 1  | ANSI S1.4-2014 Class 1     |
| IEC 60804:2000 Type 1  | ANSI S1.4 (R2006) Type 1   |
| IEC 61252:2002         | ANSI S1.25 (R2007)         |
| IEC 61672:2013 Class 1 | ANSI S1.43 (R2007) Type 1  |
| IEC 61260:2001 Class 1 | ANSI S1.11 (R2009) Class 1 |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma ( $k=2$ ) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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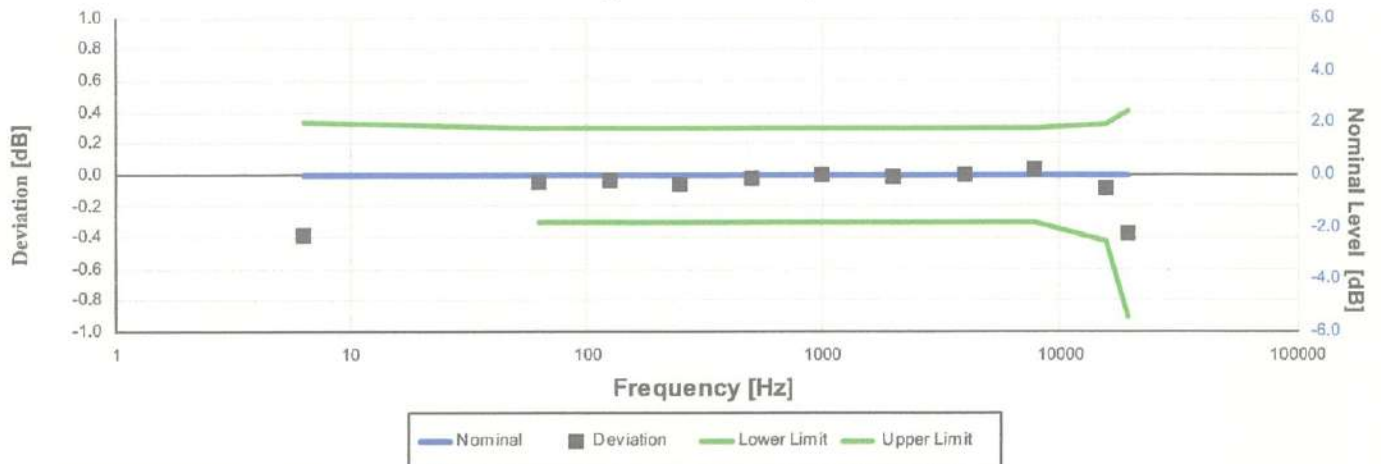


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| Description                              | Standards Used |            |              |
|--|----------------|------------|--------------|
|  | Cal Date       | Cal Due    | Cal Standard |
| Hart Scientific 2626-H Temperature Probe | 2021-08-25     | 2023-05-25 | 006798       |
| SRS DS360 Ultra Low Distortion Generator | 2022-03-29     | 2023-03-29 | 007635       |



## Z-weight Filter Response

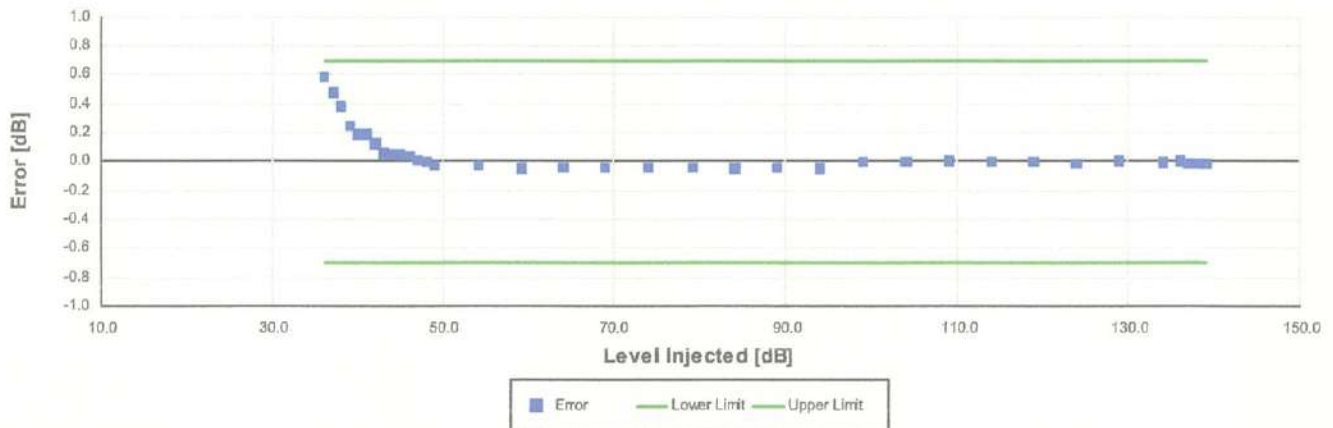


Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Deviation [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|----------------|------------------|------------------|---------------------------|--------|
| 6.31           | -0.39            | -0.39          | -1.11            | 0.33             | 0.15                      | Pass   |
| 63.10          | -0.05            | -0.05          | -0.30            | 0.30             | 0.15                      | Pass   |
| 125.89         | -0.04            | -0.04          | -0.30            | 0.30             | 0.15                      | Pass   |
| 251.19         | -0.06            | -0.06          | -0.30            | 0.30             | 0.15                      | Pass   |
| 501.19         | -0.02            | -0.02          | -0.30            | 0.30             | 0.15                      | Pass   |
| 1,000.00       | 0.00             | 0.00           | -0.30            | 0.30             | 0.15                      | Pass   |
| 1,995.26       | -0.02            | -0.02          | -0.30            | 0.30             | 0.15                      | Pass   |
| 3,981.07       | 0.00             | 0.00           | -0.30            | 0.30             | 0.15                      | Pass   |
| 7,943.28       | 0.03             | 0.03           | -0.30            | 0.30             | 0.15                      | Pass   |
| 15,848.93      | -0.09            | -0.09          | -0.42            | 0.32             | 0.15                      | Pass   |
| 19,952.62      | -0.37            | -0.37          | -0.91            | 0.41             | 0.15                      | Pass   |

— End of measurement results—

## A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

| Level [dB] | Error [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|------------|------------|------------------|------------------|---------------------------|--------|
| 36.00      | 0.59       | -0.70            | 0.70             | 0.16                      | Pass   |
| 37.00      | 0.47       | -0.70            | 0.70             | 0.16                      | Pass   |
| 38.00      | 0.38       | -0.70            | 0.70             | 0.16                      | Pass   |
| 39.00      | 0.25       | -0.70            | 0.70             | 0.16                      | Pass   |
| 40.00      | 0.19       | -0.70            | 0.70             | 0.16                      | Pass   |
| 41.00      | 0.19       | -0.70            | 0.70             | 0.16                      | Pass   |
| 42.00      | 0.12       | -0.70            | 0.70             | 0.16                      | Pass   |
| 43.00      | 0.06       | -0.70            | 0.70             | 0.16                      | Pass   |
| 44.00      | 0.05       | -0.70            | 0.70             | 0.17                      | Pass   |
| 45.00      | 0.05       | -0.70            | 0.70             | 0.16                      | Pass   |
| 46.00      | 0.04       | -0.70            | 0.70             | 0.16                      | Pass   |
| 47.00      | 0.02       | -0.70            | 0.70             | 0.16                      | Pass   |
| 48.00      | 0.00       | -0.70            | 0.70             | 0.16                      | Pass   |
| 49.00      | -0.03      | -0.70            | 0.70             | 0.16                      | Pass   |
| 54.00      | -0.03      | -0.70            | 0.70             | 0.16                      | Pass   |
| 59.00      | -0.04      | -0.70            | 0.70             | 0.16                      | Pass   |
| 64.00      | -0.04      | -0.70            | 0.70             | 0.16                      | Pass   |
| 69.00      | -0.04      | -0.70            | 0.70             | 0.16                      | Pass   |
| 74.00      | -0.04      | -0.70            | 0.70             | 0.16                      | Pass   |
| 79.00      | -0.04      | -0.70            | 0.70             | 0.16                      | Pass   |
| 84.00      | -0.05      | -0.70            | 0.70             | 0.16                      | Pass   |
| 89.00      | -0.04      | -0.70            | 0.70             | 0.16                      | Pass   |
| 94.00      | -0.05      | -0.70            | 0.70             | 0.16                      | Pass   |
| 99.00      | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 104.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 109.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 114.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 119.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 124.00     | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 129.00     | 0.01       | -0.70            | 0.70             | 0.15                      | Pass   |
| 134.00     | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 136.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 137.00     | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 138.00     | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 139.00     | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |

-- End of measurement results--

## Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

| Amplitude [dB] | Duration [μs] |                | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|---------------|----------------|------------------|------------------|------------------|---------------------------|--------|
| 137.85         | 40            | Negative Pulse | 135.26           | 133.82           | 135.82           | 0.15                      | Pass   |
|                |               | Positive Pulse | 135.25           | 133.81           | 135.81           | 0.15                      | Pass   |
|                | 30            | Negative Pulse | 134.29           | 133.82           | 135.82           | 0.15                      | Pass   |
|                |               | Positive Pulse | 134.29           | 133.81           | 135.81           | 0.15                      | Pass   |

-- End of measurement results--

## Positive Pulse Crest Factor

## 200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|----------------|--------------|------------------|-------------|---------------------------|--------|
| 136.85         | 3            | OVLD             | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | OVLD             | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ‡                    | Pass   |
| 126.85         | 3            | -0.14            | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | -0.13            | ± 1.00      | 0.16 ‡                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ‡                    | Pass   |
| 116.85         | 3            | -0.14            | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | -0.12            | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | -0.16            | ± 1.50      | 0.15 ‡                    | Pass   |
| 106.85         | 3            | -0.14            | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | -0.11            | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | -0.25            | ± 1.50      | 0.15 ‡                    | Pass   |

-- End of measurement results--

## Negative Pulse Crest Factor

## 200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|----------------|--------------|------------------|-------------|---------------------------|--------|
| 136.85         | 3            | OVLD             | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | OVLD             | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ‡                    | Pass   |
| 126.85         | 3            | -0.13            | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | -0.12            | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ‡                    | Pass   |
| 116.85         | 3            | -0.13            | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | -0.12            | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | -0.17            | ± 1.50      | 0.15 ‡                    | Pass   |
| 106.85         | 3            | -0.14            | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | -0.12            | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | -0.24            | ± 1.50      | 0.15 ‡                    | Pass   |

-- End of measurement results--



**Gain**

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

| Measurement          | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------------|------------------|------------------|------------------|---------------------------|--------|
| 0 dB Gain            | 93.95            | 93.90            | 94.10            | 0.15                      | Pass   |
| 0 dB Gain, Linearity | 41.16            | 40.30            | 41.70            | 0.16                      | Pass   |
| OBA Low Range        | 94.00            | 93.90            | 94.10            | 0.15                      | Pass   |
| OBA Normal Range     | 94.00            | 93.20            | 94.80            | 0.15                      | Pass   |

-- End of measurement results--

**Broadband Noise Floor**

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

| Measurement          | Test Result [dB] | Upper limit [dB] | Result |
|----------------------|------------------|------------------|--------|
| A-weight Noise Floor | 26.99            | 36.00            | Pass   |
| C-weight Noise Floor | 27.20            | 35.00            | Pass   |
| Z-weight Noise Floor | 33.04            | 39.00            | Pass   |

-- End of measurement results--

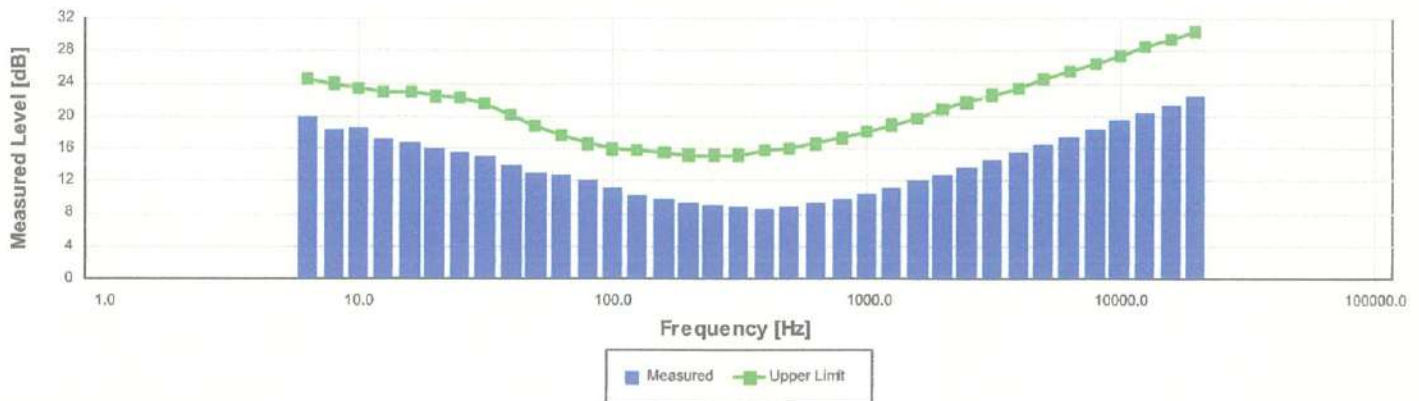
**Total Harmonic Distortion**

Measured using 1/3-Octave filters

| Measurement  | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|--------------|------------------|------------------|------------------|---------------------------|--------|
| 10 Hz Signal | 135.85           | 135.05           | 136.65           | 0.15                      | Pass   |
| THD          | -65.77           |                  | -58.00           | 0.00 ‡                    | Pass   |
| THD+N        | -61.89           |                  | -58.00           | 0.00 ‡                    | Pass   |

-- End of measurement results--

## 1/3-Octave Self-Generated Noise



The SLM is set to low range.

| Frequency [Hz] | Test Result [dB] | Upper limit [dB] | Result |
|----------------|------------------|------------------|--------|
| 6.30           | 19.96            | 24.60            | Pass   |
| 8.00           | 18.41            | 24.00            | Pass   |
| 10.00          | 18.46            | 23.50            | Pass   |
| 12.50          | 17.19            | 23.00            | Pass   |
| 16.00          | 16.76            | 22.90            | Pass   |
| 20.00          | 16.12            | 22.40            | Pass   |
| 25.00          | 15.58            | 22.30            | Pass   |
| 31.50          | 15.02            | 21.50            | Pass   |
| 40.00          | 13.96            | 20.20            | Pass   |
| 50.00          | 13.10            | 18.80            | Pass   |
| 63.00          | 12.83            | 17.60            | Pass   |
| 80.00          | 11.97            | 16.60            | Pass   |
| 100.00         | 11.14            | 15.90            | Pass   |
| 125.00         | 10.24            | 15.70            | Pass   |
| 160.00         | 9.68             | 15.50            | Pass   |
| 200.00         | 9.33             | 15.20            | Pass   |
| 250.00         | 8.99             | 15.20            | Pass   |
| 315.00         | 8.80             | 15.20            | Pass   |
| 400.00         | 8.63             | 15.70            | Pass   |
| 500.00         | 8.84             | 16.00            | Pass   |
| 630.00         | 9.18             | 16.60            | Pass   |
| 800.00         | 9.69             | 17.30            | Pass   |
| 1,000.00       | 10.36            | 18.10            | Pass   |
| 1,250.00       | 11.06            | 18.90            | Pass   |
| 1,600.00       | 11.97            | 19.80            | Pass   |
| 2,000.00       | 12.72            | 20.80            | Pass   |
| 2,500.00       | 13.62            | 21.70            | Pass   |
| 3,150.00       | 14.53            | 22.60            | Pass   |
| 4,000.00       | 15.49            | 23.50            | Pass   |
| 5,000.00       | 16.43            | 24.50            | Pass   |
| 6,300.00       | 17.48            | 25.50            | Pass   |
| 8,000.00       | 18.45            | 26.50            | Pass   |
| 10,000.00      | 19.43            | 27.40            | Pass   |
| 12,500.00      | 20.40            | 28.50            | Pass   |
| 16,000.00      | 21.43            | 29.50            | Pass   |
| 20,000.00      | 22.39            | 30.40            | Pass   |

-- End of measurement results--

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-- End of Report--

Signatory: Jacob Cannon

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1681 West 820 North  
Provo, UT 84601, United States  
716-684-0001

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# Calibration Certificate

Certificate Number 2023003666

**Customer:**

United Analyst and Engineering Consultant Co Ltd  
No. 81 Soi Udonsuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong,  
Bangkok, 10260, Thailand

**Model Number** LxT1  
**Serial Number** 0007308  
**Test Results** **Pass**  
**Initial Condition** As Manufactured  
**Description** SoundTrack LxT Class 1  
Class 1 Sound Level Meter  
Firmware Revision: 2.404

**Procedure Number** D0001.8384  
**Technician** Jacob Cannon  
**Calibration Date** 23 Mar 2023  
**Calibration Due**  
**Temperature** 23.54 °C ± 0.25 °C  
**Humidity** 50.5 %RH ± 2.0 %RH  
**Static Pressure** 85.96 kPa ± 0.13 kPa

**Evaluation Method** **Tested with:** **Data reported in dB re 20 µPa.**  
Larson Davis CAL200, S/N 9079  
Larson Davis CAL291, S/N 0108  
PCB 377B02, S/N 345238  
Larson Davis PRMLxT1, S/N 077643

**Compliance Standards** Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

|                        |                            |
|------------------------|----------------------------|
| IEC 60651:2001 Type 1  | ANSI S1.4-2014 Class 1     |
| IEC 60804:2000 Type 1  | ANSI S1.4 (R2006) Type 1   |
| IEC 61252:2002         | ANSI S1.11 (R2009) Class 1 |
| IEC 61260:2001 Class 1 | ANSI S1.25 (R2007)         |
| IEC 61672:2013 Class 1 | ANSI S1.43 (R2007) Type 1  |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

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716-684-0001



**Certificate Number 2023003666**

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014/Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1; the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

| Standards Used                                       |            |            |              |
|--|------------|------------|--------------|
| Description  | Cal Date   | Cal Due    | Cal Standard |
| Larson Davis CAL291 Residual Intensity Calibrator    | 2022-09-09 | 2023-09-09 | 001250       |
| Hart Scientific 2626-H Temperature Probe             | 2021-08-25 | 2023-05-25 | 006798       |
| Larson Davis CAL200 Acoustic Calibrator              | 2022-07-21 | 2023-07-21 | 007027       |
| Larson Davis Model 831                               | 2023-02-22 | 2024-02-22 | 007182       |
| PCB 377A13 1/2 inch Prepolarized Pressure Microphone | 2023-03-06 | 2024-03-06 | 007185       |
| SRS DS360 Ultra Low Distortion Generator             | 2022-03-29 | 2023-03-29 | 007635       |
| Larson Davis 1/2" Preamplifier for Model 831 Type 1  | 2022-09-28 | 2023-09-28 | PCB0004783   |

**Acoustic Calibration**

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

| Measurement | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|-------------|------------------|------------------|------------------|---------------------------|--------|
| 1000 Hz     | 114.01           | 113.80           | 114.20           | 0.14                      | Pass   |

**Loaded Circuit Sensitivity**

| Measurement | Test Result [dB re 1 V / Pa] | Lower Limit [dB re 1 V / Pa] | Upper Limit [dB re 1 V / Pa] | Expanded Uncertainty [dB] | Result |
|-------------|------------------------------|------------------------------|------------------------------|---------------------------|--------|
| 1000 Hz     | -49.76                       | -52.44                       | -48.33                       | 0.14                      | Pass   |

— End of measurement results—

**Acoustic Signal Tests, C-weighting**

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Expected [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|---------------|------------------|------------------|---------------------------|--------|
| 125            | -0.17            | -0.20         | -1.20            | 0.80             | 0.23                      | Pass   |
| 1000           | 0.16             | 0.00          | -0.70            | 0.70             | 0.23                      | Pass   |
| 8000           | -3.88            | -3.00         | -5.50            | -1.50            | 0.32                      | Pass   |

— End of measurement results—

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Certificate Number 2023003666

### Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

| Measurement | Test Result [dB] |
|-------------|------------------|
| A-weighted  | 40.34            |

-- End of measurement results--

-- End of Report--

Signatory: Jacob Cannon

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# Calibration Certificate

Certificate Number 2023003654

**Customer:**

United Analyst and Engineering Consultant Co Ltd  
No. 81 Soi Udonsuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong,  
Bangkok, 10260, Thailand

**Model Number** LxT1  
**Serial Number** 0007308  
**Test Results** Pass  
**Initial Condition** As Manufactured  
**Description** SoundTrack LxT Class 1  
Class 1 Sound Level Meter  
Firmware Revision: 2.404

**Procedure Number** D0001.8378  
**Technician** Jacob Cannon  
**Calibration Date** 23 Mar 2023  
**Calibration Due**  
**Temperature** 23.64 °C ± 0.25 °C  
**Humidity** 49.2 %RH ± 2.0 %RH  
**Static Pressure** 86.07 kPa ± 0.13 kPa

**Evaluation Method** Tested electrically using Larson Davis PRMLxT1 S/N 077643 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

**Compliance Standards** Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

|                        |                            |
|------------------------|----------------------------|
| IEC 60651:2001 Type 1  | ANSI S1.4-2014 Class 1     |
| IEC 60804:2000 Type 1  | ANSI S1.4 (R2006) Type 1   |
| IEC 61252:2002         | ANSI S1.25 (R2007)         |
| IEC 61672:2013 Class 1 | ANSI S1.43 (R2007) Type 1  |
| IEC 61260:2001 Class 1 | ANSI S1.11 (R2009) Class 1 |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

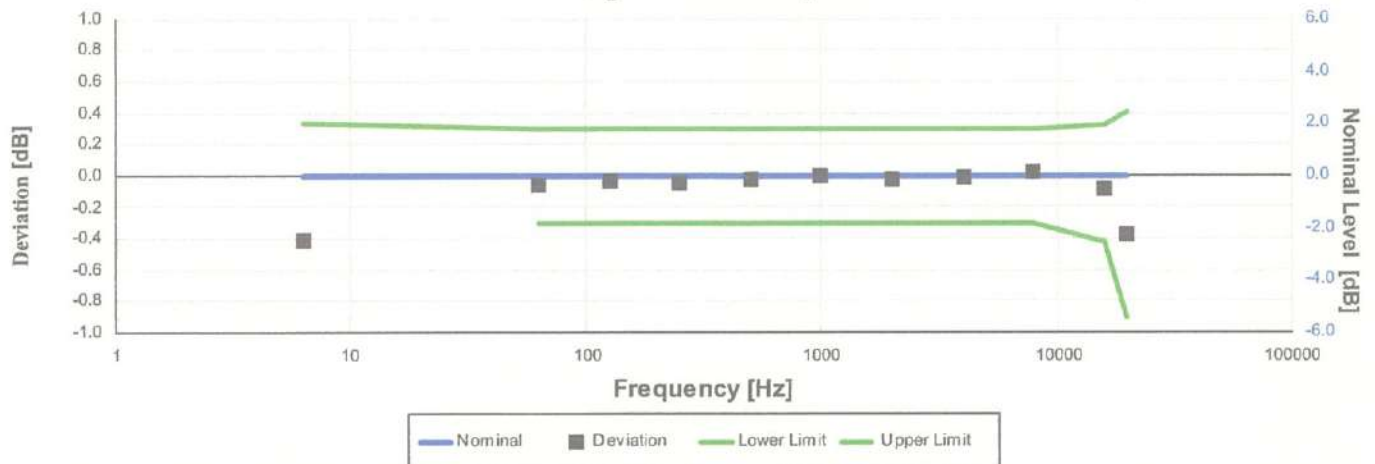
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| Description                              | Standards Used |            |              |
|--|----------------|------------|--------------|
|  | Cal Date       | Cal Due    | Cal Standard |
| Hart Scientific 2626-H Temperature Probe | 2021-08-25     | 2023-05-25 | 006798       |
| SRS DS360 Ultra Low Distortion Generator | 2022-12-29     | 2023-12-29 | 007118       |

## Z-weight Filter Response



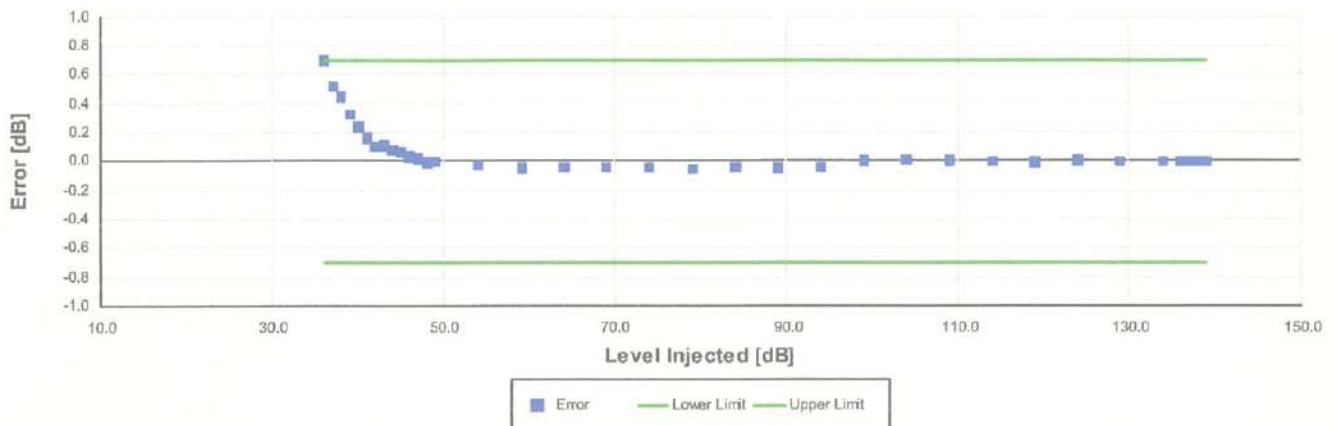
Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Deviation [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|----------------|------------------|------------------|---------------------------|--------|
| 6.31           | -0.41            | -0.41          | -1.11            | 0.33             | 0.15                      | Pass   |
| 63.10          | -0.06            | -0.06          | -0.30            | 0.30             | 0.15                      | Pass   |
| 125.89         | -0.04            | -0.04          | -0.30            | 0.30             | 0.15                      | Pass   |
| 251.19         | -0.05            | -0.05          | -0.30            | 0.30             | 0.15                      | Pass   |
| 501.19         | -0.03            | -0.03          | -0.30            | 0.30             | 0.15                      | Pass   |
| 1,000.00       | 0.00             | 0.00           | -0.30            | 0.30             | 0.15                      | Pass   |
| 1,995.26       | -0.03            | -0.03          | -0.30            | 0.30             | 0.15                      | Pass   |
| 3,981.07       | -0.02            | -0.02          | -0.30            | 0.30             | 0.15                      | Pass   |
| 7,943.28       | 0.02             | 0.02           | -0.30            | 0.30             | 0.15                      | Pass   |
| 15,848.93      | -0.08            | -0.08          | -0.42            | 0.32             | 0.15                      | Pass   |
| 19,952.62      | -0.37            | -0.37          | -0.91            | 0.41             | 0.15                      | Pass   |

-- End of measurement results--



## A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

| Level [dB] | Error [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|------------|------------|------------------|------------------|---------------------------|--------|
| 36.00      | 0.69       | -0.70            | 0.70             | 0.16                      | Pass   |
| 37.00      | 0.52       | -0.70            | 0.70             | 0.16                      | Pass   |
| 38.00      | 0.45       | -0.70            | 0.70             | 0.16                      | Pass   |
| 39.00      | 0.32       | -0.70            | 0.70             | 0.16                      | Pass   |
| 40.00      | 0.24       | -0.70            | 0.70             | 0.16                      | Pass   |
| 41.00      | 0.16       | -0.70            | 0.70             | 0.16                      | Pass   |
| 42.00      | 0.10       | -0.70            | 0.70             | 0.16                      | Pass   |
| 43.00      | 0.11       | -0.70            | 0.70             | 0.17                      | Pass   |
| 44.00      | 0.07       | -0.70            | 0.70             | 0.17                      | Pass   |
| 45.00      | 0.06       | -0.70            | 0.70             | 0.16                      | Pass   |
| 46.00      | 0.03       | -0.70            | 0.70             | 0.16                      | Pass   |
| 47.00      | 0.02       | -0.70            | 0.70             | 0.16                      | Pass   |
| 48.00      | -0.01      | -0.70            | 0.70             | 0.16                      | Pass   |
| 49.00      | 0.00       | -0.70            | 0.70             | 0.16                      | Pass   |
| 54.00      | -0.03      | -0.70            | 0.70             | 0.16                      | Pass   |
| 59.00      | -0.05      | -0.70            | 0.70             | 0.16                      | Pass   |
| 64.00      | -0.04      | -0.70            | 0.70             | 0.16                      | Pass   |
| 69.00      | -0.04      | -0.70            | 0.70             | 0.16                      | Pass   |
| 74.00      | -0.04      | -0.70            | 0.70             | 0.16                      | Pass   |
| 79.00      | -0.05      | -0.70            | 0.70             | 0.16                      | Pass   |
| 84.00      | -0.04      | -0.70            | 0.70             | 0.16                      | Pass   |
| 89.00      | -0.05      | -0.70            | 0.70             | 0.16                      | Pass   |
| 94.00      | -0.04      | -0.70            | 0.70             | 0.16                      | Pass   |
| 99.00      | 0.01       | -0.70            | 0.70             | 0.15                      | Pass   |
| 104.00     | 0.01       | -0.70            | 0.70             | 0.15                      | Pass   |
| 109.00     | 0.01       | -0.70            | 0.70             | 0.15                      | Pass   |
| 114.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 119.00     | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 124.00     | 0.01       | -0.70            | 0.70             | 0.15                      | Pass   |
| 129.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 134.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 136.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 137.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 138.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 139.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |

-- End of measurement results--

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## Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

| Amplitude [dB] | Duration [μs] |                | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|---------------|----------------|------------------|------------------|------------------|---------------------------|--------|
| 137.85         | 40            | Negative Pulse | 135.16           | 133.68           | 135.68           | 0.15                      | Pass   |
|                |               | Positive Pulse | 135.16           | 133.67           | 135.67           | 0.15                      | Pass   |
|                | 30            | Negative Pulse | 133.97           | 133.68           | 135.68           | 0.15                      | Pass   |
|                |               | Positive Pulse | 134.12           | 133.67           | 135.67           | 0.15                      | Pass   |

-- End of measurement results--

## Positive Pulse Crest Factor

## 200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|----------------|--------------|------------------|-------------|---------------------------|--------|
| 136.85         | 3            | OVLD             | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | OVLD             | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ‡                    | Pass   |
| 126.85         | 3            | -0.13            | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | -0.14            | ± 1.00      | 0.16 ‡                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ‡                    | Pass   |
| 116.85         | 3            | -0.14            | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | -0.12            | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | -0.26            | ± 1.50      | 0.15 ‡                    | Pass   |
| 106.85         | 3            | -0.15            | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | -0.13            | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | 0.00             | ± 1.50      | 0.15 ‡                    | Pass   |

-- End of measurement results--

## Negative Pulse Crest Factor

## 200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|----------------|--------------|------------------|-------------|---------------------------|--------|
| 136.85         | 3            | OVLD             | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | OVLD             | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ‡                    | Pass   |
| 126.85         | 3            | -0.13            | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | -0.13            | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ‡                    | Pass   |
| 116.85         | 3            | -0.14            | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | -0.13            | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | -0.26            | ± 1.50      | 0.15 ‡                    | Pass   |
| 106.85         | 3            | -0.15            | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | -0.14            | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | -0.26            | ± 1.50      | 0.15 ‡                    | Pass   |

-- End of measurement results--

**Gain**

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

| Measurement          | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------------|------------------|------------------|------------------|---------------------------|--------|
| 0 dB Gain            | 93.95            | 93.90            | 94.10            | 0.15                      | Pass   |
| 0 dB Gain, Linearity | 41.12            | 40.30            | 41.70            | 0.16                      | Pass   |
| OBA Low Range        | 94.00            | 93.90            | 94.10            | 0.15                      | Pass   |
| OBA Normal Range     | 94.00            | 93.20            | 94.80            | 0.15                      | Pass   |

-- End of measurement results--

**Broadband Noise Floor**

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

| Measurement          | Test Result [dB] | Upper limit [dB] | Result |
|----------------------|------------------|------------------|--------|
| A-weight Noise Floor | 26.99            | 36.00            | Pass   |
| C-weight Noise Floor | 26.75            | 35.00            | Pass   |
| Z-weight Noise Floor | 32.72            | 39.00            | Pass   |

-- End of measurement results--

**Total Harmonic Distortion**

Measured using 1/3-Octave filters

| Measurement  | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|--------------|------------------|------------------|------------------|---------------------------|--------|
| 10 Hz Signal | 135.72           | 135.05           | 136.65           | 0.15                      | Pass   |
| THD          | -66.98           |                  | -58.00           | 0.01 ‡                    | Pass   |
| THD+N        | -62.79           |                  | -58.00           | 0.01 ‡                    | Pass   |

-- End of measurement results--



## 1/3-Octave Self-Generated Noise



The SLM is set to low range.

| Frequency [Hz] | Test Result [dB] | Upper limit [dB] | Result |
|----------------|------------------|------------------|--------|
| 6.30           | 20.17            | 24.60            | Pass   |
| 8.00           | 18.77            | 24.00            | Pass   |
| 10.00          | 18.00            | 23.50            | Pass   |
| 12.50          | 17.78            | 23.00            | Pass   |
| 16.00          | 15.73            | 22.90            | Pass   |
| 20.00          | 15.18            | 22.40            | Pass   |
| 25.00          | 14.40            | 22.30            | Pass   |
| 31.50          | 13.51            | 21.50            | Pass   |
| 40.00          | 12.61            | 20.20            | Pass   |
| 50.00          | 11.82            | 18.80            | Pass   |
| 63.00          | 10.73            | 17.60            | Pass   |
| 80.00          | 9.86             | 16.60            | Pass   |
| 100.00         | 9.25             | 15.90            | Pass   |
| 125.00         | 8.88             | 15.70            | Pass   |
| 160.00         | 8.17             | 15.50            | Pass   |
| 200.00         | 8.12             | 15.20            | Pass   |
| 250.00         | 7.81             | 15.20            | Pass   |
| 315.00         | 7.95             | 15.20            | Pass   |
| 400.00         | 8.02             | 15.70            | Pass   |
| 500.00         | 8.52             | 16.00            | Pass   |
| 630.00         | 8.96             | 16.60            | Pass   |
| 800.00         | 9.59             | 17.30            | Pass   |
| 1,000.00       | 10.38            | 18.10            | Pass   |
| 1,250.00       | 11.10            | 18.90            | Pass   |
| 1,600.00       | 11.95            | 19.80            | Pass   |
| 2,000.00       | 12.80            | 20.80            | Pass   |
| 2,500.00       | 13.67            | 21.70            | Pass   |
| 3,150.00       | 14.58            | 22.60            | Pass   |
| 4,000.00       | 15.52            | 23.50            | Pass   |
| 5,000.00       | 16.48            | 24.50            | Pass   |
| 6,300.00       | 17.43            | 25.50            | Pass   |
| 8,000.00       | 18.47            | 26.50            | Pass   |
| 10,000.00      | 19.41            | 27.40            | Pass   |
| 12,500.00      | 20.40            | 28.50            | Pass   |
| 16,000.00      | 21.37            | 29.50            | Pass   |
| 20,000.00      | 22.38            | 30.40            | Pass   |

-- End of measurement results--

-- End of Report--

Signatory: Jacob Cannon

LARSON DAVIS – A PCB DIVISION  
1681 West 820 North  
Provo, UT 84601, United States  
716-684-0001



เอกสารไม่ควบคุม

# Calibration Certificate

Certificate Number 2023003671

**Customer:**

United Analyst and Engineering Consultant Co Ltd  
No. 81 Soi Udonsuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong,  
Bangkok, 10260, Thailand

**Model Number** LxT1  
**Serial Number** 0007309  
**Test Results** Pass  
**Initial Condition** As Manufactured  
**Description** SoundTrack LxT Class 1  
Class 1 Sound Level Meter  
Firmware Revision: 2.404

**Procedure Number** D0001.8384  
**Technician** Jacob Cannon  
**Calibration Date** 24 Mar 2023  
**Calibration Due**  
**Temperature** 23.54 °C ± 0.25 °C  
**Humidity** 50.6 %RH ± 2.0 %RH  
**Static Pressure** 85.68 kPa ± 0.13 kPa

**Evaluation Method** Tested with: Data reported in dB re 20 µPa.  
Larson Davis PRMLxT1. S/N 077644  
Larson Davis CAL291. S/N 0108  
PCB 377B02. S/N 345239  
Larson Davis CAL200. S/N 9079

**Compliance Standards** Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

|                        |                            |
|------------------------|----------------------------|
| IEC 60651:2001 Type 1  | ANSI S1.4-2014 Class 1     |
| IEC 60804:2000 Type 1  | ANSI S1.4 (R2006) Type 1   |
| IEC 61252:2002         | ANSI S1.11 (R2009) Class 1 |
| IEC 61260:2001 Class 1 | ANSI S1.25 (R2007)         |
| IEC 61672:2013 Class 1 | ANSI S1.43 (R2007) Type 1  |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

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**Certificate Number 2023003671**

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20  $\mu$ Pa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014/Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1; the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

**Standards Used**

| Description  | Cal Date   | Cal Due    | Cal Standard |
|--|------------|------------|--------------|
| Larson Davis CAL291 Residual Intensity Calibrator    | 2022-09-09 | 2023-09-09 | 001250       |
| Hart Scientific 2626-H Temperature Probe             | 2021-08-25 | 2023-05-25 | 006798       |
| Larson Davis CAL200 Acoustic Calibrator              | 2022-07-21 | 2023-07-21 | 007027       |
| Larson Davis Model 831                               | 2023-02-22 | 2024-02-22 | 007182       |
| PCB 377A13 1/2 inch Prepolarized Pressure Microphone | 2023-03-06 | 2024-03-06 | 007185       |
| SRS DS360 Ultra Low Distortion Generator             | 2022-03-29 | 2023-03-29 | 007635       |
| Larson Davis 1/2" Preamplifier for Model 831 Type 1  | 2022-09-28 | 2023-09-28 | PCB0004783   |

**Acoustic Calibration**

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

| Measurement | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|-------------|------------------|------------------|------------------|---------------------------|--------|
| 1000 Hz     | 114.00           | 113.80           | 114.20           | 0.14                      | Pass   |

**Loaded Circuit Sensitivity**

| Measurement | Test Result [dB re 1 V / Pa] | Lower Limit [dB re 1 V / Pa] | Upper Limit [dB re 1 V / Pa] | Expanded Uncertainty [dB] | Result |
|-------------|------------------------------|------------------------------|------------------------------|---------------------------|--------|
| 1000 Hz     | -49.99                       | -52.44                       | -48.33                       | 0.14                      | Pass   |

-- End of measurement results--

**Acoustic Signal Tests, C-weighting**

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Expected [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|---------------|------------------|------------------|---------------------------|--------|
| 125            | -0.06            | -0.20         | -1.20            | 0.80             | 0.23                      | Pass   |
| 1000           | 0.12             | 0.00          | -0.70            | 0.70             | 0.23                      | Pass   |
| 8000           | -5.12            | -3.00         | -5.50            | -1.50            | 0.32                      | Pass   |

-- End of measurement results--

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## Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

| Measurement | Test Result [dB] |
|-------------|------------------|
|-------------|------------------|

|            |       |
|------------|-------|
| A-weighted | 40.25 |
|------------|-------|

— End of measurement results—

— End of Report—

Signatory: Jacob Cannon

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# Calibration Certificate

Certificate Number 2023003643

**Customer:**

United Analyst and Engineering Consultant Co Ltd  
No. 81 Soi Udonsuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong,  
Bangkok, 10260, Thailand

**Model Number** LxT1  
**Serial Number** 0007309  
**Test Results** Pass  
**Initial Condition** As Manufactured  
**Description** SoundTrack LxT Class 1  
Class 1 Sound Level Meter  
Firmware Revision: 2.404

**Procedure Number** D0001.8378  
**Technician** Jacob Cannon  
**Calibration Date** 23 Mar 2023  
**Calibration Due**  
**Temperature** 23.69 °C ± 0.25 °C  
**Humidity** 50.2 %RH ± 2.0 %RH  
**Static Pressure** 86.13 kPa ± 0.13 kPa

**Evaluation Method** Tested electrically using Larson Davis PRMLxT1 S/N 077644 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

**Compliance Standards** Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

|                        |                            |
|------------------------|----------------------------|
| IEC 60651:2001 Type 1  | ANSI S1.4-2014 Class 1     |
| IEC 60804:2000 Type 1  | ANSI S1.4 (R2006) Type 1   |
| IEC 61252:2002         | ANSI S1.25 (R2007)         |
| IEC 61672:2013 Class 1 | ANSI S1.43 (R2007) Type 1  |
| IEC 61260:2001 Class 1 | ANSI S1.11 (R2009) Class 1 |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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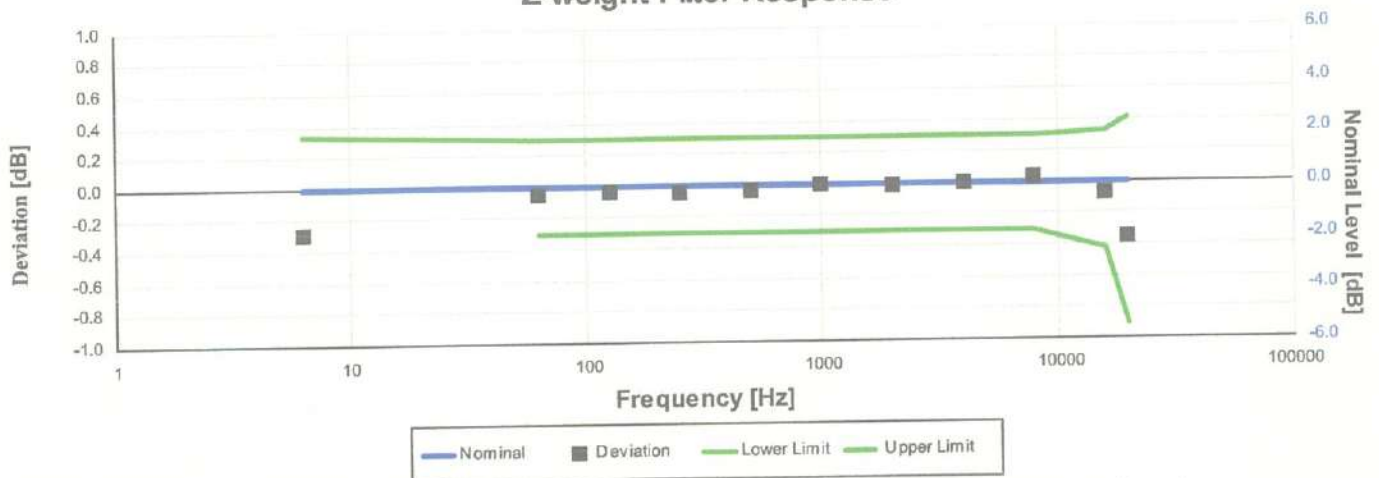


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| Description                              | Standards Used |            |              |
|--|----------------|------------|--------------|
|  | Cal Date       | Cal Due    | Cal Standard |
| Hart Scientific 2626-H Temperature Probe | 2021-08-25     | 2023-05-25 | 006798       |
| SRS DS360 Ultra Low Distortion Generator | 2022-03-30     | 2023-03-30 | 007174       |

## Z-weight Filter Response

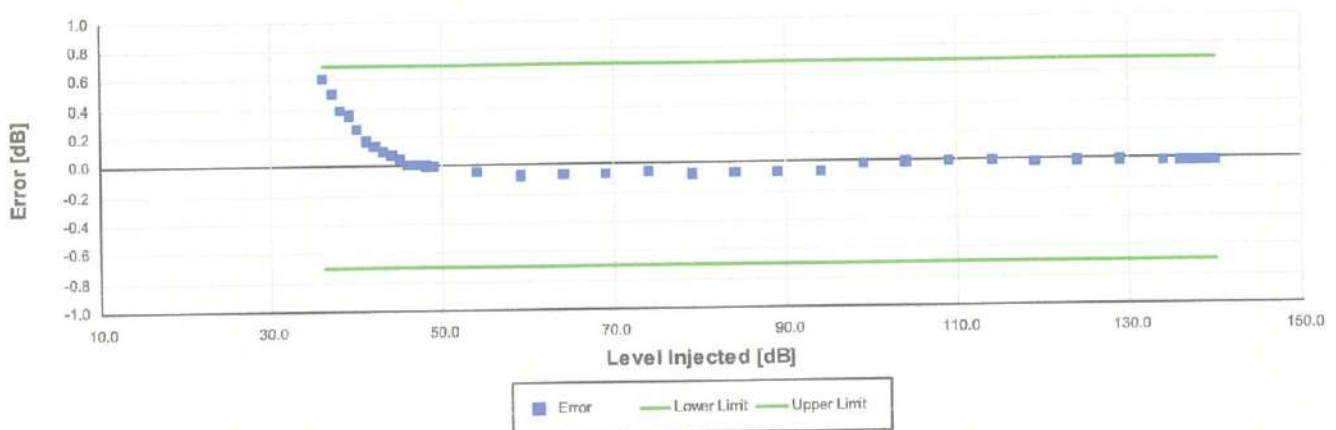


Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Deviation [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|----------------|------------------|------------------|---------------------------|--------|
| 6.31           | -0.29            | -0.29          | -1.11            | 0.33             | 0.15                      | Pass   |
| 63.10          | -0.05            | -0.05          | -0.30            | 0.30             | 0.15                      | Pass   |
| 125.89         | -0.04            | -0.04          | -0.30            | 0.30             | 0.15                      | Pass   |
| 251.19         | -0.05            | -0.05          | -0.30            | 0.30             | 0.15                      | Pass   |
| 501.19         | -0.03            | -0.03          | -0.30            | 0.30             | 0.15                      | Pass   |
| 1,000.00       | 0.00             | 0.00           | -0.30            | 0.30             | 0.15                      | Pass   |
| 1,995.26       | -0.02            | -0.01          | -0.30            | 0.30             | 0.15                      | Pass   |
| 3,981.07       | 0.00             | 0.00           | -0.30            | 0.30             | 0.15                      | Pass   |
| 7,943.28       | 0.04             | 0.04           | -0.30            | 0.30             | 0.15                      | Pass   |
| 15,848.93      | -0.07            | -0.07          | -0.42            | 0.32             | 0.15                      | Pass   |
| 19,952.62      | -0.36            | -0.36          | -0.91            | 0.41             | 0.15                      | Pass   |

— End of measurement results—

## A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

| Level [dB] | Error [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|------------|------------|------------------|------------------|---------------------------|--------|
| 36.00      | 0.61       | -0.70            | 0.70             | 0.16                      | Pass   |
| 37.00      | 0.51       | -0.70            | 0.70             | 0.16                      | Pass   |
| 38.00      | 0.39       | -0.70            | 0.70             | 0.16                      | Pass   |
| 39.00      | 0.36       | -0.70            | 0.70             | 0.16                      | Pass   |
| 40.00      | 0.26       | -0.70            | 0.70             | 0.16                      | Pass   |
| 41.00      | 0.18       | -0.70            | 0.70             | 0.16                      | Pass   |
| 42.00      | 0.14       | -0.70            | 0.70             | 0.16                      | Pass   |
| 43.00      | 0.10       | -0.70            | 0.70             | 0.17                      | Pass   |
| 44.00      | 0.08       | -0.70            | 0.70             | 0.17                      | Pass   |
| 45.00      | 0.05       | -0.70            | 0.70             | 0.16                      | Pass   |
| 46.00      | 0.01       | -0.70            | 0.70             | 0.16                      | Pass   |
| 47.00      | 0.01       | -0.70            | 0.70             | 0.16                      | Pass   |
| 48.00      | 0.01       | -0.70            | 0.70             | 0.16                      | Pass   |
| 49.00      | 0.00       | -0.70            | 0.70             | 0.16                      | Pass   |
| 54.00      | -0.04      | -0.70            | 0.70             | 0.16                      | Pass   |
| 59.00      | -0.07      | -0.70            | 0.70             | 0.16                      | Pass   |
| 64.00      | -0.06      | -0.70            | 0.70             | 0.16                      | Pass   |
| 69.00      | -0.06      | -0.70            | 0.70             | 0.16                      | Pass   |
| 74.00      | -0.06      | -0.70            | 0.70             | 0.16                      | Pass   |
| 79.00      | -0.07      | -0.70            | 0.70             | 0.16                      | Pass   |
| 84.00      | -0.06      | -0.70            | 0.70             | 0.16                      | Pass   |
| 89.00      | -0.06      | -0.70            | 0.70             | 0.16                      | Pass   |
| 94.00      | -0.07      | -0.70            | 0.70             | 0.16                      | Pass   |
| 99.00      | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 104.00     | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 109.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 114.00     | 0.00       | -0.70            | 0.70             | 0.15                      | Pass   |
| 119.00     | -0.02      | -0.70            | 0.70             | 0.15                      | Pass   |
| 124.00     | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 129.00     | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 134.00     | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 136.00     | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 137.00     | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 138.00     | -0.01      | -0.70            | 0.70             | 0.15                      | Pass   |
| 139.00     | -0.02      | -0.70            | 0.70             | 0.15                      | Pass   |
| 140.00     | -0.02      | -0.70            | 0.70             | 0.15                      | Pass   |



-- End of measurement results--

**Peak Rise Time**

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

| Amplitude [dB] | Duration [μs] |                | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|---------------|----------------|------------------|------------------|------------------|---------------------------|--------|
| 137.85         | 40            | Negative Pulse | 134.90           | 133.44           | 135.44           | 0.15                      | Pass   |
|                |               | Positive Pulse | 134.89           | 133.43           | 135.43           | 0.15                      | Pass   |
|                | 30            | Negative Pulse | 133.95           | 133.44           | 135.44           | 0.15                      | Pass   |
|                |               | Positive Pulse | 133.90           | 133.43           | 135.43           | 0.15                      | Pass   |

-- End of measurement results--

**Positive Pulse Crest Factor****200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit**

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|----------------|--------------|------------------|-------------|---------------------------|--------|
| 136.85         | 3            | OVLD             | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | OVLD             | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ‡                    | Pass   |
| 126.85         | 3            | -0.12            | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | -0.11            | ± 1.00      | 0.16 ‡                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ‡                    | Pass   |
| 116.85         | 3            | -0.13            | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | -0.14            | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | -0.09            | ± 1.50      | 0.15 ‡                    | Pass   |
| 106.85         | 3            | -0.13            | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | -0.12            | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | -0.16            | ± 1.50      | 0.15 ‡                    | Pass   |

-- End of measurement results--

**Negative Pulse Crest Factor****200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit**

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|----------------|--------------|------------------|-------------|---------------------------|--------|
| 136.85         | 3            | OVLD             | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | OVLD             | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ‡                    | Pass   |
| 126.85         | 3            | -0.12            | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | -0.11            | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | OVLD             | ± 1.50      | 0.15 ‡                    | Pass   |
| 116.85         | 3            | -0.13            | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | -0.12            | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | -0.08            | ± 1.50      | 0.15 ‡                    | Pass   |
| 106.85         | 3            | -0.12            | ± 0.50      | 0.15 ‡                    | Pass   |
|                | 5            | -0.10            | ± 1.00      | 0.15 ‡                    | Pass   |
|                | 10           | -0.08            | ± 1.50      | 0.15 ‡                    | Pass   |

-- End of measurement results--

## Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

| Measurement          | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------------|------------------|------------------|------------------|---------------------------|--------|
| 0 dB Gain            | 93.95            | 93.90            | 94.10            | 0.15                      | Pass   |
| 0 dB Gain, Linearity | 41.14            | 40.30            | 41.70            | 0.16                      | Pass   |
| OBA Low Range        | 94.00            | 93.90            | 94.10            | 0.15                      | Pass   |
| OBA Normal Range     | 94.00            | 93.20            | 94.80            | 0.15                      | Pass   |

-- End of measurement results--

## Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

| Measurement          | Test Result [dB] | Upper limit [dB] | Result |
|----------------------|------------------|------------------|--------|
| A-weight Noise Floor | 27.17            | 36.00            | Pass   |
| C-weight Noise Floor | 27.11            | 35.00            | Pass   |
| Z-weight Noise Floor | 33.45            | 39.00            | Pass   |

-- End of measurement results--

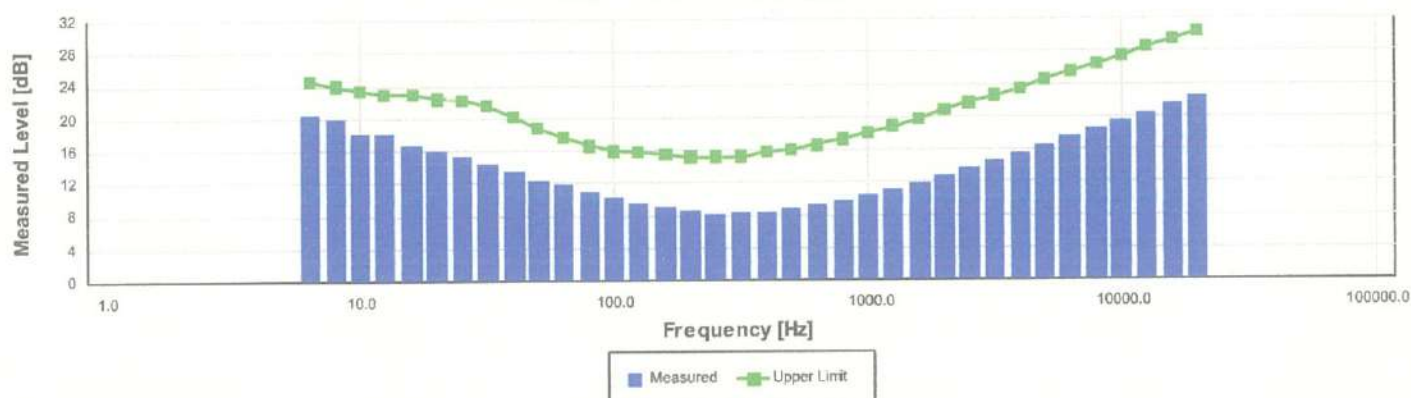
## Total Harmonic Distortion

Measured using 1/3-Octave filters

| Measurement  | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|--------------|------------------|------------------|------------------|---------------------------|--------|
| 10 Hz Signal | 135.48           | 135.05           | 136.65           | 0.15                      | Pass   |
| THD          | -66.97           |                  | -58.00           | 0.01 ‡                    | Pass   |
| THD+N        | -62.77           |                  | -58.00           | 0.01 ‡                    | Pass   |

-- End of measurement results--

## 1/3-Octave Self-Generated Noise



The SLM is set to low range.

| Frequency [Hz] | Test Result [dB] | Upper limit [dB] | Result |
|----------------|------------------|------------------|--------|
| 6.30           | 20.34            | 24.60            | Pass   |
| 8.00           | 19.89            | 24.00            | Pass   |
| 10.00          | 18.12            | 23.50            | Pass   |
| 12.50          | 18.13            | 23.00            | Pass   |
| 16.00          | 16.66            | 22.90            | Pass   |
| 20.00          | 15.98            | 22.40            | Pass   |
| 25.00          | 15.30            | 22.30            | Pass   |
| 31.50          | 14.43            | 21.50            | Pass   |
| 40.00          | 13.41            | 20.20            | Pass   |
| 50.00          | 12.32            | 18.80            | Pass   |
| 63.00          | 11.73            | 17.60            | Pass   |
| 80.00          | 10.83            | 16.60            | Pass   |
| 100.00         | 10.13            | 15.90            | Pass   |
| 125.00         | 9.49             | 15.70            | Pass   |
| 160.00         | 9.11             | 15.50            | Pass   |
| 200.00         | 8.56             | 15.20            | Pass   |
| 250.00         | 8.22             | 15.20            | Pass   |
| 315.00         | 8.28             | 15.20            | Pass   |
| 400.00         | 8.42             | 15.70            | Pass   |
| 500.00         | 8.75             | 16.00            | Pass   |
| 630.00         | 9.18             | 16.60            | Pass   |
| 800.00         | 9.71             | 17.30            | Pass   |
| 1,000.00       | 10.35            | 18.10            | Pass   |
| 1,250.00       | 11.09            | 18.90            | Pass   |
| 1,600.00       | 11.95            | 19.80            | Pass   |
| 2,000.00       | 12.88            | 20.80            | Pass   |
| 2,500.00       | 13.79            | 21.70            | Pass   |
| 3,150.00       | 14.69            | 22.60            | Pass   |
| 4,000.00       | 15.54            | 23.50            | Pass   |
| 5,000.00       | 16.54            | 24.50            | Pass   |
| 6,300.00       | 17.56            | 25.50            | Pass   |
| 8,000.00       | 18.54            | 26.50            | Pass   |
| 10,000.00      | 19.55            | 27.40            | Pass   |
| 12,500.00      | 20.51            | 28.50            | Pass   |
| 16,000.00      | 21.52            | 29.50            | Pass   |
| 20,000.00      | 22.51            | 30.40            | Pass   |

-- End of measurement results--

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-- End of Report--

Signatory: Jacob Cannon

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 23CH1487

Page.: 1 of 3

## Certificate of Calibration

|                         |   |
|-------------------------|---|
| Equipment :             | pH Meter  |
| Manufacturer :          | EcoSense  |
| Model :                 | pH100A  |
| Serial No. :            | JC03354   |
| ID No. :                | UAE.EFM.063/2562(ENV.pH 03/62)  |
| Condition As-Received:  | Used Item   |
| Received Date :         | 21 November 2023  |
| Calibration Date :      | 22 November 2023  |
| Reference :             | 2311-0720WSC-1  |
| Submitted by :          | United Analyst and Engineering Consultant Co.,Ltd.<br>3 Soi Udomsuk 41, Sukhumvit Road,<br>Bangchak, Phrakhanong, Bangkok 10260   |
| Ambient Temperature :   | (25 ± 2.5) °C   |
| Relative Humidity :     | (50 ± 15) %   |
| Calibration Procedure : | In - house method :<br>- CP-CH5 by direct measurement with standard<br>voltage calibrator and direct measurement with<br>certified reference material (CRM)<br>- CP-CH8 by comparison with standard thermometer |

Calibrated by : Warakorn Lerngagtrakul

Approved by :

  
Approved Signatory

- (☒) Saithip Meangmai  
( ) Warakorn Lerngagtrakul  
( ) Ponpan Paipim

Issue Date : 27 November 2023

The Uncertainties are for a confidence probability of approximately 95%

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A 0061266



Cert.No.: 23CH1487

Page.: 2 of 3

**Condition of this calibration result**

**1. Reference Standard Instrument : -**

| <u>Instrument</u>              | <u>Serial No.</u> | <u>ID No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|--------------------------------|-------------------|---------------|------------------|-----------------|
| 1) Document Process Calibrator | 54030049          | 130RC116      | 23E2802          | 27 Aug 2024     |
| 2) Ref. Standard Thermometer   | 4982054           | 110RC044      | 23I908           | 26 July 2024    |

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

- Technology Promotion Association (Thailand-Japan)

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

| <u>Buffer Solution</u> | <u>Manufacturer</u> | <u>Lot No.</u> | <u>Exp. date</u> |
|------------------------|---------------------|----------------|------------------|
| pH 4.008               | CPA chem            | 913598         | 14 July 2025     |
| pH 6.985               | CPA chem            | 913599         | 14 July 2024     |
| pH 9.997               | CPA chem            | 940106         | 02 Nov 2024      |

**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)(7,10)**

| <u>Unit Under Calibration</u> | <u>Nominal Value</u> | <u>Standard Voltage Input</u> | <u>Actual Reading</u> |           | <u>Uncertainty of Measurement</u><br>( ±mV ) | <u>Coverage factor</u><br><i>k</i> |
|-------------------------------|----------------------|-------------------------------|-----------------------|-----------|--|------------------------------------|
|                               | <u>pH</u>            | <u>mV</u>                     | <u>mV</u>             | <u>pH</u> |  |                                    |
| pH Meter<br>S/N.: JC03354     | 4.00                 | 177.48                        | 177                   | 4.01      | 0.58   | 2.00                               |
|                               | 7.00                 | 0.00                          | 0                     | 7.00      | 0.58   | 2.00                               |
|                               | 7.00                 | 0.00                          | 0                     | 7.00      | 0.58   | 2.00                               |
|                               | 10.00                | -177.48                       | -178                  | 10.01     | 0.58   | 2.00                               |

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a 1191352





Cert.No.: 23CH1487

Page.: 3 of 3

**Calibration Results****Function : pH Measurement**

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

| Unit Under Calibration                | Standard pH Buffer Solution | Actual pH Reading | Actual mV Reading ( mV ) | Uncertainty of pH measurement ( $\pm$ ) | Coverage factor $k$ |
|---------------------------------------|-----------------------------|-------------------|--------------------------|---|---------------------|
| pH Electrode<br>S/N.: 230906SIA605377 | 4.008                       | 4.01              | 174                      | 0.0085                                  | 2.05                |
|                                       | 6.985                       | 7.00              | -2                       | 0.0099                                  | 2.00                |
|                                       | 6.985                       | 7.00              | -2                       | 0.0093                                  | 2.00                |
|                                       | 9.997                       | 10.00             | -177                     | 0.0092                                  | 2.00                |

**Function : Temperature Measurement**

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model :

-

- Serial No. :

230906SIA605377

Dimension of probe;

- Length :

110 mm

- Diameter :

12 mm

- Immersion Depth :

100 mm

| Calibration Point ( $^{\circ}\text{C}$ ) | Standard Temperature ( $^{\circ}\text{C}$ ) | UUC* Reading ( $^{\circ}\text{C}$ ) | Error ( $^{\circ}\text{C}$ ) | Uncertainty of measurement ( $\pm$ $^{\circ}\text{C}$ ) | Coverage factor $k$ |
|--|---|-------------------------------------|------------------------------|---|---------------------|
| 25.0                                     | 25.002                                      | 25.1                                | 0.098                        | 0.13  | 2.00                |
| 30.0                                     | 30.001                                      | 30.1                                | 0.099                        | 0.13  | 2.00                |
| 35.0                                     | 35.003                                      | 35.0                                | -0.003                       | 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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Saitip

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a 1191351



**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.:** 23TW174

**Page.:** 1 of 2

## Certificate of Testing

**Equipment :** DO Meter  
**Manufacturer :** YSI  
**Model :** Pro 20i  
**Serial No. :** 18H110495  
**ID No. :** UAE.EFM.200/2561(ENV.DO.04/61)  
**Received Date :** 25 July 2023  
**Test Date :** 26 July 2023  
**Reference :** 2307-0788WSC-1  
**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260  
**Laboratory Condition :** Temperature (  $25 \pm 5$  ) °C  
Humidity (  $50 \pm 20$  ) %  
**Test Procedure :** In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method  
**Tested by :** Walalak Sirithean  
**Approved by :**   
Approved Signatory  
( ) Malee Butkruea  
(✓) Saithip Meangmai  
( ) Warakorn Lerngagtrakul  
**Issue Date :** 27 July 2023

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B 0320266



Cert.No.: 23TW174

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).

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

**2. Standard Material :-**

| <u>Material</u>                 | <u>Manufacturer</u> | <u>Lot.No.</u> | <u>Assay</u> |
|---------------------------------|---------------------|----------------|--------------|
| Sodium Thiosulfate pentahydrate | Merck               | AM1763316      | 100.2%       |

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

**Dissolved Oxygen Probe No.:**      18H100129

| <b>Titration Method<br/>(Azide Modification Method)<br/>(mg/L)</b> | <b>DO Meter<br/>Reading<br/>(mg/L)</b> | <b>Standard Deviation<br/>(mg/L)</b> |
|--|--|--------------------------------------|
| 8.18   | 8.18                                   | 0.0045                               |

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 1173159**



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.: 23LM123

Page.: 1 of 2

## Certificate of Calibration

**Equipment :** DO Meter with Sensor

**Manufacturer :** YSI

**Model :** Pro 20i

**Serial No. :** 18H110495

**ID No. :** UAE.EFM.200/2561(ENV.DO.04/61)

**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260

**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 :** 4 August 2023

The Uncertainties are for a confidence probability of approximately 95%

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A 0056826





**Equipment :** DO Meter with Sensor  
**Condition As-Received :** Used Item  
**Reference :** 2307-0788WSC-2

**Cert. No.:** 23LM123

**Page.:** 2 of 2

**Procedure Used :-**

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:-**

| <u>Instrument</u>      | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Traceable</u> | <u>Due Date</u> |
|------------------------|-------------------|------------------|------------------|-----------------|
| 1) Digital Thermometer | 2188080           | 2211285          | 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.: 18H100129

| <u>Calibration Point</u><br>( °C ) | <u>Immersion Depth</u><br>( mm ) | <u>Standard Temperature</u><br>( °C ) | <u>UUC* Reading</u><br>( °C ) | <u>Error</u><br>( °C ) | <u>Uncertainty</u><br>( ± °C ) | <u>Coverage Factor</u><br><i>k</i> |
|------------------------------------|----------------------------------|---------------------------------------|-------------------------------|------------------------|--------------------------------|------------------------------------|
| 25.0                               | 100                              | 25.009                                | 24.8                          | -0.209                 | 0.16                           | 2.00                               |
| 30.0                               | 100                              | 30.010                                | 29.8                          | -0.210                 | 0.16                           | 2.00                               |
| 35.0                               | 100                              | 35.009                                | 34.7                          | -0.309                 | 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 %.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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Cert.No.: 23CH1228

Page.: 1 of 3

## Certificate of Calibration

|                        |   |
|------------------------|---|
| Equipment :            | Conductivity Meter  |
| Manufacturer :         | YSI   |
| Model :                | Pro30   |
| Serial No. :           | 17A102921   |
| ID No. :               | UAE.EFM.123/2560(ENV.SCT.03/60)   |
| Condition As-Received: | Used Item   |
| Received Date :        | 26 September 2023   |
| Calibration Date :     | 28 September 2023   |
| Reference :            | 2309-0882WSC-1  |
| Submitted by :         | United Analyst and Engineering Consultant Co.,Ltd.<br>3 Soi Udomsuk 41, Sukhumvit Road,<br>Bangchak, Phrakhanong, Bangkok 10260                     |
| Ambient Temperature :  | (25 ± 2.5) °C   |
| Relative Humidity :    | (50 ± 15) %   |
| Calibration Procedure: | In -house method :<br>- CP-CH6 by direct measurement<br>with certified reference material (CRM)<br>- CP-CH8 by comparison with standard thermometer |

Calibrated by : Saithip Meangmai

Approved by :

Approved Signatory

- ( ☒ ) Saithip Meangmai  
( ☐ ) Warakorn Lerngagtrakul  
( ☐ ) Ponpan Paipim

Issue Date : 2 October 2023

The Uncertainties are for a confidence probability of approximately 95%

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A 0053078



Cert.No.: 23CH1228

Page.: 2 of 3

**Condition of this result of calibration**

**1. Reference Standard Instrument :-**

| <u>Instrument</u>       | <u>Serial No.</u> | <u>ID No.</u> | <u>Certificate No.</u> | <u>Due date</u> |
|-------------------------|-------------------|---------------|------------------------|-----------------|
| 1) Thermometer          | 1963878           | 130RC095      | 23I1051                | 05 Sep 2024     |
| 2) Ref. Std.Thermometer | 4982054           | 110RC044      | 23I908                 | 26 Jul 2024     |

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

**2. Certified Reference Materials :-**

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

| <u>Conductivity Solution</u> | <u>Manufacturer</u> | <u>Lot No.</u> | <u>Exp. date</u> |
|------------------------------|---------------------|----------------|------------------|
| 1413.0 $\mu\text{S/cm}$      | CPA Chem            | 913596         | 14 July 2024     |
| 12.880 mS/cm                 | CPA Chem            | 913597         | 14 July 2024     |

- Control Conductivity calibration solution temperature by Water bath ( $25 \pm 0.1$ )  $^{\circ}\text{C}$

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

**Function : Conductivity Measurement**

(\*) After Adjustment at 1413.0  $\mu\text{S/cm}$

Conductivity Electrode Serial No.: 17A100315

| Standard<br>Conductivity Solution | Before Adjustment<br>UUC* Reading | After Adjustment<br>UUC* Reading | Uncertainty<br>of Measurement<br>( $\pm$ ) | Coverage<br>factor<br>k |
|-----------------------------------|-----------------------------------|----------------------------------|--|-------------------------|
| 1413.0 $\mu\text{S/cm}$           | 1271.5 $\mu\text{S/cm}$           | 1412 $\mu\text{S/cm}$            | 9.2 $\mu\text{S/cm}$                       | 2.00                    |
| 12.880 mS/cm                      | 10.11 mS/cm                       | 11.52 mS/cm                      | 0.086 mS/cm                                | 2.00                    |

**Remark** - UUC\* = Unit Under Calibration

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Cert.No.: 23CH1228

Page.: 3 of 3

**Calibration Results**

**Function : Temperature Measurement**

**( \* ) Without adjustment**

This equipment was connected with Temperature Probe;

- Model : PRO 30 COND-T  
- Serial No. : 17A100315

Dimension of probe;

- Length : 95 mm  
- Diameter : 2.5 mm  
- Immersion Depth : 90 mm

| Calibration Point<br>( °C ) | Standard Temperature<br>( °C ) | UUC*<br>Reading<br>( °C ) | Error<br>( °C ) | Uncertainty of Measurement<br>( ± °C ) | Coverage factor<br><i>k</i> |
|-----------------------------|--------------------------------|---------------------------|-----------------|--|-----------------------------|
| 25.0                        | 25.003                         | 24.7                      | -0.303          | 0.13                                   | 2.00                        |
| 30.0                        | 30.004                         | 29.7                      | -0.304          | 0.13                                   | 2.00                        |
| 35.0                        | 35.004                         | 34.7                      | -0.304          | 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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Saithip

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a 1182389





## Certificate of Calibration

**Customer**

Name : UNITED ANALYST AND ENGINEERING  
CONSULTANT CO.,LTD.

**Certificate No : 23-TPM-253****Request No : Req-2023-0955**

Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong,  
Bangkok 10260

**Page : 1/2****Unit Under Calibration Details**

Calibration Parameter : Temperature

Instrument Name : Thermal Environment Monitor

Range Calibration : 20 °C to 60 °C

Manufacturer : 3M

Type of Sensor : RTD

Model : QT-32

Sensor Diameter (mm) : 4.5

Serial Number : TPQ020025

Calibration Position (mm) : 67.5

Resolution : 0.1 °C

Instrument Status : Used

ID Number : UAE.EFM.008/2559

**Calibration Environment and Details**

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 15 %RH

Received Date : 4 May 2023

Calibrated Date : 12 May 2023

Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

**Reference Standard** : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/ RTD100, SN: 08000057, ID: 02-TPM Which was calibrated on 27 February 2023, Calibration Certificate No. : QR23-0494

**Traceability** : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0292

**Note**

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor  $k=2$ , providing a level of confidence approximately 95 %.

**Approved By :**

Mr. Noppadon Luangart

Technical Manager

**Issue Date :**

12 May 2023

**Calibration Note**

UUC Adjustment : Not Adjust

Certificate No : 23-TPM-253

Request No : Req-2023-0955

Page : 2/2

**Result of Calibration :**

| UUC Sensor | Standard Temperature (°C) | UUC Reading (°C) | Correction (°C) | Uncertainty (± °C) |
|------------|---------------------------|------------------|-----------------|--------------------|
| WET        | 20.031                    | 20.1             | - 0.1           | 0.13               |
|            | 25.033                    | 25.1             | - 0.1           | 0.13               |
|            | 30.036                    | 30.1             | - 0.1           | 0.13               |
|            | 35.039                    | 35.1             | - 0.1           | 0.13               |
|            | 40.040                    | 40.1             | - 0.1           | 0.13               |
|            | 45.042                    | 45.1             | - 0.1           | 0.13               |
|            | 50.045                    | 50.1             | - 0.1           | 0.13               |
|            | 60.050                    | 60.1             | - 0.1           | 0.13               |
| DRY        | 20.033                    | 20.0             | 0.0             | 0.13               |
|            | 25.034                    | 25.0             | 0.0             | 0.13               |
|            | 30.034                    | 30.0             | 0.0             | 0.13               |
|            | 35.036                    | 35.0             | 0.0             | 0.13               |
|            | 40.040                    | 40.0             | 0.0             | 0.13               |
|            | 45.044                    | 45.0             | 0.0             | 0.13               |
|            | 50.042                    | 50.0             | 0.0             | 0.13               |
|            | 60.048                    | 60.0             | 0.0             | 0.13               |
| GLOBE      | 20.032                    | 20.1             | - 0.1           | 0.13               |
|            | 25.034                    | 25.1             | - 0.1           | 0.13               |
|            | 30.034                    | 30.1             | - 0.1           | 0.13               |
|            | 35.037                    | 35.1             | - 0.1           | 0.13               |
|            | 40.038                    | 40.0             | 0.0             | 0.13               |
|            | 45.039                    | 45.0             | 0.0             | 0.13               |
|            | 50.044                    | 50.0             | 0.0             | 0.13               |
|            | 60.047                    | 60.0             | 0.0             | 0.13               |

End of Certificate

Calibrated By :



Mr. Sittichok Jirapukdeesakun

## Certificate of Calibration

### Customer

Name : UNITED ANALYST AND ENGINEERING  
CONSULTANT CO.,LTD.  
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong,  
Bangkok 10260

Certificate No : 24-TPM-045

Request No : Req-2023-2692

Page : 1/2

### Unit Under Calibration Details

|                       |                               |                           |                  |
|-----------------------|-------------------------------|---------------------------|------------------|
| Calibration Parameter | : Temperature                 | Range Calibration         | : 20 °C to 60 °C |
| Instrument Name       | : Thermal Environment Monitor | Type of Sensor            | : RTD            |
| Manufacturer          | : 3M                          | Sensor Diameter (mm)      | : 4.5            |
| Model                 | : QT-32                       | Calibration Position (mm) | : 67.5           |
| Serial Number         | : TPS030005                   | Instrument Status         | : Used           |
| Resolution            | : 0.1 °C                      |                           |                  |
| ID Number             | : UAE.EFM.080/2561            |                           |                  |

### Calibration Environment and Details

Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 15 %RH  
Received Date : 21 December 2023  
Calibrated Date : 23 January 2024  
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

**Reference Standard** : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/ RTD100, SN:  
08000057, ID: 02-TPM Which was calibrated on 27 Febuary 2023, Calibration Certificate No. : QR23-  
0494

**Traceability** : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.:  
Calibration 0292

### Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor  $k=2$ , providing a level of confidence approximately 95 %.

Approved By :



Mr. Noppadon Luangart

Technical Manager

Issue Date :

23 January 2024

**Calibration Note**

UUC Adjustment : Not Adjust

Certificate No : 24-TPM-045

Request No : Req-2023-2692

Page : 2/2

**Result of Calibration :**

| UUC Sensor | Standard Temperature (°C) | UUC Reading (°C) | Correction (°C) | Uncertainty (± °C) |
|------------|---------------------------|------------------|-----------------|--------------------|
| WET        | 20.031                    | 20.2             | - 0.2           | 0.13               |
|            | 25.032                    | 25.2             | - 0.2           | 0.13               |
|            | 30.035                    | 30.2             | - 0.2           | 0.13               |
|            | 35.038                    | 35.2             | - 0.2           | 0.13               |
|            | 40.040                    | 40.1             | - 0.1           | 0.13               |
|            | 45.040                    | 40.1             | + 4.9           | 0.13               |
|            | 50.043                    | 50.1             | - 0.1           | 0.13               |
|            | 60.047                    | 60.1             | - 0.1           | 0.13               |
| DRY        | 20.032                    | 20.2             | - 0.2           | 0.13               |
|            | 25.034                    | 25.2             | - 0.2           | 0.13               |
|            | 30.034                    | 30.2             | - 0.2           | 0.13               |
|            | 35.036                    | 35.2             | - 0.2           | 0.13               |
|            | 40.038                    | 40.1             | - 0.1           | 0.13               |
|            | 45.040                    | 40.1             | + 4.9           | 0.13               |
|            | 50.043                    | 50.1             | - 0.1           | 0.13               |
|            | 60.047                    | 60.1             | - 0.1           | 0.13               |
| GLOBE      | 20.031                    | 20.2             | - 0.2           | 0.13               |
|            | 25.033                    | 25.2             | - 0.2           | 0.13               |
|            | 30.035                    | 30.2             | - 0.2           | 0.13               |
|            | 35.038                    | 35.2             | - 0.2           | 0.13               |
|            | 40.039                    | 40.1             | - 0.1           | 0.13               |
|            | 45.040                    | 40.1             | + 4.9           | 0.13               |
|            | 50.043                    | 50.1             | - 0.1           | 0.13               |
|            | 60.046                    | 60.1             | - 0.1           | 0.13               |

End of Certificate

Calibrated By :



Mr. Sittichok Jirapukdeesakul





## Certificate of Calibration

### Customer

Name : UNITED ANALYST AND ENGINEERING  
CONSULTANT CO.,LTD.  
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong,  
Bangkok 10260

Certificate No : 24-TPM-046

Request No : Req-2023-2693

Page : 1/2

### Unit Under Calibration Details

|                       |                               |                           |                  |
|-----------------------|-------------------------------|---------------------------|------------------|
| Calibration Parameter | : Temperature                 | Range Calibration         | : 20 °C to 60 °C |
| Instrument Name       | : Thermal Environment Monitor | Type of Sensor            | : RTD            |
| Manufacturer          | : TSI QUEST                   | Sensor Diameter (mm)      | : 4.5            |
| Model                 | : QT-32                       | Calibration Position (mm) | : 67.5           |
| Serial Number         | : TPT060015                   | Instrument Status         | : Used           |
| Resolution            | : 0.1 °C                      |                           |                  |
| ID Number             | : UAE.EFM.222/2562            |                           |                  |

### Calibration Environment and Details

Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 15 %RH  
Received Date : 21 December 2023  
Calibrated Date : 23 January 2024  
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

**Reference Standard** : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/ RTD100, SN: 08000057, ID: 02-TPM Which was calibrated on 27 Febuary 2023, Calibration Certificate No. : QR23-0494

**Traceability** : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0292

### Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor  $k=2$ , providing a level of confidence approximately 95 %.

Approved By :

Mr. Noppadon Luangart

Technical Manager

Issue Date :

23 January 2024



## Certificate of Calibration

### Customer

Name : UNITED ANALYST AND ENGINEERING  
CONSULTANT CO.,LTD.  
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong,  
Bangkok 10260

Certificate No : 23-TPM-484

Request No : Req-2023-2175

Page : 1/2

### Unit Under Calibration Details

|                       |                               |                                    |
|-----------------------|-------------------------------|------------------------------------|
| Calibration Parameter | : Temperature                 |                                    |
| Instrument Name       | : Thermal Environment Monitor | Range Calibration : 20 °C to 60 °C |
| Manufacturer          | : 3M                          | Type of Sensor : RTD               |
| Model                 | : QT-32                       | Sensor Diameter (mm) : 4.5         |
| Serial Number         | : TPS030004                   | Calibration Position (mm) : 67.5   |
| Resolution            | : 0.1 °C                      | Instrument Status : Used           |
| ID Number             | : UAE.EFM.079/2561            |                                    |

### Calibration Environment and Details

Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 15 %RH  
Received Date : 11 October 2023  
Calibrated Date : 17 October 2023  
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.  
Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/ RTD100, SN: 08000057, ID: 02-TPM Which was calibrated on 27 Febuary 2023, Calibration Certificate No. : QR23-0494  
Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0292

### Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor  $k=2$ , providing a level of confidence approximately 95 %.

Approved By :



Mr. Noppadon Luangart

Technical Manager

Issue Date :

17 October 2023





## Certificate of Calibration

### Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong,  
Bangkok 10260

Certificate No : 23-AFM-221 Rev.1

Request No : Req-2023-2172

### Unit Under Calibration Details

Measurement Item : Air Flow Meter  
Manufacturer : TSI  
Model : 4146 Sensor Model : -  
Serial Number : 41461922007 Sensor Serial Number : -  
ID : UAE.EFM.223/2562  
Location of Calibration : LAB 4 AIR VELOCITY METER

### Calibration Environment and Details

Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 11 October 2023  
Calibration Date : 25 October 2023  
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator


| Reference Standard | Model                      | Serial Number   | Traceble  | Due Calibration  |
|--------------------|----------------------------|-----------------|-----------|------------------|
| Air Flow Meter     | Gilibrator 3 Standard flow | 19031011003     | Sensidyne | 12 July 2024     |
| Air Flow Meter     | Gilibrator 3 High flow     | 18501012012     | Sensidyne | 12 July 2024     |
| Temperature meter  | GT 11                      | 08000057        | Qreborn   | 27 February 2024 |
| Pressure meter     | CPG2400                    | 41000KDU/651882 | TPA       | 7 November 2023  |


### Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

### Note :

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor  $k = 2$ , providing a level of confidence approximately 95 %.  
This Certificate was issued to replace to Calibration Certificate No. 23-AFM-221

Calibration By :   
Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By :   
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor

Issue Date : 7 November 2023

Certificate No : 23-AFM-221 Rev.1

Request No : Req-2023-2172

**Result of Calibration :**

| Temperature<br>(°C) | Pressure<br>(kPa) | STD<br>(l/min) | UUC<br>(l/min) | Error<br>(l/min) | Uncertainty<br>(l/min) |
|---------------------|-------------------|----------------|----------------|------------------|------------------------|
| 25.40               | 101.16            | 0.020          | 0.019          | -0.001           | 0.0013                 |
| 25.30               | 101.17            | 0.049          | 0.049          | 0.000            | 0.0033                 |
| 25.30               | 101.19            | 0.098          | 0.101          | 0.003            | 0.0028                 |
| 25.20               | 101.18            | 0.196          | 0.200          | 0.004            | 0.0056                 |
| 25.30               | 101.18            | 0.498          | 0.500          | 0.002            | 0.0073                 |
| 25.20               | 101.16            | 1.001          | 1.001          | 0.000            | 0.083                  |
| 25.20               | 101.18            | 1.705          | 1.701          | -0.004           | 0.085                  |
| 25.40               | 101.15            | 2.003          | 2.007          | 0.004            | 0.086                  |
| 25.30               | 101.10            | 2.986          | 3.000          | 0.014            | 0.042                  |
| 25.30               | 101.10            | 3.979          | 4.001          | 0.022            | 0.056                  |
| 25.30               | 101.10            | 5.013          | 5.002          | -0.011           | 0.070                  |

**Note**                      STD : Standard                      UUC : Unit Under Calibration  
 - UUC Reference Condition : At 21.1 °C, 101.3 kPa, Air  
 - Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{\text{meas}} = Q_{\text{ref}} \times \frac{P_{\text{ref}}}{P_{\text{meas}}} \times \frac{T_{\text{meas}}}{T_{\text{ref}}}$$

where    Q = Flow Rate                      P = Absolute Pressure                      T = Absolute Temperature  
           Meas = Measurement Condition                      ref = Standard Condition

\* Indicates non accredited

End of 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. 0-2717-3000-24 FAX. 0-2719-9484



## Certificate of Calibration

Certificate No. : 23H1200

Page : 1 of 2

Equipment : Dial Thermo-Hygrometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: UAE.ANV.130/2550

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 30 May 2023  
to 06 June 2023

Reference: 2305-0919WSC

Ambient Temperature: ( 25 ± 3 ) °C

Relative Humidity: ( 50 ± 20 ) %

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.

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

Procedure used: Calibration were conducted using in-house calibration procedure CP-H02 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

### Condition of this result of calibration

1.Reference standards instruments :

| <u>Instrument</u>                   | <u>Model</u> | <u>Serial No.</u> | <u>Certificate No.</u> | <u>Due Date</u> |
|-------------------------------------|--------------|-------------------|------------------------|-----------------|
| 1) Hygro-M2 Dew Point Monitor       | 5112         | 2360195           | 20703                  | 02 Aug 2023     |
| 2) Handheld Thermometer With Sensor | 1523         | 3240076           | 231305                 | 15 Mar 2024     |


2.The 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 maintained through:-

- National Institute of Standards and Technology (NIST) , The United States of America
- Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

Calibrated by : Somchai Dumwor  
Issue Date : 07 June 2023

Approved Signatory :

-   
☒ Chakrit Waewwanjua  
☐ Pornthippa Tameyakul  
☐ Viporn Tantiyawutti

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B 0316274





Cert. No.: 23H1200

Page.: 2 of 2

**Result of Calibration:-**

Before Adjustment

Function:

Humidity Measurement

| <u>Reference</u><br><u>Temperature</u><br>(°C) | <u>Standard</u><br><u>Humidity</u><br>(%R.H.) | <u>UUC*</u><br><u>Reading</u><br>(%R.H.) | <u>Error</u><br>(%R.H.) | <u>Uncertainty</u><br><u>of Measurement</u><br>(±%R.H.) |
|--|---|--|-------------------------|---|
| 25.0   | 40.1  | 48                                       | 7.9                     | 1.6   |
| 25.0   | 60.0  | 63                                       | 3.0                     | 1.7   |
| 25.0   | 80.0  | 76                                       | -4.0                    | 1.9   |

**Result of Calibration:-**

After Adjustment

Function:

Humidity Measurement

| <u>Reference</u><br><u>Temperature</u><br>(°C) | <u>Standard</u><br><u>Humidity</u><br>(%R.H.) | <u>UUC*</u><br><u>Reading</u><br>(%R.H.) | <u>Error</u><br>(%R.H.) | <u>Uncertainty</u><br><u>of Measurement</u><br>(±%R.H.) |
|--|---|--|-------------------------|---|
| 25.0   | 40.1  | 44                                       | 3.9                     | 1.6   |
| 25.0   | 60.0  | 60                                       | 0.0                     | 1.7   |
| 25.0   | 80.0  | 75                                       | -5.0                    | 1.9   |

**Result of Calibration:-**

Without Adjustment

Function:

Temperature Measurement

| <u>Standard</u><br><u>Temperature</u><br>(°C) | <u>UUC*</u><br><u>Reading</u><br>(°C) | <u>Error</u><br>(°C) | <u>Uncertainty</u><br><u>of Measurement</u><br>(±°C) |
|---|---------------------------------------|----------------------|--|
| 19.987  | 20.0                                  | 0.013                | 0.72   |
| 30.016  | 30.0                                  | -0.016               | 0.72   |
| 39.944  | 39.5                                  | -0.444               | 0.72   |

UUC\* : Unit Under Calibration

The reported uncertainty of measurement was base on standard uncertainty multiplied by coverage factor  $k = 2.00$ , providing confidence level approximately 95%.

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a 1165295





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. : 23H1101

Page : 1 of 2

Equipment : Digital Thermo-Hygrometer

Manufacturer: Digicon

Model : TH-02

Serial No.: 395034175

ID No.: UAE.EFM.184/2565

Condition As-Received: Used Item

Received Date: 18 May 2023

Calibration Date: 22 May 2023  
to 24 May 2023

Reference: 2305-0641WSC

Ambient Temperature: ( 25  $\pm$  3 ) °C

Relative Humidity: ( 50  $\pm$  20 ) %

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.

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260

Procedure used: Calibration were conducted using in-house calibration procedure CP-H03 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

### Condition of this result of calibration

1.Reference standards instruments :

| <u>Instrument</u>                   | <u>Model</u> | <u>Serial No.</u> | <u>Certificate No.</u> | <u>Due Date</u> |
|-------------------------------------|--------------|-------------------|------------------------|-----------------|
| 1) Chilled Mirror Hygrometer        | Dew Master   | 44730             | 20563A                 | 14 Jun 2023     |
| 2) Handheld Thermometer With Sensor | 1521         | A5A339            | 2211251                | 12 Oct 2023     |

2.The 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 maintained through:-

- National Institute of Standards and Technology (NIST) , The United States of America
- National Institute of Metrology Thailand (NIMT)

Calibrated by : Kraipop Onrat

Issue Date : 25 May 2023

Approved Signatory :

  
[✓] Chakrit Waewwanjua

[ ] Pornthippa Tameyakul

[ ] Viporn Tantiyawutti

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B 0314979



Cert. No.: 23H1101

Page.: 2 of 2

**Result of Calibration:-**

Without Adjustment

Function:

Humidity Measurement

| <u>Reference</u><br><u>Temperature</u><br>(°C) | <u>Standard</u><br><u>Humidity</u><br>(%R.H.) | <u>UUC*</u><br><u>Reading</u><br>(%R.H.) | <u>Error</u><br>(%R.H.) | <u>Uncertainty</u><br><u>of Measurement</u><br>(±%R.H.) |
|--|---|--|-------------------------|---|
| 25.0   | 40.1  | 41                                       | 0.9                     | 1.3   |
| 25.0   | 50.1  | 51                                       | 0.9                     | 1.6   |
| 25.0   | 60.0  | 60                                       | 0.0                     | 1.6   |
| 25.0   | 70.2  | 67                                       | -3.2                    | 1.6   |

**Result of Calibration:-**

Without Adjustment

Function:

Temperature Measurement

| <u>Standard</u><br><u>Temperature</u><br>(°C) | <u>UUC*</u><br><u>Reading</u><br>(°C) | <u>Error</u><br>(°C) | <u>Uncertainty</u><br><u>of Measurement</u><br>(±°C) |
|---|---------------------------------------|----------------------|--|
| 20.014  | 20.4                                  | 0.386                | 0.42   |
| 25.022  | 25.6                                  | 0.578                | 0.42   |
| 30.033  | 30.3                                  | 0.267                | 0.42   |
| 40.000  | 40.1                                  | 0.100                | 0.42   |

**UUC\*** : Unit Under Calibration

The reported uncertainty of measurement was base on standard uncertainty multiplied by coverage factor  $k = 2.00$ , providing confidence level approximately 95%.

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a 1162980

## Certificate of Calibration

### Customer

Name : UNITED ANALYST AND ENGINEERING  
CONSULTANT CO.,LTD.  
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Prakanong, Bangkok 10260

Certificate No : 23-ACT-109  
Request No : Req-2023-1406

### Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 1  
Manufacturer : 01dB Range : 94 dB / 1000 Hz  
Model : CAL31 Intrument Status : Used  
Serial Number : 82795  
ID : UAE.EFM.113/2560

### Calibration Environment and Details

Temperature : ( 23  $\pm$ 2  $^{\circ}$ C )  
Humidity : ( 50  $\pm$  20 %RH )  
Barometric Pressure : ( 1013  $\pm$ 10.0 hPa )  
Received Date : 26 June 2023  
Calibration Date : 27 June 2023  
Location of Calibration : LAB 1 Acoustic  
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

| Reference Standard | Model  | Serial Number | Traceable | Due Calibration |
|--------------------|--------|---------------|-----------|-----------------|
| Sound Calibrator   | SV 35A | 58079         | EEI       | 31 May 2024     |
| THD Multimeter     | 2015   | 1047765       | NIMT      | 31 January 2024 |

**Traceability** : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

### Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor  $k=2$ , providing a level of confidence approximately 95 %.

Calibrated By : me  
Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By : ปณิ  
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor

Issue Date : 27 June 2023



Certificate No : 23-ACT-109

Request No : Req-2023-1406

**Sound pressure level**

**Calibration Results : Without Adjustment**

| Calibration Range<br>(dB) | Without Adjustment (dB) |       | Adjustment (dB) |       | Uncertainty<br>( ± dB) | Acceptance limit<br>Class 1 ( ± dB) |
|---------------------------|-------------------------|-------|-----------------|-------|------------------------|-------------------------------------|
|                           | Measured                | Error | Measured        | Error |                        |                                     |
| 94 dB / 1000 Hz           | 94.11                   | 0.11  | -               | -     | 0.13                   | 0.25                                |

**Frequency of Sound pressure level**

| Calibration Range<br>(Hz) | Without Adjustment |           | Adjustment    |           | Uncertainty<br>( ± %) | Acceptance limit<br>Class 1 ( ± %) |
|---------------------------|--------------------|-----------|---------------|-----------|-----------------------|------------------------------------|
|                           | Measured (Hz)      | Error (%) | Measured (Hz) | Error (%) |                       |                                    |
| 94 dB / 1000 Hz           | 1000.00            | 0.00      | -             | -         | 0.01                  | 0.70                               |

**Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)**

| Calibration Range<br>(Hz) | Without Adjustment | Adjustment   | Uncertainty<br>( ± %) | Acceptance limit<br>Class 1 ( ± %) |
|---------------------------|--------------------|--------------|-----------------------|------------------------------------|
|                           | Measured (%)       | Measured (%) |                       |                                    |
| 94 dB / 1000 Hz           | 0.08               | -            | 0.40                  | 2.5                                |

**Note :**

- Acceptance limit was IEC60942:2017 Class 1
- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

**End of Calibration**



# SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, 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. : ACL23111

Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00321441 / 139083 / 11461  
**ID No.:** UAE.EMA2.090/2555

**Condition As Found :** GOOD

**Customer :** UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)  
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,  
BANGCHAK SUB-DISTRICT,  
PHRAKHANONG DISTRICT, BANGKOK 10260  
THAILAND.

**Location :** -

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

**Received Date :** 05 APRIL 2023  
**Calibration Date :** 10 -11 APRIL 2023  
**Date of Issue :** 18 APRIL 2023

**Calibrated by :**

Nathakorn Pisutpaisan

**Approved by :**

( 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. : ACL23111

Job No. : VC66AC0044

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 :

| <u>Instrument</u>       | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator      | 33210A       | MY48017076        | EF-0009-23       | 07-FEB-24       |
| Waveform Generator      | 33511B       | MY52302742        | EF-0010-23       | 07-FEB-24       |
| Digital Multimeter      | 33461A       | MY53220104        | EEL.BP 30/0266   | 13-FEB-24       |
| Digital Multimeter      | 33461A       | MY53220076        | EEL.BP 29/0266   | 13-FEB-24       |
| Digital Multimeter      | 34461A       | MY60024273        | EEL.BP 31/0266   | 14-FEB-24       |
| Programmable Attenuator | MAT-1070     | 62100114          | EF-0011-23       | 08-FEB-24       |
| Condenser Microphone    | 4180         | 2977900           | AA-1001-23       | 14-FEB-24       |
| Measuring Amplifier     | NA-42KAI     | 34560495          | AA-3002-23       | 14-FEB-24       |

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. : ACL23111

Job No. : VC66AC0044

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   |

Note : Pass/Fail evaluation for each parameter,  
will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

## Continuation of Calibration Certificate

Cert. No. : ACL23111

Job No. : VC66AC0044

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 ) |
|--------------------------|
| 16.7                     |

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             | 14.4                     |
| C - weight             | 20.4                     |
| Flat                   | 26.2                     |

**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                 | 0.1  | 0.1      | 0.1      | ± 1.5                |
| 1000                | -0.1   | -0.1     | 0.0      | ± 1.0                |
| 8000                | 0.7  | 0.8      | 0.7      | ±5.0                 |



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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                  | 0.0  | -0.1     | 0.0      | ±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  | 0.0      | 0.0      | ±5.0                 |

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

**5.1 Frequency weightings at 1 kHz**

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

**5.2 Time weighting at 1 kHz**

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

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## 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                          | 137.1                       | 0.1                         | ± 1.1                          |
| 136.0                          | 136.1                       | 0.1                         | ± 1.1                          |
| 135.0                          | 135.1                       | 0.1                         | ± 1.1                          |
| 134.0                          | 134.1                       | 0.1                         | ± 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                          | 129.1                       | 0.1                         | ± 1.1                          |
| 124.0                          | 124.0                       | 0.0                         | ± 1.1                          |
| 119.0                          | 119.1                       | 0.1                         | ± 1.1                          |
| 114.0                          | 114.1                       | 0.1                         | ± 1.1                          |
| 109.0                          | 109.1                       | 0.1                         | ± 1.1                          |
| 104.0                          | 104.1                       | 0.1                         | ± 1.1                          |
| 99.0                           | 99.1                        | 0.1                         | ± 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                           | 30.1                        | 0.1                         | ± 1.1                          |
| 29.0                           | 29.1                        | 0.1                         | ± 1.1                          |
| 28.0                           | 28.1                        | 0.1                         | ± 1.1                          |
| 27.0                           | 27.1                        | 0.1                         | ± 1.1                          |
| 26.0                           | 26.3                        | 0.3                         | ± 1.1                          |
| 25.0                           | 25.2                        | 0.2                         | ± 1.1                          |



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

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

**9. Tone burst response**

| Time<br>Weighting | Tone burst<br>duration, Tb<br>( ms ) | Cycle | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|-------------------|--------------------------------------|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast              | 0.25                                 | 1     | 108.0                          | 107.9                       | -0.1                        | 1.5 ; -5.0                     |
|                   | 2                                    | 8     | 117.0                          | 116.9                       | -0.1                        | 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<br>in<br>test signal | Anticipated<br>Value<br>( dB ) | Measured<br>Value, Lcpeak<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|--------------------------------------|--------------------------------|-------------------------------------|-----------------------------|--------------------------------|
| Continuous                           | 133.0                          | 133.0                               | 0.0                         | ±3.0                           |
| One                                  | 136.4                          | 136.4                               | 0.0                         | ±3.0                           |

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

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## 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                       | 89.5                       | -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



# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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NSC-TISI-TIS 17025  
CALIBRATION 0394

Cert. No. : ACL23119

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## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 01010780 / 194535 / 14658  
**ID No.:** UAE.EFM.083/2565

**Condition As Found :** GOOD

**Customer :** UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)  
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,  
BANGCHAK SUB-DISTRICT,  
PHRAKHANONG DISTRICT, BANGKOK 10260  
THAILAND.

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

**Received Date :** 05 APRIL 2023  
**Calibration Date :** 10 -11 APRIL 2023  
**Date of Issue :** 18 APRIL 2023

**Calibrated by :**

Nathakorn Pisutpaisan

**Approved by :**

  
( 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

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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 :

| <u>Instrument</u>       | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator      | 33210A       | MY48017076        | EF-0009-23       | 07-FEB-24       |
| Waveform Generator      | 33511B       | MY52302742        | EF-0010-23       | 07-FEB-24       |
| Digital Multimeter      | 33461A       | MY53220104        | EEL.BP 30/0266   | 13-FEB-24       |
| Digital Multimeter      | 33461A       | MY53220076        | EEL.BP 29/0266   | 13-FEB-24       |
| Digital Multimeter      | 34461A       | MY60024273        | EEL.BP 31/0266   | 14-FEB-24       |
| Programmable Attenuator | MAT-1070     | 62100114          | EF-0011-23       | 08-FEB-24       |
| Condenser Microphone    | 4180         | 2977900           | AA-1001-23       | 14-FEB-24       |
| Measuring Amplifier     | NA-42KAI     | 34560495          | AA-3002-23       | 14-FEB-24       |

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).



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**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   |

Note : Pass/Fail evaluation for each parameter,  
will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

## Continuation of Calibration Certificate

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**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 ) |
|--------------------------|
| 14.6                     |

## 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             | 16.8                     |
| Flat                   | 22.6                     |

**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                 | 0.3  | 0.3      | 0.3      | ± 1.5                |
| 1000                | 0.0  | 0.0      | 0.0      | ± 1.0                |
| 8000                | 0.5  | 0.6      | 0.6      | ±5.0                 |



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

**5.2 Time weighting at 1 kHz**

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

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## 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                           | 53.9                        | -0.1                        | ± 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                           | 30.3                        | 0.3                         | ± 1.1                          |
| 29.0                           | 29.3                        | 0.3                         | ± 1.1                          |
| 28.0                           | 28.4                        | 0.4                         | ± 1.1                          |
| 27.0                           | 27.2                        | 0.2                         | ± 1.1                          |
| 26.0                           | 26.6                        | 0.6                         | ± 1.1                          |
| 25.0                           | 25.8                        | 0.8                         | ± 1.1                          |



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## 8. Level linearity including the level range control

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

## 9. Tone burst response

| Time<br>Weighting | Tone burst<br>duration, Tb<br>( ms ) | Cycle | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( 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<br>in<br>test signal | Anticipated<br>Value<br>( dB ) | Measured<br>Value, L <sub>peak</sub><br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|--------------------------------------|--------------------------------|--|-----------------------------|--------------------------------|
| Continuous                           | 133.0                          | 133.0  | 0.0                         | ±3.0                           |
| One                                  | 136.4                          | 135.6  | -0.8                        | ±3.0                           |

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



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## 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 |                             |                                |
| 89.7                       | 89.7                       | 0.0                         | ±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

# SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbumru, 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. : ACL23131

Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00409178 / 185837 / 90624  
**ID No.:** UAE.EFM.017/2564

**Condition As Found :** GOOD

**Customer :** UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)  
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,  
BANGCHAK SUB-DISTRICT,  
PHRAKHANONG DISTRICT, BANGKOK 10260  
THAILAND.

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

**Received Date :** 18 APRIL 2023  
**Calibration Date :** 24 -26 APRIL 2023  
**Date of Issue :** 27 APRIL 2023

**Calibrated by :**

Nathakorn Pisutpaisan

**Approved by :**

  
( 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. : ACL23131

Job No. : VC66AC0048

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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 :

| <u>Instrument</u>       | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator      | 33210A       | MY48017076        | EF-0009-23       | 07-FEB-24       |
| Waveform Generator      | 33511B       | MY52302742        | EF-0010-23       | 07-FEB-24       |
| Digital Multimeter      | 33461A       | MY53220104        | EEL.BP 30/0266   | 13-FEB-24       |
| Digital Multimeter      | 33461A       | MY53220076        | EEL.BP 29/0266   | 13-FEB-24       |
| Digital Multimeter      | 34461A       | MY60024273        | EEL.BP 31/0266   | 14-FEB-24       |
| Programmable Attenuator | MAT-1070     | 62100114          | EF-0011-23       | 08-FEB-24       |
| Condenser Microphone    | 4180         | 2977900           | AA-1001-23       | 14-FEB-24       |
| Measuring Amplifier     | NA-42KAI     | 34560495          | AA-3002-23       | 14-FEB-24       |

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. : ACL23131

Job No. : VC66AC0048

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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   |

Note : Pass/Fail evaluation for each parameter,  
will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

## Continuation of Calibration Certificate

Cert. No. : ACL23131

Job No. : VC66AC0048

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**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 (93.98)                           | 93.9                        | 0.0                 | ±0.3                          |

**2. Self-generated noise**

## 2.1 Normal test

| Measured Value<br>( dB ) |
|--------------------------|
| 14.8                     |

## 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             | 12.0                     |
| C - weight             | 18.1                     |
| Flat                   | 23.9                     |

**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) |          |          | Acceptance<br>Limits |
|---------------------|--|----------|----------|----------------------|
|                     | Flat   | C-weight | A-weight |                      |
| 125                 | 0.3  | 0.3      | 0.3      | ± 1.5                |
| 1000                | 0.1  | 0.1      | 0.1      | ± 1.0                |
| 8000                | 1.3  | 1.3      | 1.3      | ±5.0                 |

## Continuation of Calibration Certificate

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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  | 0.0      | 0.0      | ±5.0                 |

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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



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## 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                          | 137.1                       | 0.1                         | $\pm 1.1$                      |
| 136.0                          | 136.1                       | 0.1                         | $\pm 1.1$                      |
| 135.0                          | 135.1                       | 0.1                         | $\pm 1.1$                      |
| 134.0                          | 134.1                       | 0.1                         | $\pm 1.1$                      |
| 133.0                          | 133.0                       | 0.0                         | $\pm 1.1$                      |
| 132.0                          | 132.0                       | 0.0                         | $\pm 1.1$                      |
| 131.0                          | 131.0                       | 0.0                         | $\pm 1.1$                      |
| 129.0                          | 129.1                       | 0.1                         | $\pm 1.1$                      |
| 124.0                          | 124.0                       | 0.0                         | $\pm 1.1$                      |
| 119.0                          | 119.1                       | 0.1                         | $\pm 1.1$                      |
| 114.0                          | 114.1                       | 0.1                         | $\pm 1.1$                      |
| 109.0                          | 109.1                       | 0.1                         | $\pm 1.1$                      |
| 104.0                          | 104.1                       | 0.1                         | $\pm 1.1$                      |
| 99.0                           | 99.1                        | 0.1                         | $\pm 1.1$                      |
| 94.0                           | 94.0                        | 0.0                         | $\pm 1.1$                      |
| 89.0                           | 89.0                        | 0.0                         | $\pm 1.1$                      |
| 84.0                           | 84.0                        | 0.0                         | $\pm 1.1$                      |
| 79.0                           | 79.0                        | 0.0                         | $\pm 1.1$                      |
| 74.0                           | 74.0                        | 0.0                         | $\pm 1.1$                      |
| 69.0                           | 69.0                        | 0.0                         | $\pm 1.1$                      |
| 64.0                           | 64.0                        | 0.0                         | $\pm 1.1$                      |
| 59.0                           | 59.0                        | 0.0                         | $\pm 1.1$                      |
| 54.0                           | 54.0                        | 0.0                         | $\pm 1.1$                      |
| 49.0                           | 49.0                        | 0.0                         | $\pm 1.1$                      |
| 44.0                           | 44.0                        | 0.0                         | $\pm 1.1$                      |
| 39.0                           | 39.0                        | 0.0                         | $\pm 1.1$                      |
| 34.0                           | 34.0                        | 0.0                         | $\pm 1.1$                      |
| 30.0                           | 30.0                        | 0.0                         | $\pm 1.1$                      |
| 29.0                           | 29.1                        | 0.1                         | $\pm 1.1$                      |
| 28.0                           | 28.0                        | 0.0                         | $\pm 1.1$                      |
| 27.0                           | 27.1                        | 0.1                         | $\pm 1.1$                      |
| 26.0                           | 26.1                        | 0.1                         | $\pm 1.1$                      |
| 25.0                           | 25.1                        | 0.1                         | $\pm 1.1$                      |

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

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

**9. Tone burst response**

| Time<br>Weighting | Tone burst<br>duration, Tb<br>( ms ) | Cycle | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( 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<br>in<br>test signal | Anticipated<br>Value<br>( dB ) | Measured<br>Value, Lcpeak<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|--------------------------------------|--------------------------------|-------------------------------------|-----------------------------|--------------------------------|
| Continuous                           | 133.0                          | 133.0                               | 0.0                         | ±3.0                           |
| One                                  | 136.4                          | 136.1                               | -0.3                        | ±3.0                           |

| Number of cycle<br>in<br>test signal | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|--------------------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Continuous                           | 133.0                          | 133.0                       | 0.0                         | ±2.0                           |
| 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

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## 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                       | 89.6                       | 0.0                         | ±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



## Certificate of Calibration

### Customer

Name UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 23-NDM-185  
Address 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260 Request No : Req-2023-1488

### Unit Under Calibration Details

Measurement item : Noise Dosimeter Microphone Class : 2  
Manufacturer : SVANTEK Microphone Model : SV 27  
Model : SV 104 Microphone S/N : 136863  
Serial Number : 143231 Preamplifier Model : -  
ID : - Preamplifier S/N : -  
Resolution : 0.1 dB Intrument Status : New

### Calibration Environment and Details


Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 12 July 2023  
Calibrated Date : 7 August 2023  
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017  
Location of Calibration : Lab Acoustic


### Reference Standard

| Instrument                | Brand   | Model     | SN.    | Due calibration | Traceability |
|---------------------------|---------|-----------|--------|-----------------|--------------|
| Multifrequency Calibrator | Quest   | Quest-cal | 188272 | 25 July 2024    | TSI          |
| Standard Microphone       | GRAS    | 40AN      | 188273 | 6 October 2023  | GRAS         |
| Sine Generator            | Svantek | Svan401   | 131    | 12 October 2023 | WK Electric  |
| Timer                     | EXTECH  | -         | 05-ACT | 20 March 2024   | TPA          |

### Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor  $k = 2$ , providing a level of confidence approximately 95 %.

Calibrated By :   
Mr. Noppadon Luangart  
Calibration Officer

Approved By :   
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor

Issue Date : 7 August 2023

Certificate No : 23-NDM-185

Request No : Req-2023-1488

### 1. Absolute acoustical sensitivity

| UUC Setting        | Time |     | Exposure Measurement |                     |       | UNCERTAINTY | Tolerances<br>Limit |
|--------------------|------|-----|----------------------|---------------------|-------|-------------|---------------------|
| FAST / A / 55-140  | Ref  | UUC | Ref                  | UUC                 | Error |             |                     |
| Calibrator Setting | (s)  | (s) | (Pa <sup>2</sup> h)  | (Pa <sup>2</sup> h) | (%)   | (%)         | (%)                 |
| 1000 Hz 114 dB     | 120  | 120 | 3.18                 | 3.13                | -1.57 | 3.1         | -21, +26            |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

### 2. Frequency weightings

| UUC Setting   | Deviation from various<br>Frequency Weighting |      | UNCERTAINTY | Tolerances<br>Limit |
|---------------|---|------|-------------|---------------------|
| FAST / 55-140 | A   | C    | ( ± dB)     | ( ± dB)             |
| STD Setting   | (dB)  | (dB) |             |                     |
| *63 Hz        | 0.0   | 0.1  | 0.40        | 2.0                 |
| 125 Hz        | 0.3   | 0.6  | 0.40        | 1.5                 |
| 250 Hz        | 0.0   | 0.5  | 0.40        | 1.5                 |
| 500 Hz        | 0.1   | 0.5  | 0.40        | 1.5                 |
| 1000 Hz       | 0.0   | 0.0  | 0.40        | -                   |
| 2000 Hz       | -0.4  | 0.0  | 0.40        | 2.0                 |
| 4000 Hz       | 1.7   | 1.8  | 0.40        | 3.0                 |
| 8000 Hz       | -2.9  | -2.9 | 0.40        | 5.0                 |

Certificate No : 23-NDM-185

Request No : Req-2023-1488

### 3. Linearity of response to steady signals

#### a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting      |         | FAST / A / High |      |      |      |       |       |       |       |       |       |
|------------------|---------|-----------------|------|------|------|-------|-------|-------|-------|-------|-------|
| 1000 Hz          | Ref     | (dB)            | 55.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 |
|                  | Level A | (dB)            | 54.6 | 80.1 | 90.1 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 |
|                  | Error   | (dB)            | -0.4 | 0.1  | 0.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   |
| 8000 Hz          | Ref     | (dB)            |      |      |      | 88.9  | 98.9  | 108.9 | 112.9 | 118.9 | 128.9 |
|                  | Level A | (dB)            |      |      |      | 88.9  | 98.9  | 108.9 | 112.9 | 118.8 | 128.8 |
|                  | Error   | (dB)            |      |      |      | 0.0   | 0.0   | 0.0   | 0.0   | -0.1  | -0.1  |
| 63 Hz            | Ref     | (dB)            |      |      |      |       |       | 87.8  | 93.8  | 103.8 | 113.8 |
|                  | Level A | (dB)            |      |      |      |       |       | 87.8  | 93.8  | 103.8 | 113.8 |
|                  | Error   | (dB)            |      |      |      |       |       | 0.0   | 0.0   | 0.0   | 0.0   |
| Tolerances Limit |         | (±dB)           | 1.0  |      |      |       |       |       |       |       |       |
| UNCERTAINTY      |         | (±dB)           | 0.3  |      |      |       |       |       |       |       |       |

#### b. Sound exposure meter linearity of error

| UUC Setting        | Time |     | Exposure Measurement |                     |       | UNCERTAINTY | Tolerances |
|--------------------|------|-----|----------------------|---------------------|-------|-------------|------------|
| FAST / A / 55-140  | Ref  | UUC | Ref                  | UUC                 | Error |             |            |
| Calibrator Setting | (s)  | (s) | (Pa <sup>2</sup> h)  | (Pa <sup>2</sup> h) | (%)   |             |            |
| 1000 Hz 110 dB     | 27   | 27  | 0.30                 | 0.30                | 0.00  | 5.6         | -21, +26   |
| 1000 Hz 110 dB     | 45   | 45  | 0.50                 | 0.50                | 0.00  |             |            |
| 1000 Hz 110 dB     | 90   | 90  | 1.00                 | 0.99                | -1.00 |             |            |
| 1000 Hz 110 dB     | 180  | 180 | 2.00                 | 1.98                | -1.00 |             |            |
| 1000 Hz 120 dB     | 36   | 36  | 4.00                 | 3.94                | -1.50 |             |            |
| 1000 Hz 120 dB     | 72   | 72  | 8.00                 | 7.87                | -1.63 | 5.6         |            |
| 1000 Hz 120 dB     | 90   | 90  | 10.00                | 9.90                | -1.00 |             |            |
| 1000 Hz 120 dB     | 180  | 180 | 20.00                | 19.76               | -1.20 |             |            |
| 1000 Hz 120 dB     | 360  | 360 | 40.00                | 39.42               | -1.45 |             |            |
| 1000 Hz 120 dB     | 720  | 720 | 80.00                | 78.66               | -1.68 |             |            |



Certificate No : 23-NDM-185

Request No : Req-2023-1488

#### 4. Response to short duration

##### a. Response for sinusoidal signals - reference level

| UUC Setting        | Time |      | Exposure Measurement |                     |                     | UNCERTAINTY         | Tolerances          |
|--------------------|------|------|----------------------|---------------------|---------------------|---------------------|---------------------|
| FAST / A / 55-140  | Ref  | UUC  | Ref                  | UUC                 | Error               |                     | Limit               |
| Calibrator Setting | (s)  | (s)  | (Pa <sup>2</sup> h)  | (Pa <sup>2</sup> h) | (Pa <sup>2</sup> h) | (Pa <sup>2</sup> h) | (Pa <sup>2</sup> h) |
| 4000 Hz 95 dB      | 2846 | 2846 | 1.00                 | 1.00                | 0.00                | 0.052               | -0.29 - +0.41       |

##### b. Sound exposure meter response for series of toneburst impulses

| UUC Setting        | Time |      | Exposure Measurement |                     |       | UNCERTAINTY | Tolerances |
|--------------------|------|------|----------------------|---------------------|-------|-------------|------------|
| FAST / A / 55-140  | Ref  | UUC  | Ref                  | UUC                 | Error |             | Limit      |
| Calibrator Setting | (s)  | (s)  | (Pa <sup>2</sup> h)  | (Pa <sup>2</sup> h) | (%)   | (%)         | (%)        |
| Burst 1 ms, 95 dB  | 2846 | 2846 | 1.00                 | 1.00                | 0.00  | 5.6         | -21 - +26  |
| Burst 1 ms, 100 dB | 900  | 900  | 1.00                 | 1.00                | 0.00  |             | -29 - +41  |
| Burst 1 ms, 108 dB | 143  | 143  | 1.00                 | 1.01                | +1.00 |             | -29 - +41  |

#### 5. Response to unipolar pulse

| UUC Setting            | Time | Exposure Measurement |           | UNCERTAINTY | Tolerances |
|------------------------|------|----------------------|-----------|-------------|------------|
| FAST / A / 55-140      | UUC  | UUC                  | Different |             | Limit      |
| Calibrator Setting     | (s)  | (Pa <sup>2</sup> h)  | (%)       | (%)         | (%)        |
| Continuous Rectangle + | 29   | 10.13                | 0.00      | 3.7         | -21 - +26  |
| Continuous Rectangle - |      | 10.13                |           |             |            |

\* Indicates non accredited

End of Certificate

## Certificate of Calibration

### Customer

Name UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 23-NDM-179

Request No : Req-2023-1488

### Unit Under Calibration Details

Measurement item : Noise Dosimeter  
Manufacturer : SVANTEK  
Model : SV 104  
Serial Number : 143225  
ID : -  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : SV 27  
Microphone S/N : 139831  
Preamplifier Model : -  
Preamplifier S/N : -  
Instrument Status : New

### Calibration Environment and Details


Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 12 July 2023  
Calibrated Date : 7 August 2023  
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017  
Location of Calibration : Lab Acoustic


### Reference Standard

| Instrument                | Brand   | Model     | SN.    | Due calibration | Traceability |
|---------------------------|---------|-----------|--------|-----------------|--------------|
| Multifrequency Calibrator | Quest   | Quest-cal | 188272 | 25 July 2024    | TSI          |
| Standard Microphone       | GRAS    | 40AN      | 188273 | 6 October 2023  | GRAS         |
| Sine Generator            | Svantek | Svan401   | 131    | 12 October 2023 | WK Electric  |
| Timer                     | EXTECH  | -         | 05-ACT | 20 March 2024   | TPA          |

### Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor  $k = 2$ , providing a level of confidence approximately 95 %.

Calibrated By :   
Mr. Noppadon Luangart  
Calibration Officer

Approved By :   
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor

Issue Date : 7 August 2023

Certificate No : 23-NDM-179

Request No : Req-2023-1488

### 1. Absolute acoustical sensitivity

| UUC Setting        | Time |     | Exposure Measurement |                     |       | UNCERTAINTY | Tolerances<br>Limit |
|--------------------|------|-----|----------------------|---------------------|-------|-------------|---------------------|
| FAST / A / 55-140  | Ref  | UUC | Ref                  | UUC                 | Error |             |                     |
| Calibrator Setting | (s)  | (s) | (Pa <sup>2</sup> h)  | (Pa <sup>2</sup> h) | (%)   | (%)         | (%)                 |
| 1000 Hz 114 dB     | 120  | 120 | 3.18                 | 3.13                | -1.57 | 3.1         | -21, +26            |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

### 2. Frequency weightings

| UUC Setting   | Deviation from various<br>Frequency Weighting |      | UNCERTAINTY | Tolerances<br>Limit |
|---------------|---|------|-------------|---------------------|
| FAST / 55-140 | A   | C    | (± dB)      | (± dB)              |
| STD Setting   | (dB)  | (dB) |             |                     |
| *63 Hz        | 0.0   | 0.1  | 0.40        | 2.0                 |
| 125 Hz        | 0.7   | 0.9  | 0.40        | 1.5                 |
| 250 Hz        | 0.3   | 0.8  | 0.40        | 1.5                 |
| 500 Hz        | 0.3   | 0.7  | 0.40        | 1.5                 |
| 1000 Hz       | 0.0   | 0.0  | 0.40        | -                   |
| 2000 Hz       | -0.6  | -0.2 | 0.40        | 2.0                 |
| 4000 Hz       | 2.3   | 2.4  | 0.40        | 3.0                 |
| 8000 Hz       | -2.9  | -2.9 | 0.40        | 5.0                 |



Certificate No : 23-NDM-179

Request No : Req-2023-1488

### 3. Linearity of response to steady signals

#### a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting      |         | FAST / A / High |      |      |      |       |       |       |       |       |       |
|------------------|---------|-----------------|------|------|------|-------|-------|-------|-------|-------|-------|
| 1000 Hz          | Ref     | (dB)            | 55.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 |
|                  | Level A | (dB)            | 54.5 | 80.1 | 90.1 | 100.1 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 |
|                  | Error   | (dB)            | -0.5 | 0.1  | 0.1  | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   |
| 8000 Hz          | Ref     | (dB)            |      |      |      | 88.9  | 98.9  | 108.9 | 112.9 | 118.9 | 128.9 |
|                  | Level A | (dB)            |      |      |      | 89.0  | 98.9  | 108.9 | 112.9 | 118.9 | 128.9 |
|                  | Error   | (dB)            |      |      |      | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | -0.1  |
| 63 Hz            | Ref     | (dB)            |      |      |      |       |       | 87.8  | 93.8  | 103.8 | 113.8 |
|                  | Level A | (dB)            |      |      |      |       |       | 87.8  | 93.8  | 103.8 | 113.8 |
|                  | Error   | (dB)            |      |      |      |       |       | 0.0   | 0.0   | 0.0   | 0.0   |
| Tolerances Limit |         | (±dB)           | 1.0  |      |      |       |       |       |       |       |       |
| UNCERTAINTY      |         | (±dB)           | 0.3  |      |      |       |       |       |       |       |       |

#### b. Sound exposure meter linearity of error

| UUC Setting        | Time |     | Exposure Measurement |                     |       | UNCERTAINTY | Tolerances |
|--------------------|------|-----|----------------------|---------------------|-------|-------------|------------|
| FAST / A / 55-140  | Ref  | UUC | Ref                  | UUC                 | Error |             | Limit      |
| Calibrator Setting | (s)  | (s) | (Pa <sup>2</sup> h)  | (Pa <sup>2</sup> h) | (%)   |             |            |
| 1000 Hz 110 dB     | 27   | 27  | 0.30                 | 0.30                | 0.00  | 5.6         | -21, +26   |
| 1000 Hz 110 dB     | 45   | 45  | 0.50                 | 0.50                | 0.00  |             |            |
| 1000 Hz 110 dB     | 90   | 90  | 1.00                 | 1.01                | +1.00 |             |            |
| 1000 Hz 110 dB     | 180  | 180 | 2.00                 | 2.02                | +1.00 |             |            |
| 1000 Hz 120 dB     | 36   | 36  | 4.00                 | 4.03                | +0.75 |             |            |
| 1000 Hz 120 dB     | 72   | 72  | 8.00                 | 8.05                | +0.63 | 5.6         |            |
| 1000 Hz 120 dB     | 90   | 90  | 10.00                | 9.90                | -1.00 |             |            |
| 1000 Hz 120 dB     | 180  | 180 | 20.00                | 20.22               | +1.10 |             |            |
| 1000 Hz 120 dB     | 360  | 360 | 40.00                | 40.34               | +0.85 |             |            |
| 1000 Hz 120 dB     | 720  | 720 | 80.00                | 80.49               | +0.61 |             |            |

Certificate No : 23-NDM-179

Request No : Req-2023-1488

#### 4. Response to short duration

##### a. Response for sinusoidal signals - reference level

| UUC Setting        | Time |      | Exposure Measurement |                     |                     | UNCERTAINTY         | Tolerances<br>Limit |
|--------------------|------|------|----------------------|---------------------|---------------------|---------------------|---------------------|
| FAST / A / 55-140  | Ref  | UUC  | Ref                  | UUC                 | Error               |                     |                     |
| Calibrator Setting | (s)  | (s)  | (Pa <sup>2</sup> h)  | (Pa <sup>2</sup> h) | (Pa <sup>2</sup> h) | (Pa <sup>2</sup> h) | (Pa <sup>2</sup> h) |
| 4000 Hz 95 dB      | 2846 | 2846 | 1.00                 | 1.00                | 0.00                | 0.052               | -0.29 - +0.41       |

##### b. Sound exposure meter response for series of toneburst impulses

| UUC Setting        | Time |      | Exposure Measurement |                     |       | UNCERTAINTY | Tolerances<br>Limit |
|--------------------|------|------|----------------------|---------------------|-------|-------------|---------------------|
| FAST / A / 55-140  | Ref  | UUC  | Ref                  | UUC                 | Error |             |                     |
| Calibrator Setting | (s)  | (s)  | (Pa <sup>2</sup> h)  | (Pa <sup>2</sup> h) | (%)   | (%)         | (%)                 |
| Burst 1 ms, 95 dB  | 2846 | 2846 | 1.00                 | 1.00                | 0.00  | 5.6         | -21 - +26           |
| Burst 1 ms, 100 dB | 900  | 900  | 1.00                 | 1.00                | 0.00  |             | -29 - +41           |
| Burst 1 ms, 108 dB | 143  | 143  | 1.00                 | 1.01                | +1.00 |             | -29 - +41           |

#### 5. Response to unipolar pulse

| UUC Setting            | Time | Exposure Measurement |           | UNCERTAINTY | Tolerances<br>Limit |
|------------------------|------|----------------------|-----------|-------------|---------------------|
| FAST / A / 55-140      | UUC  | UUC                  | Different |             |                     |
| Calibrator Setting     | (s)  | (Pa <sup>2</sup> h)  | (%)       | (%)         | (%)                 |
| Continuous Rectangle + | 29   | 10.37                | 0.00      | 3.7         | -21 - +26           |
| Continuous Rectangle - |      | 10.37                |           |             |                     |

\* Indicates non accredited

End of Certificate

## ภาคผนวก ฉ

หนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

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ที่ อก ๐๓๑๐(๑)/ ๘๗๒๔

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๕ พฤษภาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๑๖ พฤษภาคม ๒๕๖๖

ตามหนังสือที่อ้างถึง บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด  
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๑๔๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก  
เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ ราย

- |                                 |                            |
|---------------------------------|----------------------------|
| ๑) นางสาวพริตตา เจริญชัยสมบัติ  | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๓๐ |
| ๒) นายสงกรานต์ มาลัยทอง         | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๘๗ |
| ๓) นางสาวธนธรณ์ คุณานุพันธ์ชัย  | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๘๒ |
| ๔) นางสาวธนภรณ์ ลาพรม           | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๐๐ |
| ๕) นางสาวสุภารัตน์ จันทร์ประทัด | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๐๕ |

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๔ ราย

- |                           |                            |
|---------------------------|----------------------------|
| ๑) นางสาววิฑิตา ฝ่ายสิงห์ | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๔๓ |
| ๒) นางสาวณเฮอร์ลิน สุจริต | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๔๔ |
| ๓) นางสาวเพ็ญพิชชา รอดทอง | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๔๕ |
| ๔) นางสาวณัชชา แสงสว่าง   | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๔๖ |

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์  
เอกชน คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์  
กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายประสม ดำรงพงษ์)

ผู้อำนวยการกองวิจัยและเฝ้าระวังมลพิษโรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

UNITED ANALYST AND ENGINEERING  
CONSULTANT COMPANY LIMITED

กองวิจัยและเฝ้าระวังมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



“อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว”



ดำเนินถูกต้อง

ที่ อก ๐๓๑๐(๑)/ ๒๐๒ ๘



กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๒ มีนาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูไนเต็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน

ลงวันที่ ๓๐ มกราคม ๒๕๖๖

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์

บริษัท ยูไนเต็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด จำนวน ๒ แผ่น

ตามหนังสือที่อ้างถึง บริษัท ยูไนเต็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๑๔๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย

- |                        |               |              |
|------------------------|---------------|--------------|
| ๑) นายวิชณุ สุวรรณราช  | ทะเบียนเลขที่ | ว-๑๔๕-จ-๐๐๑๖ |
| ๒) นายพิพัฒน์ ตันธนกุล | ทะเบียนเลขที่ | ว-๑๔๕-จ-๐๐๕๗ |

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๑ ราย

- |                              |               |              |
|------------------------------|---------------|--------------|
| ๑) นางสาวอรุณา ประสานศรี     | ทะเบียนเลขที่ | ว-๑๔๕-จ-๐๑๓๒ |
| ๒) นายนพดล เนียมนิยม         | ทะเบียนเลขที่ | ว-๑๔๕-จ-๐๑๓๓ |
| ๓) นายศุภกร สวนศรี           | ทะเบียนเลขที่ | ว-๑๔๕-จ-๐๑๓๔ |
| ๔) นายคณพล คิลานนท์          | ทะเบียนเลขที่ | ว-๑๔๕-จ-๐๑๓๕ |
| ๕) นายโชคชัย พุ่มไสว         | ทะเบียนเลขที่ | ว-๑๔๕-จ-๐๑๓๖ |
| ๖) นายนวชัย กลับบ้านเกาะ     | ทะเบียนเลขที่ | ว-๑๔๕-จ-๐๑๓๗ |
| ๗) นายธีรวัฒน์ ธรรมสุวรรณ    | ทะเบียนเลขที่ | ว-๑๔๕-จ-๐๑๓๘ |
| ๘) นายนันทพงศ์ ชะขุนทด       | ทะเบียนเลขที่ | ว-๑๔๕-จ-๐๑๓๙ |
| ๙) นางสาวณัฐกฤตา พลนิกรกิจ   | ทะเบียนเลขที่ | ว-๑๔๕-จ-๐๑๔๐ |
| ๑๐) นางสาวชไมพร ทองบุรณ์     | ทะเบียนเลขที่ | ว-๑๔๕-จ-๐๑๔๑ |
| ๑๑) นางสาวพรชิตา ขจรเนติยุทธ | ทะเบียนเลขที่ | ว-๑๔๕-จ-๐๑๔๒ |

๓. ให้เพิ่มขอบข่ายสารมลพิษที่วิเคราะห์ในดิน ตามสิ่งที่ส่งมาด้วย

**UAE**  
UNITED ANALYST AND ENGINEERING  
CONSULTANT COMPANY LIMITED

  
ดำเนินาณูกตอง

อนึ่ง...

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
ที่ อก ๐๓๑๐(๑)/๑๘๗๙ ลงวันที่ ๙ กุมภาพันธ์ ๒๕๖๕ คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอ  
ผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



(นายประสม ดำรงพงษ์)  
ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
ปฏิบัติการตรวจเฝ้าระวังมลพิษโรงงานอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕ โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th

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ดำเนินาถูกต้อง





เอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์

บริษัท ยูโนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด เลขทะเบียน ว-๑๔๕

ที่ อก ๐๓๑๐(๑)/ ๖๐๒ ๘

ลงวันที่ ๒๒ มีนาคม ๒๕๖๖

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๖ รายการ

เดิม จำนวน 16 รายการ

| ลำดับที่ | สารมลพิษ                   | วิธีวิเคราะห์   |
|----------|----------------------------|---|
| 1        | Benzene                    | Equilibrium Headspace, Gas Chromatographic/<br>Mass Spectrometric Method <sup>[1,2]</sup> |
| 2        | Carbon tetrachloride       | Equilibrium Headspace, Gas Chromatographic/<br>Mass Spectrometric Method <sup>[1,2]</sup> |
| 3        | 1,2-Dichloroethane         | Equilibrium Headspace, Gas Chromatographic/<br>Mass Spectrometric Method <sup>[1,2]</sup> |
| 4        | 1,1-Dichloroethylene       | Equilibrium Headspace, Gas Chromatographic/<br>Mass Spectrometric Method <sup>[1,2]</sup> |
| 5        | cis-1,2-Dichloroethylene   | Equilibrium Headspace, Gas Chromatographic/<br>Mass Spectrometric Method <sup>[1,2]</sup> |
| 6        | trans-1,2-Dichloroethylene | Equilibrium Headspace, Gas Chromatographic/<br>Mass Spectrometric Method <sup>[1,2]</sup> |
| 7        | Ethylbenzene               | Equilibrium Headspace, Gas Chromatographic/<br>Mass Spectrometric Method <sup>[1,2]</sup> |
| 8        | Methylene chloride         | Equilibrium Headspace, Gas Chromatographic/<br>Mass Spectrometric Method <sup>[1,2]</sup> |
| 9        | Styrene                    | Equilibrium Headspace, Gas Chromatographic/<br>Mass Spectrometric Method <sup>[1,2]</sup> |
| 10       | Tetrachloroethylene        | Equilibrium Headspace, Gas Chromatographic/<br>Mass Spectrometric Method <sup>[1,2]</sup> |
| 11       | Toluene                    | Equilibrium Headspace, Gas Chromatographic/<br>Mass Spectrometric Method <sup>[1,2]</sup> |
| 12       | Trichloroethylene          | Equilibrium Headspace, Gas Chromatographic/<br>Mass Spectrometric Method <sup>[1,2]</sup> |
| 13       | m-Xylene                   | Equilibrium Headspace, Gas Chromatographic/<br>Mass Spectrometric Method <sup>[1,2]</sup> |
| 14       | o-Xylene                   | Equilibrium Headspace, Gas Chromatographic/<br>Mass Spectrometric Method <sup>[1,2]</sup> |
| 15       | p-Xylene                   | Equilibrium Headspace, Gas Chromatographic/<br>Mass Spectrometric Method <sup>[1,2]</sup> |
| 16       | Xylene (Total)             | Equilibrium Headspace, Gas Chromatographic/<br>Mass Spectrometric Method <sup>[1,2]</sup> |

เอกสารอ้างอิง...

เอกสารอ้างอิง

1. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Volatile Organic Compounds in Various Sample Matrices Using Equilibrium Headspace Analysis**. SW-846 Method 5021A, 2014.
2. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry**. SW-846 Method 8260D, 2018. 



  
**ดำเนินาถูกต้อง**



ที่ อก ๐๓๑๐(๑)/ ๑๕๕๕ ๓

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๕ ตุลาคม ๒๕๖๕

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๑๘ ตุลาคม ๒๕๖๕

ตามหนังสือที่อ้างถึง บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด  
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๑๔๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก  
เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๔ ราย

- |                                   |                            |
|-----------------------------------|----------------------------|
| ๑) นางสาวสุธรรมา แก้วซ้อนนอก      | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๐๒ |
| ๒) นายกานต์พงศ์ บุญพวง            | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๙ |
| ๓) นายกฤตพล พงศ์สถาพร             | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๙๕ |
| ๔) นางสาวธัญญลักษณ์ ธนโชติกาญจนกร | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๐๗ |

๒. ให้เพิ่มผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย

- |                              |                            |
|------------------------------|----------------------------|
| ๑) นายกานต์พงศ์ บุญพวง       | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๔๑ |
| ๒) นางสาวสุธรรมา แก้วซ้อนนอก | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๔๒ |

๓. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๒ ราย

- |                            |                            |
|----------------------------|----------------------------|
| ๑) นายชินวัฒน์ หอยสังข์    | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๒๐ |
| ๒) นายประพันธ์ แก้วภาค     | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๒๑ |
| ๓) นายกิตติบดี มุสิกเตุ    | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๒๒ |
| ๔) นายคุณานนท์ ฤทธาคนานนท์ | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๒๓ |
| ๕) นายชาญณรงค์ อ่ำลอย      | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๒๔ |
| ๖) นางสาวจิตรมาส ศรีวรรณ   | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๒๕ |
| ๗) นายสุจิต โปชันเงิน      | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๒๖ |
| ๘) นายเจษฎา ช่วยตริก       | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๒๗ |
| ๙) นายรชต เหมะจุลิน        | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๒๘ |
| ๑๐) นายสุรศักดิ์ ชุมเอียด  | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๒๙ |
| ๑๑) นายสุรโชค หล้าโท       | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๓๐ |
| ๑๒) นายชัย บัวสด           | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๓๑ |

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ลงนามถูกต้อง

อนึ่ง หนังสือฉบับนี้...



อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
ที่ อก ๐๓๑๐(๑)/๑๘๗๙ ลงวันที่ ๙ กุมภาพันธ์ ๒๕๖๕ คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอ  
ผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ทำหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



(นายประสม ดำรงพงษ์)

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



ดำเนินการถูกต้อง



“อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว”





ที่ อก ๐๓๑๐(๑)/ ๑๒ ๑๗ ๓

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๐ ๑ กันยายน ๒๕๖๕

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๒๖ สิงหาคม ๒๕๖๕

ตามหนังสือที่อ้างถึง บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด  
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๑๔๕๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก  
เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๘ ราย

- |                                  |                             |
|----------------------------------|-----------------------------|
| ๑) นายปรีดา ไชยภูมิสกุล          | ทะเบียนเลขที่ ว-๑๔๕๕-จ-๐๐๓๓ |
| ๒) นายปิยะณัฐ ศรีภูโรจน์         | ทะเบียนเลขที่ ว-๑๔๕๕-จ-๐๐๓๕ |
| ๓) นายธีรเมธ สุขศรี              | ทะเบียนเลขที่ ว-๑๔๕๕-จ-๐๐๔๑ |
| ๔) นางสาวศิริวรรณ ขอนพา          | ทะเบียนเลขที่ ว-๑๔๕๕-จ-๐๐๕๐ |
| ๕) นายศักดิ์สิทธิ์ เกิดข้ง       | ทะเบียนเลขที่ ว-๑๔๕๕-จ-๐๐๖๓ |
| ๖) นางสาวลัดดาวลย์ โพธิ์พันธ์    | ทะเบียนเลขที่ ว-๑๔๕๕-จ-๐๐๘๐ |
| ๗) นางสาวกมลวรรณ เจริญจันทร์     | ทะเบียนเลขที่ ว-๑๔๕๕-จ-๐๐๘๑ |
| ๘) นางสาวจันทร์จิรา ประกอบทรัพย์ | ทะเบียนเลขที่ ว-๑๔๕๕-จ-๐๑๐๘ |

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๑ ราย

- |                               |                             |
|-------------------------------|-----------------------------|
| ๑) นางสาวนาตาชา แหวนในเมือง   | ทะเบียนเลขที่ ว-๑๔๕๕-จ-๐๑๐๙ |
| ๒) นางสาวพิมพ์วรรณ สิมมา      | ทะเบียนเลขที่ ว-๑๔๕๕-จ-๐๑๑๐ |
| ๓) นายนันทวัฒน์ วงศ์คำ        | ทะเบียนเลขที่ ว-๑๔๕๕-จ-๐๑๑๑ |
| ๔) นายประพันธ์ยุทธ เพ็ญนาง    | ทะเบียนเลขที่ ว-๑๔๕๕-จ-๐๑๑๒ |
| ๕) นางสาวศมิษฐา ลำซิด         | ทะเบียนเลขที่ ว-๑๔๕๕-จ-๐๑๑๓ |
| ๖) นางสาวนภาพร ชื่นนุกข์      | ทะเบียนเลขที่ ว-๑๔๕๕-จ-๐๑๑๔ |
| ๗) นางสาวเบญญา มอมงคุณ        | ทะเบียนเลขที่ ว-๑๔๕๕-จ-๐๑๑๕ |
| ๘) นายอมรพล อมรลักษณ์         | ทะเบียนเลขที่ ว-๑๔๕๕-จ-๐๑๑๖ |
| ๙) นางสาวศรีเพชร ทองขาว       | ทะเบียนเลขที่ ว-๑๔๕๕-จ-๐๑๑๗ |
| ๑๐) นางสาวณิชากร ศุภชาติไกรสร | ทะเบียนเลขที่ ว-๑๔๕๕-จ-๐๑๑๘ |
| ๑๑) นางสาววิมลวรรณ คำตัน      | ทะเบียนเลขที่ ว-๑๔๕๕-จ-๐๑๑๙ |

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อนึ่ง หนังสือฉบับนี้...

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
ที่ อก ๐๓๑๐(๑)/๑๘๗๙ ลงวันที่ ๙ กุมภาพันธ์ ๒๕๖๕ คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอ  
ผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ห้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



(นางจันทา เดชะศรีนทร์)

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
ปฏิบัติการการแทนอธิบดีกรมโรงงานอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th

**UAE**

UNITED ANALYST AND ENGINEERING  
CONSULTANT COMPANY LIMITED

  
ดำเนินาถูกต้อง





ที่ อก ๐๓๑๐(๑)/ ๔๗๘ ๗



กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๑ เมษายน ๒๕๖๕

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๓๐ มีนาคม ๒๕๖๕

ตามหนังสือที่อ้างถึง บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด  
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๑๔๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ถนนสุขุมวิท แขวงบางจาก  
เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย

- |                       |                            |
|-----------------------|----------------------------|
| ๑) นางมานิดา แยมโย    | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๐๕ |
| ๒) นางสาวนภสวรรณ คงขำ | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๓๒ |

๒. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย

- |                           |                            |
|---------------------------|----------------------------|
| ๑) นางสาวศิริพร อปการัตน์ | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๖๔ |
| ๒) นางสาวพรนัชชา กลิ่นอุณ | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๘๔ |

๓. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย

- |                                   |                            |
|-----------------------------------|----------------------------|
| ๑) นางสาวธัญญลักษณ์ ธนโชติกาญจนกร | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๐๗ |
| ๒) นางสาวจันทร์จิรา ประกอบทรัพย์  | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๐๘ |

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
ที่ อก ๐๓๑๐(๑)/๑๘๗๙ ลงวันที่ ๙ กุมภาพันธ์ ๒๕๖๕ คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอ  
ผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

  
(นางจินดา เดชะศรีรินทร์)

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕ โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



ดำเนินาถูกต้อง



“อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว”







ที่ อก ๐๓๑๐(๑)/ ๑๘๗ ๙

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๐ ๙ กุมภาพันธ์ ๒๕๖๕

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท ยูไนเต็ท แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๒๗ ธันวาคม ๒๕๖๔

สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย  
๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย  
๓. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม


ตามหนังสือที่อ้างถึง บริษัท ยูไนเต็ท แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด ขอต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๑๔๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท ยูไนเต็ท แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้  
ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย ตามสิ่งที่ส่งมาด้วย ๑  
ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย ตามสิ่งที่ส่งมาด้วย ๒  
ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย น้ำใต้ดิน อากาศเสีย สิ่งปฏิกูล หรือวัสดุที่ไม่ใช้แล้ว และดิน ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ หากประสงค์จะต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อกรมโรงงานอุตสาหกรรมภายใน ๓๐ วัน ก่อนวันสิ้นสุดอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

  
(นางจินดา เตชะศรีนทร์)  
ผู้อำนวยการกองวิจัยและพัฒนายุทธศาสตร์โรงงาน  
ปฏิบัติการด้านสิ่งแวดล้อมโรงงานอุตสาหกรรม  
UNITED ANALYST AND ENGINEERING  
CONSULTANT COMPANY LIMITED



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์  
**ดำเนินการถูกต้อง**

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๔๙

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.gmail.go.th




เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
บริษัท ยูไนเต็ท แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด เลขทะเบียน ว-๑๔๕  
ที่ อก ๐๓๑๐(๑)/ ๑๘๗๙ ลงวันที่ ๐๙ กุมภาพันธ์ ๒๕๖๕

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย

|                                     |                            |
|-------------------------------------|----------------------------|
| ๑) นางสาวกฤชวรรณ ภัทรธีรกุล         | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๐๑ |
| ๒) นายณรงค์ นิมพาลี                 | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๐๒ |
| ๓) นางสาวนันทิตา บุญไสย             | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๐๓ |
| ๔) นางปิยะพัชร สุทมนัสวงษ์          | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๐๔ |
| ๕) นางมานิดา แยมโย                  | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๐๕ |
| ๖) นางสาวเบญจวรรณ วิริโยทัย         | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๐๖ |
| ๗) นายพนรัตน์ วงศ์อนุรักษชัย        | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๐๗ |
| ๘) นางสาวฉวีวรรณ บุญลา              | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๐๘ |
| ๙) นายสุวิทย์ จอดนอก                | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๐๙ |
| ๑๐) นางสาวโชติภา สมบรรณ             | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๑๐ |
| ๑๑) นางสาวบุษกร เลิศภาณุมาศ         | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๑๑ |
| ๑๒) นางสาววิไลลักษณ์ ศรีสุข         | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๑๒ |
| ๑๓) นางสาวปวีณา จรัสโชติพิณิต       | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๑๓ |
| ๑๔) นายศิลา บรรจงใจรักษ์            | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๑๔ |
| ๑๕) นายปฏิกรณ์ คณะนา                | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๑๕ |
| ๑๖) นายธีรวัฒน์ ขมมิ่ง              | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๑๖ |
| ๑๗) นางสาวศิริพร ศรีประดิษฐ์        | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๑๗ |
| ๑๘) นางสาวสวาทรี รัง                | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๑๘ |
| ๑๙) นางสาวนพวรรณ อูรารักษ์          | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๑๙ |
| ๒๐) นายภูษงค์ พานิชย์เลิศอำไพ       | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๒๐ |
| ๒๑) นายณัฐวัฒน์ แดงสวัสดิ์          | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๒๑ |
| ๒๒) นายเอกรัตน์ ปละคามินทร์         | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๒๒ |
| ๒๓) นางสาวนิศารัตน์ ศรีสกุลสิทธิโชค | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๒๓ |
| ๒๔) นางสาวเจตจรินทร์ ทำสะอาด        | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๒๔ |
| ๒๕) นางสาวสุพรรณ คงทอง              | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๒๕ |
| ๒๖) นางสาววรรกร พัดสองชั้น          | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๒๖ |
| ๒๗) นายวิรัช โมกแก้ว                | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๒๗ |
| ๒๘) นายวัชรพงษ์ เทพดนตรี            | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๒๘ |
| ๒๙) นายอนุศาสน์ สวยดี               | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๒๙ |
| ๓๐) นายกรวิทย์ เจียศิริสกุล         | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๓๐ |
| ๓๑) นางสาวอริกา รงค์สวัสดิ์         | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๓๑ |
| ๓๒) นางสาวนภสรวรรณ คงคำ             | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๓๒ |
| ๓๓) นายสุทธิระ อรุณจันทร์           | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๓๓ |
| ๓๔) นางสาวทัศนีย์ อ่อนคำ            | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๓๔ |
| ๓๕) นางสาวพริ้มพรรณ สมบูรณ์ธรรม     | ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๓๕ |

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ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

๓๖) นายสุภณัฐ...

- ๓๖) นายสุภณัฐ คุณชนกาญจน์
- ๓๗) นางสาวศิริภาพร เหมือนแร่
- ๓๘) นางสาวนัส ขำนิล
- ๓๙) นางสาวพรนิกา อีระจินดาชล
- ๔๐) นายนาคินทร์ พันธุ์วิชาติกุล

ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๓๖  
ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๓๗  
ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๓๘  
ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๓๙  
ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๔๐



(นางจินตา เดชะศรีรินทร์)

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด เลขทะเบียน ว-๑๔๕

ที่ อก ๐๓๑๐(๑)/ ๑๘๗ ๙


ลงวันที่ ๐ ๙ กุมภาพันธ์ ๒๕๖๕

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย

|                                 |                            |
|---------------------------------|----------------------------|
| ๑) นายสุขสันต์ พันสิงห์         | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๐๑ |
| ๒) นางสุธรรมา แก้วขื่อนอก       | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๐๒ |
| ๓) นายพีรณัฐ เจริญผล            | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๐๓ |
| ๔) นางสาววิไลลักษณ์ เกโธสง      | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๐๔ |
| ๕) นายสมชาติ อุทุมรัตน์         | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๐๕ |
| ๖) นางสาวปรมาภรณ์ ทองแก้ว       | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๐๖ |
| ๗) นางสาวกัลยา สมพงษ์           | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๐๗ |
| ๘) นายอรรถพร เทพทอง             | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๐๘ |
| ๙) นางสาวอมรรัตน์ พุทธาสี       | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๐๙ |
| ๑๐) นางสาววรรณิ์ สายบุญเรือน    | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๐ |
| ๑๑) นายกฤษณพงษ์ นามทิพย์        | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๑ |
| ๑๒) นางสาวอาภรณ์ อ่อนคง         | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๒ |
| ๑๓) นายกิตติศักดิ์ ทรงจำรัส     | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๓ |
| ๑๔) นางสาวอักษรินทร์ บุญคง      | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๔ |
| ๑๕) นางสาวพรพิมล แฉ่นทอง        | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๕ |
| ๑๖) นายวิชญ์ สุวรรณราช          | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๖ |
| ๑๗) นายอภิวิชญ์ ท่วงที          | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๗ |
| ๑๘) นายมานิตย์ ปานโชติ          | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๘ |
| ๑๙) นายทศพร ธนะพิรุฬห์          | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๙ |
| ๒๐) นางสาวกัลยาณี โยธา          | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๐ |
| ๒๑) นางสาวเกวลี สุขศรี          | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๑ |
| ๒๒) นางสาวชนันญา อภิพัทธ์ปภา    | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๒ |
| ๒๓) นายศิริพัชร จงผดุงเกียรติ   | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๓ |
| ๒๔) นางสาวสุภาวดี อินยาศรี      | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๔ |
| ๒๕) นายพงศ์เทพ เหล่าขจร         | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๕ |
| ๒๖) นายขวัญชัย พันทุกซ์         | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๖ |
| ๒๗) นางสาวพัชจิรา คดีพิศาล      | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๗ |
| ๒๘) นางสาวเมวิกา เสือคำจันทร์   | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๘ |
| ๒๙) นายกานต์พงศ์ บุญพวง         | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๙ |
| ๓๐) นางสาวพุดิตา เจริญชัยสมบัติ | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๓๐ |
| ๓๑) นายณพรัตน์ จະโต             | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๓๑ |
| ๓๒) นายพีระพัฒน์ บัญญัติศิลป์   | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๓๒ |
| ๓๓) นายปรีดา ไชยภูมิสกุล        | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๓๓ |
| ๓๔) นายชัชวาลย์ เลื่อนล่อง      | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๓๔ |
| ๓๕) นายปิยะณัฐ ศรีภูโรจน์       | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๓๕ |

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๓๖) นายณภสินธุ์...



|                               |                            |
|-------------------------------|----------------------------|
| ๓๖) นายณภสินธุ์ ธนุธรรมรัตน์  | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๓๖ |
| ๓๗) นายกันนิกร ระโส           | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๓๗ |
| ๓๘) นายจักรพันธ์ ภูมิรินทร์   | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๓๘ |
| ๓๙) นายปริญญา กลมเกลียว       | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๓๙ |
| ๔๐) นายธีรวัฒน์ มาตรโพธิ์ศรี  | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๔๐ |
| ๔๑) นายธีรเมธ สุขศรี          | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๔๑ |
| ๔๒) นายบุญญฤทธิ์ ก้อนสิน      | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๔๒ |
| ๔๓) นายพรระวุฒิ โฉมสกุล       | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๔๓ |
| ๔๔) นายอชิตะ แสงจันทร์        | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๔๔ |
| ๔๕) นายณัฐพงศ์ เมืองชัย       | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๔๕ |
| ๔๖) นายธนต์ เลิศประเสริฐ      | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๔๖ |
| ๔๗) นางสาวนิภาพร จันทเขตต์    | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๔๗ |
| ๔๘) นายยุทธพงษ์ อิศระสุข      | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๔๘ |
| ๔๙) นายธณภพ ภูตระกูลพัฒนา     | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๔๙ |
| ๕๐) นางสาวศิริวรรณ ขอนพา      | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๕๐ |
| ๕๑) นายสมพงศ์ สกุลไทย         | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๕๑ |
| ๕๒) นายสุริยัน นิธิเชิดชูวงศ์ | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๕๒ |
| ๕๓) นายอัษฎาวุธ ยนศิริ        | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๕๓ |
| ๕๔) นายเอกวุฒิ เสนอใจ         | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๕๔ |
| ๕๕) นายสุชสันต์ บุญเลี้ยง     | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๕๕ |
| ๕๖) นายธนเดช หวานเสนาะ        | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๕๖ |
| ๕๗) นายพิพัฒน์ ต้นธนกุล       | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๕๗ |
| ๕๘) นายอภิสิทธิ์ ศรีคงแก้ว    | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๕๘ |
| ๕๙) นายภูวดล มงคลสูง          | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๕๙ |
| ๖๐) นายอุทัย แก้วรากมูข       | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๖๐ |
| ๖๑) นางสาววนารินทร์ สานนท์    | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๖๑ |
| ๖๒) นายศุภกร รินวงศ์          | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๖๒ |
| ๖๓) นายศักดิ์สิทธิ์ เกิดข้ง   | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๖๓ |
| ๖๔) นางสาวศิริพร อภิการรัตน์  | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๖๔ |
| ๖๕) นางสาวจินตสุภา เปลียนศรี  | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๖๕ |
| ๖๖) นางสาวเนตรนภา กมลบุรณ์    | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๖๖ |
| ๖๗) นางสาวอารียา ทารมย์       | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๖๗ |
| ๖๘) นายจิรวัฒน์ สุขเกษม       | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๖๘ |
| ๖๙) นายกิตติพงษ์ สอนชัยภูมิ   | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๖๙ |
| ๗๐) นายจุมพล สวนเพชร          | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๗๐ |
| ๗๑) นางสาวพัชรภรณ์ แสงฟ้า     | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๗๑ |
| ๗๒) นายรัตนชัย เหล่ามา        | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๗๒ |

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ปฏิบัติการการแผนอิมคิกรมโรงงานอุตสาหกรรม

๗๓) นายอิทธิพงษ์...

|                                   |                            |
|-----------------------------------|----------------------------|
| ๗๓) นายอิทธิพงษ์ ศรีวิเศษ         | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๗๓ |
| ๗๔) นางสาวกรรณิการ์ สำลีทา        | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๗๔ |
| ๗๕) นายธำปกรณ์ พิมพ์ศรี           | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๗๕ |
| ๗๖) นายพรชัย คุ่มม่วง             | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๗๖ |
| ๗๗) นางสาวทัศนีย์ ไชยหาร          | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๗๗ |
| ๗๘) นายธีรพงษ์ ศรีคำแหง           | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๗๘ |
| ๗๙) นางสาวณัฐชา พรหมศิริ          | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๗๙ |
| ๘๐) นางสาวลัดดาวัลย์ โพธิ์พันธ์   | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๘๐ |
| ๘๑) นางสาวกมลวรรณ เจริญจันทร์     | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๘๑ |
| ๘๒) นายนพรัตน์ จันทะคุณ           | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๘๒ |
| ๘๓) นายปิยวัฒน์ ไหมชู             | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๘๓ |
| ๘๔) นางสาวพรนัชชา กลิ่นนุ่น       | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๘๔ |
| ๘๕) นายณกสิทธิ์ ศรีพิมพ์          | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๘๕ |
| ๘๖) นางสาวลักขิกา จันทรสุน        | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๘๖ |
| ๘๗) นายสงกรานต์ มาลัยทอง          | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๘๗ |
| ๘๘) นางสาวสาธิตา แซ่เตียว         | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๘๘ |
| ๘๙) นายศักดิ์ศิรินทร์ นุ่มน่ม     | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๘๙ |
| ๙๐) นายวรพงษ์ นนทจันทร์           | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๙๐ |
| ๙๑) นางสาวชนาภา มาคะมาตร          | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๙๑ |
| ๙๒) นางสาวธนธรรณ์ คุณานพันธ์ชัย   | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๙๒ |
| ๙๓) นายวีระยุทธ สาระภักดี         | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๙๓ |
| ๙๔) นางสาวธิตยา วีระพันธุ์วัฒน์   | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๙๔ |
| ๙๕) นายกฤตพล พงศ์สถาพร            | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๙๕ |
| ๙๖) นายณัฐชัย พรหมอารักษ์         | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๙๖ |
| ๙๗) นายชนินทร์ พานแก้ว            | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๙๗ |
| ๙๘) นายปรัชชาพล โสภา              | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๙๘ |
| ๙๙) นายวิชรินทร์ แสนงาม           | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๙๙ |
| ๑๐๐) นางสาวธนภรณ์ ลาพรม           | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๐๐ |
| ๑๐๑) นายอาทิตย์ อุดมผล            | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๐๑ |
| ๑๐๒) นายปรวร บุณนาค               | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๐๒ |
| ๑๐๓) นายอิทธิเดช ใจบุญ            | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๐๓ |
| ๑๐๔) นายคณิติน พงษ์อิศรานุพร      | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๐๔ |
| ๑๐๕) นางสาวสุภารัตน์ จันทร์ประทีป | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๐๕ |
| ๑๐๖) นายเสกขวิวัฒน์ เอมกลิ่นบัว   | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๑๐๖ |



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(นางจินดา เตชะศรีนทร์)

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
ปฏิบัติการการแทนอธิบดีกรมโรงงานอุตสาหกรรม

ดำเนินการถูกต้อง

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด เลขทะเบียน ว-๑๔๕

ที่ อก ๐๓๑๐(๑)/ ๑๘๗ ๕

ลงวันที่ ๐๙ กุมภาพันธ์ ๒๕๖๕

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๕๗ รายการ

น้ำเสีย จำนวน 46 รายการ

| ลำดับ | สารมลพิษ                  | วิธีวิเคราะห์  |
|-------|---------------------------|--|
| 1     | Aldrin                    | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 2     | Arsenic                   | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[4]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>   |
| 3     | Barium                    | Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>  |
| 4     | α-BHC                     | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 5     | β-BHC                     | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 6     | δ-BHC                     | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 7     | γ-BHC                     | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 8     | Biochemical Oxygen Demand | 1) 5-Day BOD Test, Azide Modification Method <sup>[4]</sup><br>2) 5-Day BOD Test, Membrane Electrode Method <sup>[4]</sup>   |
| 9     | Cadmium                   | 1) Digestion, Direct Air-Acetylene Flame Method <sup>[4]</sup><br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>[4]</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> |
| 10    | Chemical Oxygen Demand    | 1) Closed Reflux, Titrimetric Method <sup>[4]</sup><br>2) Closed Reflux, Colorimetric Method <sup>[4]</sup><br>3) Open Reflux, Titrimetric Method <sup>[4]</sup>   |
| 11    | Chlordane                 | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 12    | Chromium                  | 1) Digestion, Direct Air-Acetylene Flame Method <sup>[4]</sup><br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>[4]</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> |
| 13    | Color                     | ADMI Weighted-Ordinate Spectrophotometric Method <sup>[4]</sup>  |
| 14    | Copper                    | 1) Digestion, Direct Air-Acetylene Flame Method <sup>[4]</sup><br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>[4]</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> |
| 15    | Cyanide                   | 1) Distillation, Colorimetric Method <sup>[4]</sup><br>2) Flow Injection Analysis Method <sup>[4]</sup>  |



| ลำดับ | สารมลพิษ            | วิธีวิเคราะห์  |
|-------|---------------------|--|
| 16    | o,p'-DDT            | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 17    | 4,4'-DDD            | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 18    | 4,4'-DDE            | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 19    | 4,4'-DDT            | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 20    | Dieldrin            | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 21    | Endosulfan I        | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 22    | Endosulfan II       | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 23    | Endosulfan sulfate  | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 24    | Endrin              | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 25    | Endrin aldehyde     | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 26    | Formaldehyde        | Distillation, Colorimetric Method <sup>[3]</sup>   |
| 27    | Free Chlorine       | 1) Iodometric Method <sup>[4]</sup><br>2) DPD Ferrous Titrimetric Method <sup>[4]</sup>  |
| 28    | Heptachlor          | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 29    | Heptachlor Epoxide  | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 30    | Hexavalent Chromium | 1) Colorimetric Method <sup>[4]</sup><br>2) Extraction, Direct Air-Acetylene Flame Method <sup>[4]</sup>   |
| 31    | Lead                | 1) Digestion, Direct Air-Acetylene Flame Method <sup>[4]</sup><br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>[4]</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> |
| 32    | Manganese           | 1) Digestion, Direct Air-Acetylene Flame Method <sup>[4]</sup><br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>[4]</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> |
| 33    | Mercury             | Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[4]</sup>  |
| 34    | Methoxychlor        | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 35    | Nickel              | 1) Digestion, Direct Air-Acetylene Flame Method <sup>[4]</sup><br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>[4]</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> |

| ลำดับ | สารมลพิษ                | วิธีวิเคราะห์  |
|-------|-------------------------|--|
| 36    | Oil & Grease            | 1) Liquid-Liquid, Partition-Gravimetric Method <sup>[4]</sup><br>2) Soxhlet Extraction Method <sup>[4]</sup>   |
| 37    | pH                      | Electrometric Method <sup>[4]</sup>  |
| 38    | Phenols                 | 1) Distillation, Chloroform Extraction Method <sup>[4]</sup><br>2) Distillation, Direct Photometric Method <sup>[4]</sup>  |
| 39    | Selenium                | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[4]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>   |
| 40    | Sulfide                 | 1) Iodometric Method <sup>[4]</sup><br>2) Methylene Blue Method <sup>[4]</sup>   |
| 41    | Temperature             | Laboratory and Field Methods <sup>[4]</sup>  |
| 42    | Total Dissolved Solids  | Dried at 180 °C <sup>[4]</sup>   |
| 43    | Total Kjeldahl Nitrogen | Semi-Micro-Kjeldahl Method <sup>[4]</sup>  |
| 44    | Total Suspended Solids  | Dried at 103-105 °C <sup>[4]</sup>   |
| 45    | Trivalent Chromium      | 1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation <sup>[4]</sup><br>2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>[4]</sup>                   |
| 46    | Zinc                    | 1) Digestion, Direct Air-Acetylene Flame Method <sup>[4]</sup><br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>[4]</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> |

น้ำใต้ดิน จำนวน 126 รายการ

| ลำดับ | สารมลพิษ     | วิธีวิเคราะห์   |
|-------|--------------|---|
| 1     | Acenaphthene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup> |
| 2     | Acetone      | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 3     | Aldrin       | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup> |

| ลำดับ | สารมลพิษ             | วิธีวิเคราะห์   |
|-------|----------------------|---|
| 4     | Anthracene           | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup> |
| 5     | Antimony             | Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>   |
| 6     | Arsenic              | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[4]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>            |
| 7     | Atrazine             | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 8     | Barium               | 1) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>[4]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>                |
| 9     | Benz(a)anthracene    | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup> |
| 10    | Benzene              | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 11    | Benzo(b)fluoranthene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup> |
| 12    | Benzo(k)fluoranthene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup> |
| 13    | Benzoic acid         | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 14    | Benzo(a)pyrene       | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup> |



| ลำดับ | สารมลพิษ                   | วิธีวิเคราะห์  |
|-------|----------------------------|--|
| 15    | Benzo(g,h,i)perylene       | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 16    | Beryllium                  | Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>  |
| 17    | Bis(2-chloroethyl)ether    | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 18    | Bis(2-ethylhexyl)phthalate | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 19    | Bromodichloromethane       | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 20    | Bromoform                  | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 21    | Butanol                    | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 22    | Butyl benzyl phthalate     | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 23    | Cadmium                    | 1) Digestion, Direct Air-Acetylene Flame Method <sup>[4]</sup><br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>[4]</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> |
| 24    | Carbazole                  | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 25    | Carbon disulfide           | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 26    | Carbon tetrachloride       | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 27    | Chlordane                  | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 28    | p-Chloroaniline            | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 29    | Chlorobenzene              | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |

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สำเนาถูกต้อง

| ลำดับ | สารมลพิษ             | วิธีวิเคราะห์  |
|-------|----------------------|--|
| 30    | Chlorodibromomethane | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 31    | Chloroform           | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 32    | 2-Chlorophenol       | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 33    | Chromium             | 1) Digestion, Direct Air-Acetylene Flame Method <sup>[4]</sup><br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>[4]</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> |
| 34    | Chromium (III)       | 1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation <sup>[4]</sup><br>2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>[4]</sup>                   |
| 35    | Chromium (VI)        | 1) Colorimetric Method <sup>[4]</sup><br>2) Extraction, Air-Acetylene Flame Method <sup>[4]</sup>  |
| 36    | Chrysene             | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 37    | Cyanide              | Distillation, Colorimetric Method <sup>[4]</sup>   |
| 38    | 2,4-D                | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 39    | DDD                  | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 40    | DDE                  | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 41    | DDT                  | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |

| ลำดับ | สารมลพิษ                   | วิธีวิเคราะห์   |
|-------|----------------------------|---|
| 42    | Dibenz(a,h)anthracene      | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup> |
| 43    | Di-n-butyl phthalate       | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 44    | 1,2-Dichlorobenzene        | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 45    | 1,3-Dichlorobenzene        | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 46    | 1,4-Dichlorobenzene        | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 47    | 3,3'-Dichlorobenzidine     | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 48    | 1,1-Dichloroethane         | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 49    | 1,2-Dichloroethane         | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 50    | 1,1-Dichloroethylene       | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 51    | cis-1,2-Dichloroethylene   | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 52    | trans-1,2-Dichloroethylene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 53    | 2,4-Dichlorophenol         | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 54    | 1,2-Dichloropropane        | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 55    | 1,3-Dichloropropane        | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 56    | 1,3-Dichloropropene        | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 57    | Dieldrin                   | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup> |



| ลำดับ | สารมลพิษ             | วิธีวิเคราะห์   |
|-------|----------------------|---|
| 58    | Diethyl phthalate    | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 59    | 2,4-Dimethylphenol   | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 60    | 2,4-Dinitrophenol    | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 61    | 2,4-Dinitrotoluene   | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 62    | 2,6-Dinitrotoluene   | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 63    | Di-n-Octyl phthalate | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 64    | Endosulfan           | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup> |
| 65    | Endrin               | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup> |
| 66    | Ethylbenzene         | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 67    | Fluoranthene         | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup> |
| 68    | Fluorene             | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup> |
| 69    | Heptachlor           | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup> |

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ดำเนินการต่อไป

| ลำดับ | สารมลพิษ                  | วิธีวิเคราะห์  |
|-------|---------------------------|--|
| 70    | Heptachlor epoxide        | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 71    | Hexachlorobenzene         | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 72    | Hexachloro-1,3-butadiene  | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 73    | n-Hexane                  | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 74    | $\alpha$ -HCH             | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 75    | $\beta$ -HCH              | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 76    | $\gamma$ -HCH             | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 77    | Hexachlorocyclopentadiene | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 78    | Hexachloroethane          | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 79    | Indeno(1,2,3-cd)pyrene    | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 80    | Isophorone                | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 81    | Lead                      | 1) Digestion, Direct Air-Acetylene Flame Method <sup>[4]</sup><br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>[4]</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> |

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| ลำดับ | สารมลพิษ                  | วิธีวิเคราะห์  |
|-------|---------------------------|--|
| 82    | Manganese                 | 1) Digestion, Direct Air-Acetylene Flame Method <sup>[4]</sup><br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>[4]</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> |
| 83    | Mercury                   | Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[4]</sup>  |
| 84    | Methanol                  | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 85    | Methoxychlor              | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>  |
| 86    | Methyl bromide            | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 87    | Methylene chloride        | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 88    | 2-Methylphenol            | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 89    | 2-Methylnaphthalene       | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 90    | Methyl tert-butyl ether   | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 91    | Naphthalene               | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 92    | Nickel                    | 1) Digestion, Direct Air-Acetylene Flame Method <sup>[4]</sup><br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>[4]</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> |
| 93    | Nitrobenzene              | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 94    | N-Nitrosodiphenylamine    | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 95    | N-Nitrosodi-n-propylamine | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |



| ลำดับ | สารมลพิษ  | วิธีวิเคราะห์   |
|-------|---|---|
| 96    | Polychlorinated Biphenyls<br>- PCB 1016<br>- PCB 1221<br>- PCB 1232<br>- PCB-1242<br>- PCB-1248<br>- PCB-1254<br>- PCB-1260 | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup> |
| 97    | Pentachlorophenol   | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 98    | pH  | Electrometric Method <sup>[4]</sup>   |
| 99    | Phenanthrene  | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup> |
| 100   | Phenol  | 1) Distillation, Chloroform Extraction Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>           |
| 101   | Pyrene  | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup> |
| 102   | Selenium  | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[4]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>            |
| 103   | Silver  | Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>   |
| 104   | Styrene   | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 105   | 1,1,2,2-Tetrachloroethane   | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 106   | Tetrachloroethylene   | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 107   | Toluene   | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |

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| ลำดับ | สารมลพิษ                                 | วิธีวิเคราะห์   |
|-------|--|---|
| 108   | Toxaphene                                | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup> |
| 109   | TPH (C <sub>5</sub> - C <sub>8</sub> )   | 1) Purge and Trap, Gas Chromatographic Method <sup>[11,21]</sup><br>2) Purge and Trap, Gas Chromatographic/Mass spectrometric Method <sup>[11,25]</sup>             |
| 110   | TPH (C <sub>8</sub> - C <sub>16</sub> )  | Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[9,21]</sup>  |
| 111   | TPH (C <sub>16</sub> - C <sub>35</sub> ) | Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[9,21]</sup>  |
| 112   | 1,2,4-Trichlorobenzene                   | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 113   | 1,1,1-Trichloroethane                    | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 114   | 1,1,2-Trichloroethane                    | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 115   | Trichloroethylene                        | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 116   | 2,4,5-Trichlorophenol                    | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 117   | 2,4,6-Trichlorophenol                    | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 118   | 1,3,5-Trimethylbenzene                   | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 119   | Vanadium                                 | Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>   |
| 120   | Vinyl acetate                            | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 121   | Vinyl chloride                           | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 122   | m-Xylene                                 | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |
| 123   | o-Xylene                                 | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>   |

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| ลำดับ | สารมลพิษ       | วิธีวิเคราะห์  |
|-------|----------------|--|
| 124   | p-Xylene       | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 125   | Xylene (Total) | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>  |
| 126   | Zinc           | 1) Digestion, Direct Air-Acetylene Flame Method <sup>[4]</sup><br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>[4]</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> |

อากาศเสีย (ปล่อยระบาย) จำนวน 25 รายการ

| ลำดับ | สารมลพิษ        | วิธีวิเคราะห์  |
|-------|-----------------|--|
| 1     | Antimony        | Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>   |
| 2     | Arsenic         | 1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[5]</sup><br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup> |
| 3     | Cadmium         | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>[5]</sup><br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>                         |
| 4     | Carbon Monoxide | Instrumental Analyzer Method <sup>[5]</sup>  |
| 5     | Chlorine        | Isokinetic Sampling, Ion Chromatographic Method <sup>[5]</sup>   |
| 6     | Chromium        | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>[5]</sup><br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>                         |
| 7     | Cobalt          | Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>   |
| 8     | Copper          | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>[5]</sup><br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>                         |
| 9     | Cresol          | Absorption Sampling, Gas Chromatographic Method <sup>[5]</sup>   |

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| ลำดับ | สารมลพิษ                    | วิธีวิเคราะห์  |
|-------|-----------------------------|--|
| 10    | Dioxins/Furans              | Isokinetic Sampling <sup>[5]</sup>   |
| 11    | Hydrogen Chloride           | Isokinetic Sampling, Ion Chromatographic Method <sup>[5]</sup>   |
| 12    | Hydrogen Fluoride           | Isokinetic Sampling, Ion Chromatographic Method <sup>[5]</sup>   |
| 13    | Hydrogen Sulfide            | Absorption Sampling, Iodometric Method <sup>[5]</sup>  |
| 14    | Lead                        | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>[5]</sup><br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>                         |
| 15    | Manganese                   | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>[5]</sup><br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>                         |
| 16    | Mercury                     | Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[5]</sup>   |
| 17    | Nickel                      | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>[5]</sup><br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>                         |
| 18    | Opacity                     | Ringelmann's Method <sup>[1]</sup>   |
| 19    | Oxides of Nitrogen          | 1) Absorption Sampling, Phenoldisulfonic acid Method <sup>[5]</sup><br>2) Instrumental Analyzer Method <sup>[5]</sup>  |
| 20    | Selenium                    | 1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[5]</sup><br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup> |
| 21    | Sulfur Dioxide              | 1) Absorption Sampling, Barium-Thorin Titrimetric Method <sup>[5]</sup><br>2) Instrumental Analyzer Method <sup>[5]</sup>  |
| 22    | Sulfuric Acid               | Isokinetic Sampling, Barium-Thorin Titrimetric Method <sup>[5]</sup>   |
| 23    | Total Suspended Particulate | Isokinetic Sampling, Gravimetric Method <sup>[5]</sup>   |
| 24    | Vanadium                    | Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>   |
| 25    | Xylene                      | 1) Bag Sampling, Gas Chromatographic Method <sup>[5]</sup><br>2) Adsorption Sampling, Gas Chromatographic Method <sup>[5]</sup>  |

สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 35 รายการ

| ลำดับ | สารมลพิษ  | วิธีวิเคราะห์  |
|-------|-----------|--|
| 1     | Aldrin    | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[2,9,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup>   |
| 2     | Antimony  | Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>   |
| 3     | Arsenic   | 1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[2,6,15]</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,6,13]</sup><br>3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[7,15]</sup><br>4) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup> |
| 4     | Barium    | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,6,13]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>   |
| 5     | Beryllium | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,6,13]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>   |
| 6     | Cadmium   | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>[2,6,14]</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,6,13]</sup><br>3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>[7,14]</sup><br>4) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>                           |
| 7     | Chlordane | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[2,9,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup>   |
| 8     | Chromium  | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>[2,6,14]</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,6,13]</sup>  |

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3) Digestion,...

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|-------|----------------|---|
| 9     | Chromium (III) | 3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>[7,14]</sup><br>4) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup><br>1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation <sup>[2,6,14,16]</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation <sup>[2,6,13,16]</sup><br>3) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation <sup>[7,8,14,16]</sup><br>4) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation <sup>[7,8,13,16]</sup> |
| 10    | Chromium (VI)  | 1) Waste Extraction, Colorimetric Method <sup>[2,16]</sup><br>2) Alkaline Digestion, Colorimetric Method <sup>[8,16]</sup>  |
| 11    | Cobalt         | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,6,13]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>  |
| 12    | Copper         | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>[2,6,14]</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,6,13]</sup><br>3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>[7,14]</sup><br>4) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>  |
| 13    | 2,4-D          | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[2,9,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup>  |
| 14    | DDD            | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[2,9,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup>  |



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|-------|------------|--|
| 15    | DDE        | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[2,9,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup>   |
| 16    | DDT        | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[2,9,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup>   |
| 17    | Dieldrin   | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[2,9,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup>   |
| 18    | Endrin     | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[2,9,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup>   |
| 19    | Heptachlor | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[2,9,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup>   |
| 20    | Lead       | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>[2,6,14]</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,6,13]</sup><br>3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>[7,14]</sup><br>4) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup> |
| 21    | Lindane    | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[2,9,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup>   |
| 22    | Mercury    | 1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[2,17]</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,6,13]</sup>   |

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|-------|---|--|
| 23    | Methoxychlor  | 3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[18]</sup><br>4) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup><br>5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>[19]</sup><br>1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[2,9,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup> |
| 24    | Molybdenum  | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,6,13]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>   |
| 25    | Nickel  | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>[2,6,14]</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,6,13]</sup><br>3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>[7,14]</sup><br>4) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>   |
| 26    | Polychlorinated Biphenyls<br>- Aroclor 1016<br>- Aroclor 1221<br>- Aroclor 1232<br>- Aroclor 1242<br>- Aroclor 1248<br>- Aroclor 1254<br>- Aroclor 1260<br>- 2-Chlorobiphenyl<br>- 2,3-Dichlorobiphenyl<br>- 2,2',5-Trichlorobiphenyl<br>- 2,4',5-Trichlorobiphenyl<br>- 2,2',3,5'-Tetrachlorobiphenyl<br>- 2,2',5,5'-Tetrachlorobiphenyl<br>- 2,3',4,4'-Tetrachlorobiphenyl<br>- 2,2',3,4,5'-Pentachlorobiphenyl | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[2,9,23]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,23]</sup><br><i>วิธีใหม่</i>  |

| ลำดับ | สารมลพิษ                                       | วิธีวิเคราะห์  |
|-------|--|--|
| 27    | - 2,2',4,5,5'-<br>Pentachlorobiphenyl          | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[2,9,28]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup><br>Electrometric Method <sup>[31,32]</sup>  |
|       | - 2,3,3',4',6-<br>Pentachlorobiphenyl          |  |
|       | - 2,2',3,4,4',5'-<br>Hexachlorobiphenyl        |  |
|       | - 2,2',3,4,5,5'-<br>Hexachlorobiphenyl         |  |
|       | - 2,2',3,5,5',6-<br>Hexachlorobiphenyl         |  |
|       | - 2,2',4,4',5,5'-<br>Hexachlorobiphenyl        |  |
|       | - 2,2',3,3',4,4',5-<br>Heptachlorobiphenyl     |  |
|       | - 2,2',3,4,4',5,5'-<br>Heptachlorobiphenyl     |  |
|       | - 2,2',3,4,4',5',6-<br>Heptachlorobiphenyl     |  |
|       | - 2,2',3,4',5,5',6-<br>Heptachlorobiphenyl     |  |
|       | - 2,2',3,3',4,4',5,5',6-<br>Nonachlorobiphenyl |  |
|       | Pentachlorophenol                              |  |
| 28    | pH   |  |
| 29    | Selenium                                       | 1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[2,6,20]</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,6,13]</sup><br>3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[7,20]</sup><br>4) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup> |

**Q&A**  
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**สถานะถูกต้อง**



| ลำดับ | สารมลพิษ          | วิธีวิเคราะห์   |
|-------|-------------------|---|
| 30    | Silver            | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,6,13]</sup>   |
| 31    | Thallium          | 2) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup><br>1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,6,13]</sup>  |
| 32    | Toxaphene         | 2) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup><br>1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[2,9,22]</sup>  |
| 33    | Trichloroethylene | 2) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup><br>1) Waste Extraction, Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[2,12,25]</sup>  |
| 34    | Vanadium          | 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup><br>1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,6,13]</sup>  |
| 35    | Zinc              | 2) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup><br>1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>[2,6,14]</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,6,13]</sup><br>3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>[7,14]</sup><br>4) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup> |

ดิน จำนวน 125 รายการ

| ลำดับ | สารมลพิษ     | วิธีวิเคราะห์   |
|-------|--------------|---|
| 1     | Acenaphthene | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,24]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 2     | Acetone      | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[2,25]</sup>   |

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| ลำดับ | สารมลพิษ             | วิธีวิเคราะห์   |
|-------|----------------------|---|
| 3     | Aldrin               | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 4     | Anthracene           | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,26]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 5     | Antimony             | Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>  |
| 6     | Arsenic              | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[7,15]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>        |
| 7     | Atrazine             | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 8     | Barium               | Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>  |
| 9     | Benz(a)anthracene    | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,24]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 10    | Benzene              | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 11    | Benzo(b)fluoranthene | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,24]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 12    | Benzo(k)fluoranthene | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,24]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 13    | Benzoic acid         | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 14    | Benzo(a)pyrene       | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,24]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |

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| ลำดับ | สารมลพิษ                   | วิธีวิเคราะห์   |
|-------|----------------------------|---|
| 15    | Benzo(g,h,i)perylene       | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 16    | Beryllium                  | Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>  |
| 17    | Bis(2-chloroethyl)ether    | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 18    | Bis(2-ethylhexyl)phthalate | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 19    | Bromodichloromethane       | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 20    | Bromoform                  | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 21    | Butanol                    | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 22    | Butyl benzyl phthalate     | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 23    | Cadmium                    | 1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>[7,14]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>                     |
| 24    | Carbazole                  | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 25    | Carbon disulfide           | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 26    | Carbon tetrachloride       | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 27    | Chlordane                  | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 28    | p-Chloroaniline            | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 29    | Chlorobenzene              | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 30    | Chlorodibromomethane       | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |



| ลำดับ | สารมลพิษ              | วิธีวิเคราะห์   |
|-------|-----------------------|---|
| 31    | Chloroform            | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 32    | 2-Chlorophenol        | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 33    | Chromium              | 1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>[7,14]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>   |
| 34    | Chromium (III)        | 1) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation <sup>[7,8,14,16]</sup><br>2) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation <sup>[7,8,13,16]</sup> |
| 35    | Chromium (VI)         | Alkaline Digestion, Colorimetric Method <sup>[8,16]</sup>   |
| 36    | Chrysene              | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,24]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 37    | Cyanide               | Extraction, Distillation, Colorimetric Method <sup>[28,29,30]</sup>   |
| 38    | 2,4-D                 | Ultrasonic Extraction, Gas Chromatographic Method <sup>[27]</sup>   |
| 39    | DDD                   | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 40    | DDE                   | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 41    | DDT                   | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 42    | Dibenz(a,h)anthracene | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,24]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |

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| ลำดับ | สารมลพิษ                   | วิธีวิเคราะห์   |
|-------|----------------------------|---|
| 43    | Di-n-butyl phthalate       | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 44    | 1,2-Dichlorobenzene        | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 45    | 1,3-Dichlorobenzene        | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 46    | 1,4-Dichlorobenzene        | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 47    | 3,3'-Dichlorobenzidine     | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 48    | 1,1-Dichloroethane         | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 49    | 1,2-Dichloroethane         | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 50    | 1,1-Dichloroethylene       | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 51    | cis-1,2-Dichloroethylene   | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 52    | trans-1,2-Dichloroethylene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 53    | 2,4-Dichlorophenol         | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 54    | 1,2-Dichloropropane        | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 55    | 1,3-Dichloropropane        | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 56    | 1,3-Dichloropropene        | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 57    | Dieldrin                   | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 58    | Diethyl phthalate          | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 59    | 2,4-Dimethylphenol         | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |

| ลำดับ | สารมลพิษ             | วิธีวิเคราะห์   |
|-------|----------------------|---|
| 60    | 2,4-Dinitrophenol    | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 61    | 2,4-Dinitrotoluene   | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 62    | 2,6-Dinitrotoluene   | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 63    | Di-n-Octyl phthalate | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 64    | Endosulfan           | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 65    | Endrin               | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 66    | Ethylbenzene         | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 67    | Fluoranthene         | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,24]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 68    | Fluorene             | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,24]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 69    | Heptachlor           | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 70    | Heptachlor epoxide   | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |

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| ลำดับ | สารมลพิษ                  | วิธีวิเคราะห์   |
|-------|---------------------------|---|
| 71    | Hexachlorobenzene         | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 72    | Hexachloro-1,3-butadiene  | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 73    | n-Hexane                  | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 74    | $\alpha$ -HCH             | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 75    | $\beta$ -HCH              | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 76    | $\gamma$ -HCH             | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 77    | Hexachlorocyclopentadiene | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 78    | Hexachloroethane          | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 79    | Indeno(1,2,3-cd)pyrene    | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,24]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 80    | Isophorone                | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 81    | Lead                      | 1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>[7,14]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>                     |
| 82    | Manganese                 | 1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>[7,14]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>                     |

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| ลำดับ | สารมลพิษ                  | วิธีวิเคราะห์  |
|-------|---------------------------|--|
| 83    | Mercury                   | 1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[18]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup><br>3) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>[19]</sup> |
| 84    | Methanol                  | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>   |
| 85    | Methoxychlor              | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>  |
| 86    | Methyl bromide            | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>   |
| 87    | Methylene chloride        | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>   |
| 88    | 2-Methylphenol            | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>  |
| 89    | 2-Methylnaphthalene       | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>  |
| 90    | Methyl tert-butyl ether   | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>   |
| 91    | Naphthalene               | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,24]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>  |
| 92    | Nickel                    | 1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>[7,14]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>  |
| 93    | Nitrobenzene              | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>  |
| 94    | N-Nitrosodiphenylamine    | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>  |
| 95    | N-Nitrosodi-n-propylamine | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>  |

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| ลำดับ | สารมลพิษ   | วิธีวิเคราะห์  |
|-------|--|--|
| 96    | <p>Polychlorinated Biphenyls</p> <ul style="list-style-type: none"> <li>- Aroclor 1016</li> <li>- Aroclor 1221</li> <li>- Aroclor 1232</li> <li>- Aroclor 1242</li> <li>- Aroclor 1248</li> <li>- Aroclor 1254</li> <li>- Aroclor 1260</li> </ul> <p>Polychlorinated Biphenyls</p> <ul style="list-style-type: none"> <li>- 2-Chlorobiphenyl</li> <li>- 2,3-Dichlorobiphenyl</li> <li>- 2,2',5-Trichlorobiphenyl</li> <li>- 2,4',5-Trichlorobiphenyl</li> <li>- 2,2',3,5'-Tetrachlorobiphenyl</li> <li>- 2,2',5,5'-Tetrachlorobiphenyl</li> <li>- 2,3',4,4'-Tetrachlorobiphenyl</li> <li>- 2,2',3,4,5'-</li> </ul> <p>Pentachlorobiphenyl</p> <ul style="list-style-type: none"> <li>- 2,2',4,5,5'-</li> </ul> <p>Pentachlorobiphenyl</p> <ul style="list-style-type: none"> <li>- 2,3,3',4',6-</li> </ul> <p>Pentachlorobiphenyl</p> <ul style="list-style-type: none"> <li>- 2,2',3,4,4',5'-</li> </ul> <p>Hexachlorobiphenyl</p> <ul style="list-style-type: none"> <li>- 2,2',3,4,5,5'-</li> </ul> <p>Hexachlorobiphenyl</p> <ul style="list-style-type: none"> <li>- 2,2',3,5,5',6-</li> </ul> <p>Hexachlorobiphenyl</p> <ul style="list-style-type: none"> <li>- 2,2',4,4',5,5'-</li> </ul> <p>Hexachlorobiphenyl</p> <ul style="list-style-type: none"> <li>- 2,2',3,3',4,4',5-</li> </ul> <p>Heptachlorobiphenyl</p> <ul style="list-style-type: none"> <li>- 2,2',3,4,4',5,5'-</li> </ul> <p>Heptachlorobiphenyl</p> <ul style="list-style-type: none"> <li>- 2,2',3,4,4',5',6-</li> </ul> <p>Heptachlorobiphenyl</p> | <p>1) Ultrasonic Extraction, Gas Chromatographic Method<sup>[10,23]</sup></p> <p>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method<sup>[10,26]</sup></p> <p>Ultrasonic Extraction, Gas Chromatographic Method<sup>[10,23]</sup></p> <p>UAE<br/>UNITED ANALYST AND ENGINEERING<br/>CONSULTANT COMPANY LIMITED</p> <p>ดำเนินการถูกต้อง</p> |



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|-------|---|---|
| 97    | - 2,2',3,4',5,5',6-<br>Heptachlorobiphenyl<br>- 2,2',3,3',4,4',5,5',6-<br>Nonachlorobiphenyl<br>Pentachlorophenol | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 98    | Phenanthrene  | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,24]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 99    | Phenol  | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 100   | Pyrene  | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,24]</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup> |
| 101   | Selenium  | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[7,22]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>        |
| 102   | Silver  | Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>  |
| 103   | Styrene   | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 104   | 1,1,2,2-Tetrachloroethane   | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 105   | Tetrachloroethylene   | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 106   | Toluene   | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 107   | Toxaphene   | Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,22]</sup>  |
| 108   | TPH (C <sub>5</sub> -C <sub>8</sub> )   | 1) Purge and Trap, Gas Chromatographic Method <sup>[12,21]</sup><br>2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>               |
| 109   | TPH (C <sub>8</sub> -C <sub>16</sub> )  | Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,21]</sup>  |
| 110   | TPH (C <sub>16</sub> -C <sub>35</sub> )   | Ultrasonic Extraction, Gas Chromatographic Method <sup>[10,21]</sup>  |
| 111   | 1,2,4-Trichlorobenzene  | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |

| ลำดับ | สารมลพิษ               | วิธีวิเคราะห์   |
|-------|------------------------|---|
| 112   | 1,1,1-Trichloroethane  | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 113   | 1,1,2-Trichloroethane  | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 114   | Trichloroethylene      | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 115   | 2,4,5-Trichlorophenol  | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 116   | 2,4,6-Trichlorophenol  | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,26]</sup>   |
| 117   | 1,3,5-Trimethylbenzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 118   | Vanadium               | Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup>  |
| 119   | Vinyl acetate          | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 120   | Vinyl chloride         | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 121   | m-Xylene               | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 122   | o-Xylene               | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 123   | p-Xylene               | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 124   | Xylene (Total)         | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[12,25]</sup>  |
| 125   | Zinc                   | 1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>[7,14]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[7,13]</sup> |

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