

ภาคผนวก ง  
เอกสารสอบเทียบเครื่องมือ

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MEASUREMENT RESULTS:

The Office 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 <sup>3</sup> /min | Pressure<br>[Pa]<br>mmHg | Temperature<br>[T <sub>amb</sub> ]<br>°C | Temperature<br>[T <sub>m</sub> ]<br>°C | Ap_meter<br>mmHg | Ap_Office<br>inH <sub>2</sub> O | γ     | Standard Flow [Q <sub>s</sub> ]<br>m <sup>3</sup> /min |
|-------|----------------------------------|--------------------------|--|--|------------------|---------------------------------|-------|--|
| 1     | 0.097                            | 754.265                  | 24.640                                   | 21.960                                 | 55.399           | 1.699                           | 1.299 | 0.643  |
| 2     | 1.000                            | 754.236                  | 24.950                                   | 24.350                                 | 62.172           | 3.444                           | 1.849 | 0.913  |
| 3     | 1.118                            | 754.323                  | 24.730                                   | 24.210                                 | 41.925           | 4.562                           | 2.133 | 1.051  |
| 4     | 1.169                            | 754.212                  | 24.640                                   | 24.160                                 | 31.045           | 5.150                           | 2.862 | 1.116  |
| 5     | 1.416                            | 754.175                  | 24.480                                   | 24.210                                 | 30.117           | 7.629                           | 2.754 | 1.353  |

Slope (m): 2.04804  
Intercept (b): -0.01939  
Correlation coefficient (r): 0.99982  
Uncertainty (k=2): 0.011 m<sup>3</sup>/min

Table 2: The results of Q actual calibration data

| Plate | Flow rate<br>m <sup>3</sup> /min | Pressure<br>[Pa]<br>mmHg | Temperature<br>[T <sub>amb</sub> ]<br>°C | Temperature<br>[T <sub>m</sub> ]<br>°C | Ap_meter<br>mmHg | Ap_Office<br>inH <sub>2</sub> O | γ     | Standard Flow [Q <sub>s</sub> ]<br>m <sup>3</sup> /min |
|-------|----------------------------------|--------------------------|--|--|------------------|---------------------------------|-------|--|
| 1     | 0.097                            | 754.265                  | 24.640                                   | 21.960                                 | 55.399           | 1.699                           | 0.819 | 0.647  |
| 2     | 1.000                            | 754.236                  | 24.950                                   | 24.350                                 | 62.172           | 3.444                           | 1.167 | 0.919  |
| 3     | 1.118                            | 754.323                  | 24.730                                   | 24.210                                 | 41.925           | 4.582                           | 1.345 | 1.058  |
| 4     | 1.169                            | 754.212                  | 24.640                                   | 24.160                                 | 31.045           | 5.150                           | 1.426 | 1.123  |
| 5     | 1.416                            | 754.175                  | 24.480                                   | 24.210                                 | 30.117           | 7.629                           | 1.735 | 1.361  |

Slope (m): 1.28277  
Intercept (b): -0.01223  
Correlation coefficient (r): 0.99982  
Uncertainty (k=2): 0.012 m<sup>3</sup>/min

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



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-TSI-TS 17025  
CALIBRATION 0367

Flow measurement laboratory  
Calibration services department.

CERTIFICATE OF CALIBRATION

Certificate No. : CL-003-65

Page 1 of 2 Pages

MEASUREMENT ITEM  
MANUFACTURER  
MODEL/TYPE  
SERIAL NUMBER  
ID NUMBER  
CONDITION AS-RECEIVED  
CUSTOMER

: Top Load Office  
: Ttech Environmental, Inc.  
: TE-5025A  
: 3383  
: UAE.FRM.053/2560  
: Used Item  
: United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong,  
Bangkok 10260

RECEIVED DATE  
MEASUREMENT DATE  
ISSUE DATE

: 15 Jul 2022  
: 25 Jul 2022  
: 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 24.8 °C and 55.1 %RH.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:  
The Office gas flow device was calibrated against  
Standard Rotary Displacement Meter (Roots  
Meter) Model G55/MC/W2-4p, The M1-CL-004  
was used as a calibration guideline.

Traceability:

This certificate provides a traceability of the  
measurement to recognized of the national  
standards used to realize 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. Sotawat Thachalad  
☒ Miss Jiragorn Lertsomphol

Approved signatory:



Mr. Panyia Booncharoen  
Calibration Department Manager

เอกสารไม่ควบคุม

THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR เอกสารไม่ควบคุม  
IN WRITING FROM THE LABORATORY



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484

## Certificate of Calibration

Certificate No. : 23P1402  
Page : 1 of 2

Equipment : U Tube Manometer  
Manufacturer : Dwyer  
Model : 1221-36-W/M  
Serial No. :  
ID No. : UAE EFM 1802561  
Condition As-Received: Used Item  
Received Date: 26 April 2023  
Calibration Date: 09 May 2023  
Reference: 2304-0703WSC  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1010 mbar  
Submitted by: United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,  
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 :

| Instrument  | Model  | Serial No. | Certificate No. | Due Date    |
|---|--------|------------|-----------------|-------------|
| 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 Aussaree  
Issue Date : 11 May 2023

Approved Signatory : Attapol P.  
☐ Phallinee Prabpalai  
☐ Suru Suwanmasri  
☒ Attapol Panurach

เอกสารแนบควบคุม  
B 0314242



Cert.No.: 23P1402  
Page: 2 of 2

Result of calibration:- Without adjustment  
Function:- Pressure Measurement  
Increasing Pressure  
Range : 0 inH<sub>2</sub>O to 36 inH<sub>2</sub>O  
Scale Interval : 0.1 inH<sub>2</sub>O ( The Fifth Estimate )

| Applied Pressure<br>(inH <sub>2</sub> O) | UUC Indication                         |                                       | ΔP<br>(inH <sub>2</sub> O) | Error<br>(inH <sub>2</sub> O) |
|--|--|---------------------------------------|----------------------------|-------------------------------|
|  | High-port side<br>(inH <sub>2</sub> O) | Low-port side<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                                   | -4.00                                 | 8.00                       | 0.00                          |
| 10.00                                    | 5.00                                   | -5.00                                 | 10.00                      | 0.00                          |
| 12.00                                    | 6.00                                   | -6.00                                 | 12.00                      | 0.00                          |
| 14.00                                    | 7.00                                   | -7.00                                 | 14.02                      | 0.02                          |
| 16.00                                    | 8.00                                   | -8.02                                 | 16.02                      | 0.02                          |
| 18.00                                    | 9.02                                   | -9.04                                 | 18.06                      | 0.06                          |
| 20.00                                    | 10.02                                  | -10.04                                | 20.06                      | 0.06                          |
| 22.00                                    | 11.00                                  | -11.04                                | 22.04                      | 0.04                          |
| 24.00                                    | 12.02                                  | -12.06                                | 24.08                      | 0.08                          |
| 26.00                                    | 13.02                                  | -13.06                                | 26.08                      | 0.08                          |
| 28.00                                    | 14.02                                  | -14.04                                | 28.06                      | 0.06                          |
| 30.00                                    | 15.02                                  | -15.02                                | 30.04                      | 0.04                          |
| 32.00                                    | 16.00                                  | -16.02                                | 32.02                      | 0.02                          |
| 34.00                                    | 17.00                                  | -17.00                                | 34.00                      | 0.00                          |
| 35.80                                    | 17.96                                  | -17.98                                | 35.94                      | 0.14                          |

The uncertainty of measurement was ± 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.

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a 1160343

Certificate No : 23-AFM-211  
Request No : Req 2023-2070

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) |
|---------------------|-------------------|----------------|----------------|------------------|------------------------|
| 23.90               | 100.76            | 14.40          | 14.50          | 0.10             | 0.20                   |
| 23.90               | 100.75            | 14.91          | 15.00          | 0.09             | 0.21                   |
| 24.80               | 100.90            | 15.72          | 15.80          | 0.08             | 0.22                   |
| 23.80               | 100.77            | 16.48          | 16.67          | 0.09             | 0.23                   |
| 23.70               | 100.78            | 18.23          | 18.30          | 0.07             | 0.26                   |

Note  
STD : Standard  
- UUC Reference Condition : At 25.0 °C, 101.3 kPa, Air  
- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P} \times \frac{T_{meas}}{T_{ref}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature  
Meas = Measurement Condition ref = Standard Condition

\* Indicates non accredited

End of Certificate

Certificate of Calibration

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

Unit Under Calibration Details

Measurement Item : Air Flow Meter  
Manufacturer : BGI  
Model : DeltaCal DC1  
Serial Number : 163268  
ID : UAE-EFM-17472561  
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 : 29 September 2023  
Calibration Date : 4 October 2023  
Sensor Model : -  
Sensor Serial Number : -

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

| Reference Standard | Model                      | Serial Number   | Traceable | 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                      | 080000657       | Qriborn   | 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 %.

Calibration By :

Mr. Noppadon Luangant  
Service Calibration Engineer

Approved By :

Mr. Patch Mahavorn  
Calibration Engineer Supervisor

Issue Date :

4 October 2023







Cert.No.: 23P1857

Page: 2 of 2

Result of calibration:- Without adjustment  
Function:- Absolute Pressure Measurement

Range: 960 hPa to 1030 hPa  
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  |  |  |  |

\* 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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Atapol P.

เอกสารแนบฉบับ  
a 1165501



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
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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  
Condition As-Received: Used Item  
Received Date: 26 May 2023  
Calibration Date: 02 June 2023  
Reference: 2305-0919WSC  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1007 mbar

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, Phraekhanong, Bangkok 10260

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 :

| Instrument   | Model | Serial No. | Certificate No. | Due Date    |
|--|-------|------------|-----------------|-------------|
| 1) Standard Barometer  | DP142 | 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: Atapol P.  
[ ] Phalinea Prapbpaipal  
[ ] Sura Suwannasri  
[x] Atapol Panurach

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a 1165501

เอกสารแนบฉบับ  
B 0316957



Result of Calibration:-  
Function:

Humidity Measurement  
Before Adjustment

| Reference Temperature<br>(°C) | Standard Humidity<br>(%R.H.) | UUC* Reading<br>(%R.H.) | Error<br>(%R.H.) | Uncertainty of Measurement<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:-  
Function:

Humidity Measurement  
After Adjustment

| Reference Temperature<br>(°C) | Standard Humidity<br>(%R.H.) | UUC* Reading<br>(%R.H.) | Error<br>(%R.H.) | Uncertainty of Measurement<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:-  
Function:

Temperature Measurement  
Without Adjustment

| Standard Temperature<br>(°C) | UUC* Reading<br>(°C) | Error<br>(°C) | Uncertainty of Measurement<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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Signature

เอกสารแนบควบคุม  
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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
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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 ) %

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

81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phraekhanong, 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 :

| Instrument                          | Model | Serial No. | Certificate No. | Due Date    |
|-------------------------------------|-------|------------|-----------------|-------------|
| 1) Hygro-M2 Dew Point Monitor       | 5112  | 2360195    | 20703           | 02 Aug 2023 |
| 2) Handheld Thermometer With Sensor | 1523  | 3240076    | 23105           | 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 : Somsai Dumvor

Issue Date : 07 June 2023

Approved Signatory :

☒ Chakrit Waewwanjua

☐ Ponthippa Tameyakul

☐ Viporn Tantiyawutti

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UNITED ANALYST AND ENGINEERING  
CONSULTANT COMPANY LIMITED



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UNITED ANALYST AND ENGINEERING  
CONSULTANT COMPANY LIMITED

### MULTI-POINT GAS TEST REPORT

Test Date : Mar 16, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42C  
Manufacturer : Thermo Electron Corporation Serial Number : 0517512000

#### Standard Gas Concentration

Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM Manufacturer : Thermo Scientific  
Nitric Oxide (NO) 45.94 PPM Model : 146i  
Methane (CH<sub>4</sub>) - PPM Serial Number : 1180540071  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : E80143262  
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 ] |
|----------------------------|------------------------|------------------------|---------------|------------|
| Zero                       | 0.0                    | 0.00                   | 0.00          | 0.00       |
| Level 1                    | 100.0                  | 100.7                  | 0.70          | 0.70       |
| Level 2                    | 200.0                  | 200.3                  | 0.30          | 0.15       |
| Level 3                    | 300.0                  | 300.9                  | 0.90          | 0.30       |
| Level 4                    | 400.0                  | 400.0                  | 0.00          | 0.00       |
| Level 5                    | 500.0                  | 500.0                  | 0.00          | 0.00       |
| Remark : Measuring Range   | 500.0 ppb              | Average Difference (%) | 0.23          |            |
| :Acceptable Limit $\pm$ 5% |                        |                        |               |            |

#### Multi-Point Gas Test Chart



Calculate by

Apinart K.  
16/3/23

Approve by

Patirorn N.  
16/3/23

### MULTI-POINT GAS TEST REPORT

Test Date : Mar 18, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42C  
Manufacturer : Thermo Electron Corporation Serial Number : 42C-0508011076

#### Standard Gas Concentration

Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM Manufacturer : Thermo Scientific  
Nitric Oxide (NO) 45.94 PPM Model : 146i  
Methane (CH<sub>4</sub>) - PPM Serial Number : 1180540071  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : E80143262  
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 ] |
|----------------------------|------------------------|------------------------|---------------|------------|
| Zero                       | 0.0                    | 0.00                   | 0.00          | 0.00       |
| Level 1                    | 100.0                  | 100.5                  | 0.50          | 0.50       |
| Level 2                    | 200.0                  | 200.7                  | 0.70          | 0.35       |
| Level 3                    | 300.0                  | 300.8                  | 0.80          | 0.27       |
| Level 4                    | 400.0                  | 400.0                  | 0.00          | 0.00       |
| Level 5                    | 500.0                  | 500.0                  | 0.00          | 0.00       |
| Remark : Measuring Range   | 500.0 ppb              | Average Difference (%) | 0.22          |            |
| :Acceptable Limit $\pm$ 5% |                        |                        |               |            |

#### Multi-Point Gas Test Chart



Calculate by

Apinart K.  
18/3/23

Approve by

Patirorn N.  
18/3/23



### MULTI-POINT GAS TEST REPORT

Test Date : Nov 1, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : CM08130002

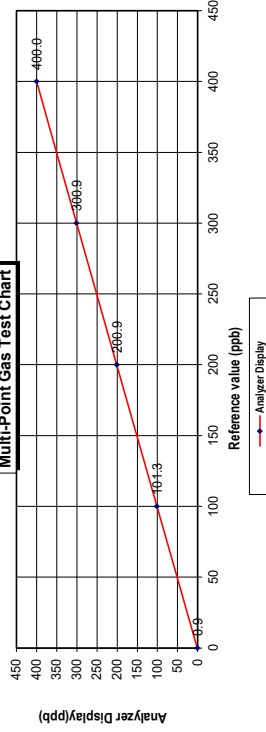
**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM  
Nitric Oxide (NO) 45.94 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : EB0143262  
Expiration Date : Jun 21, 2024

**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                    | 0.90                      | 0.90          | 0.90    |
| Level 2 20.00%                     | 100.0                  | 1.30                      | 1.28          | 1.28    |
| Level 3 40.00%                     | 200.9                  | 0.90                      | 0.45          | 0.45    |
| Level 4 60.00%                     | 300.9                  | 0.90                      | 0.30          | 0.30    |
| Level 5 80.00%                     | 400.0                  | 0.00                      | 0.00          | 0.00    |
| Remark : Measuring Range 500.0 ppb |                        | Average Difference (%)    |               |         |
|                                    |                        | Acceptable Limit $\pm$ 5% |               |         |
|                                    |                        | 0.59                      |               |         |

#### Multi-Point Gas Test Chart



Calculate by

01 Nov 2023  
...../...../.....

Approve by

01 Nov 2023  
...../...../.....

### MULTI-POINT GAS TEST REPORT

Test Date : Apr 20, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42C  
Manufacturer : Thermo Electron Corporation Serial Number : 0517512001

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM  
Nitric Oxide (NO) 45.94 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 984.8 PPM  
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                    | 0.00                      | 0.00          | 0.00    |
| Level 2 20.00%                     | 100.0                  | 101.2                     | 1.20          | 1.19    |
| Level 3 40.00%                     | 200.0                  | 200.7                     | 0.70          | 0.35    |
| Level 4 60.00%                     | 300.0                  | 301.1                     | 1.10          | 0.37    |
| Level 5 80.00%                     | 400.0                  | 400.0                     | 0.00          | 0.00    |
| Remark : Measuring Range 500.0 ppb |                        | Average Difference (%)    |               |         |
|                                    |                        | Acceptable Limit $\pm$ 5% |               |         |
|                                    |                        | 0.38                      |               |         |

#### Multi-Point Gas Test Chart



Calculate by

Apr 20 2023  
...../...../.....

Approve by

20 Apr 2023  
...../...../.....



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## MULTI-POINT GAS TEST REPORT

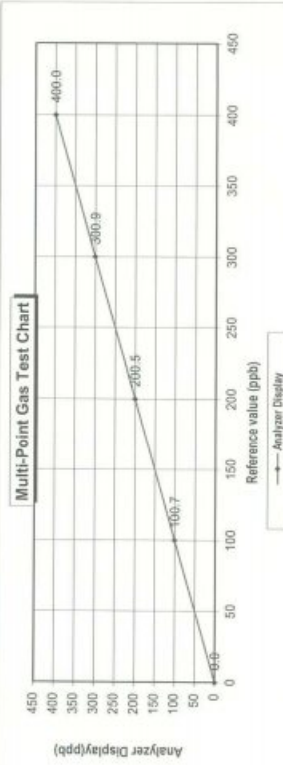
Test Date : May 3, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42C  
Manufacturer : Thermo Environmental Instruments Serial Number : 42C-76412-383

| Standard Gas Concentration         |              | Dilutor Detail |                                  |
|------------------------------------|--------------|----------------|----------------------------------|
| Sulphur Dioxide (SO <sub>2</sub> ) | 44.68        | PPM            | Manufacturer : Thermo Scientific |
| Nitric Oxide (NO)                  | 45.94        | PPM            | Model : 146i                     |
| Methane (CH <sub>4</sub> )         | -            | PPM            | Serial Number : 1180540071       |
| Carbon Monoxide (CO)               | 984.8        |                |                                  |
| Cylinder No. :                     | EB0143262    |                |                                  |
| Expiration Date :                  | Jun 21, 2024 |                |                                  |

### Multi-point gas test data

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



Calculate by

Apinwat K.

3 / 5 / 2023

Approve by

Apinwat K.

3 / May 2023



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## MULTI-POINT GAS TEST REPORT

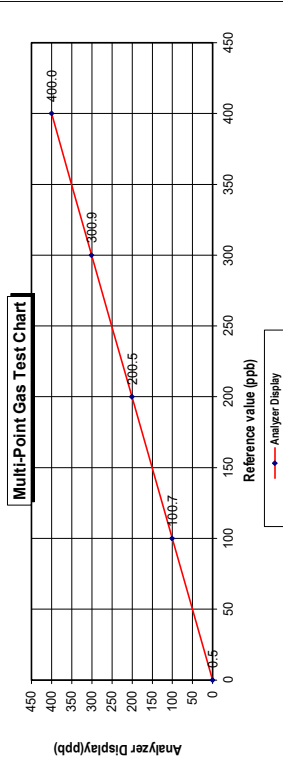
Test Date : Nov 1, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42C  
Manufacturer : Thermo Environmental Instruments Serial Number : 42C-67174-356

| Standard Gas Concentration         |              | Dilutor Detail |                                  |
|------------------------------------|--------------|----------------|----------------------------------|
| Sulphur Dioxide (SO <sub>2</sub> ) | 44.68        | PPM            | Manufacturer : Thermo Scientific |
| Nitric Oxide (NO)                  | 45.94        | PPM            | Model : 146i                     |
| Methane (CH <sub>4</sub> )         | -            | PPM            | Serial Number : 1180540071       |
| Carbon Monoxide (CO)               | 984.8        |                |                                  |
| Cylinder No. :                     | EB0143262    |                |                                  |
| Expiration Date :                  | Jun 21, 2024 |                |                                  |

### Multi-point gas test data

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



Calculate by

Apinwat K.

01 Nov 2023

Approve by

Apinwat K.

1 Nov 2023

# MULTI-POINT GAS TEST REPORT

Test Date : Mar 16, 2023

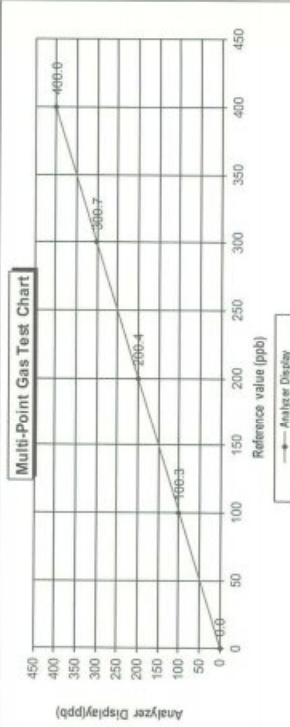
Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42C  
Manufacturer : Thermo Environmental Instruments Serial Number : 42C-58929-320

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM  
Nitric Oxide (NO) 45.94 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 984.8 PPM  
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                    | 0.00             | 0.00          | 0.00    |
| Level 2 20.00%                     | 100.3                  | 0.30             | 0.30          | 0.30    |
| Level 3 40.00%                     | 200.4                  | 0.40             | 0.20          | 0.20    |
| Level 4 60.00%                     | 300.7                  | 0.70             | 0.23          | 0.23    |
| Level 5 80.00%                     | 400.0                  | 0.00             | 0.00          | 0.00    |
| Remark : Measuring Range 500.0 ppb |                        |                  |               |         |
| :Acceptable Limit $\pm$ 5%         |                        |                  |               |         |
| Average Difference (%) 0.15        |                        |                  |               |         |



Calculate by  
Aphivat K.  
16, 3, 2023

Approve by  
Pichon W.  
16, Mar, 2023

# MULTI-POINT GAS TEST REPORT

Test Date : Mar 16, 2023

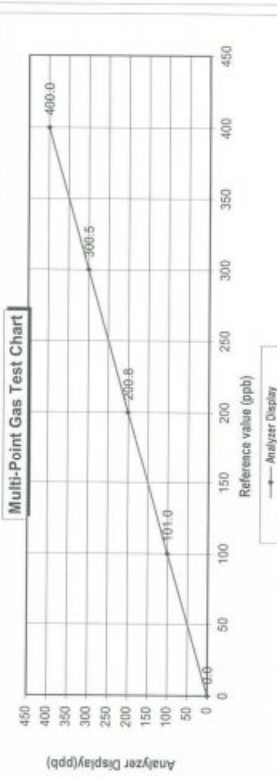
Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42C  
Manufacturer : Thermo Environmental Instruments Serial Number : 42C-70971-367

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM  
Nitric Oxide (NO) 45.94 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 984.8 PPM  
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                    | 0.00             | 0.00          | 0.00    |
| Level 2 20.00%                     | 101.0                  | 1.00             | 0.99          | 0.99    |
| Level 3 40.00%                     | 200.8                  | 0.80             | 0.40          | 0.40    |
| Level 4 60.00%                     | 300.5                  | 0.50             | 0.17          | 0.17    |
| Level 5 80.00%                     | 400.0                  | 0.00             | 0.00          | 0.00    |
| Remark : Measuring Range 500.0 ppb |                        |                  |               |         |
| :Acceptable Limit $\pm$ 5%         |                        |                  |               |         |
| Average Difference (%) 0.31        |                        |                  |               |         |



Calculate by  
Aphivat K.  
16, 3, 2023

Approve by  
Pichon W.  
16, Mar, 2023





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### MULTI-POINT GAS TEST REPORT

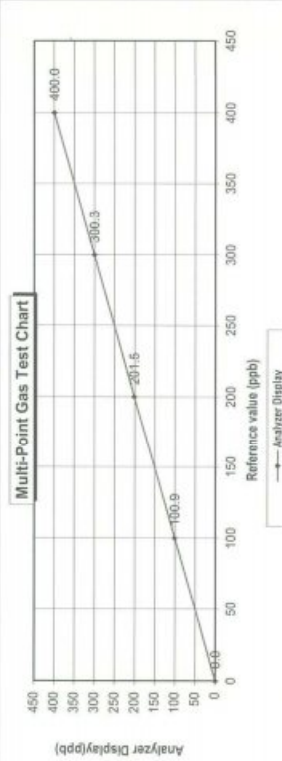
Test Date : Apr 21, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : 1180540064

| Standard Gas Concentration         |              | Dilutor Detail |                   |
|------------------------------------|--------------|----------------|-------------------|
| Sulphur Dioxide (SO <sub>2</sub> ) | 44.68        | PPM            | Thermo Scientific |
| Nitric Oxide (NO)                  | 45.94        | PPM            | 146i              |
| Methane (CH <sub>4</sub> )         | -            | PPM            | 1180540071        |
| Carbon Monoxide (CO)               | 984.8        |                |                   |
| Cylinder No. :                     | EB0143262    |                |                   |
| Expiration Date :                  | Jun 21, 2024 |                |                   |

### Multi-point gas test data

| Reference Value (ppb)              | Analyzer Display (ppb) | Difference Error          | Percent Error | [% Error] |
|------------------------------------|------------------------|---------------------------|---------------|-----------|
| Level 1 Zero                       | 0.0                    | 0.00                      | 0.00          | 0.00      |
| Level 2 20.00%                     | 100.9                  | 0.90                      | 0.89          | 0.89      |
| Level 3 40.00%                     | 201.5                  | 1.50                      | 0.74          | 0.74      |
| Level 4 60.00%                     | 300.3                  | 0.30                      | 0.10          | 0.10      |
| Level 5 80.00%                     | 400.0                  | 0.00                      | 0.00          | 0.00      |
| Remark : Measuring Range 500.0 ppb |                        | Average Difference (%)    |               |           |
|                                    |                        | Acceptable Limit $\pm$ 5% |               |           |



Calculate by

Aphiwat K. ....  
21 Apr 2023

Approve by

Pattana K. ....  
21 Apr 2023



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### MULTI-POINT GAS TEST REPORT

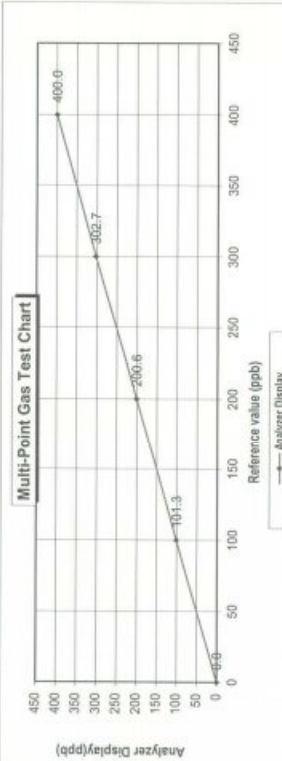
Test Date : May 3, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : 1180540062

| Standard Gas Concentration         |              | Dilutor Detail |                   |
|------------------------------------|--------------|----------------|-------------------|
| Sulphur Dioxide (SO <sub>2</sub> ) | 44.68        | PPM            | Thermo Scientific |
| Nitric Oxide (NO)                  | 45.94        | PPM            | 146i              |
| Methane (CH <sub>4</sub> )         | -            | PPM            | 1180540071        |
| Carbon Monoxide (CO)               | 984.8        |                |                   |
| Cylinder No. :                     | EB0143262    |                |                   |
| Expiration Date :                  | Jun 21, 2024 |                |                   |

### Multi-point gas test data

| Reference Value (ppb)              | Analyzer Display (ppb) | Difference Error          | Percent Error | [% Error] |
|------------------------------------|------------------------|---------------------------|---------------|-----------|
| Level 1 Zero                       | 0.0                    | 0.00                      | 0.00          | 0.00      |
| Level 2 20.00%                     | 101.3                  | 1.30                      | 1.28          | 1.28      |
| Level 3 40.00%                     | 200.6                  | 0.60                      | 0.30          | 0.30      |
| Level 4 60.00%                     | 302.7                  | 2.70                      | 0.89          | 0.89      |
| Level 5 80.00%                     | 400.0                  | 0.00                      | 0.00          | 0.00      |
| Remark : Measuring Range 500.0 ppb |                        | Average Difference (%)    |               |           |
|                                    |                        | Acceptable Limit $\pm$ 5% |               |           |



Calculate by

Aphiwat K. ....  
3 May 2023

Approve by

Pattana K. ....  
3 May 2023





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### MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>)  
Manufacturer : Thermo Scientific Model : 42i  
Serial Number : 1201778110

#### Standard Gas Concentration

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

#### Dilutor Detail

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

#### Multi-point gas test data

| Level                              | Reference Value (ppb) | Analyzer Display (ppb) | Difference Error | Percent Error | [% Error ] |
|------------------------------------|-----------------------|------------------------|------------------|---------------|------------|
| Level 1                            | Zero                  | 0.0                    | 0.00             | 0.00          | 0.00       |
| Level 2                            | 20.00%                | 100.0                  | 1.10             | 1.09          | 1.09       |
| Level 3                            | 40.00%                | 200.0                  | 0.90             | 0.45          | 0.45       |
| Level 4                            | 60.00%                | 300.0                  | 0.50             | 0.17          | 0.17       |
| Level 5                            | 80.00%                | 400.0                  | 0.00             | 0.00          | 0.00       |
| Remark : Measuring Range 500.0 ppb |                       |                        |                  |               | 0.34       |
| : Acceptable Limit $\pm$ 5%        |                       |                        |                  |               |            |
| Average Difference (%)             |                       |                        |                  |               | 0.34       |

#### Multi-Point Gas Test Chart



Calculate by

Apichart K.  
21 Apr 2023

Approve by

Patirak  
21 Apr 2023



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### MULTI-POINT GAS TEST REPORT

Test Date : Nov 1, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>)  
Manufacturer : Thermo Scientific Model : 42i  
Serial Number : 1182920006

#### Standard Gas Concentration

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

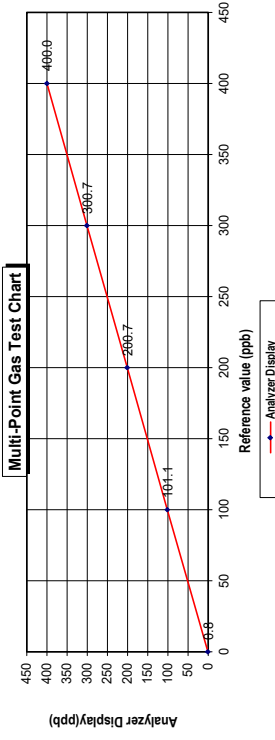
#### Dilutor Detail

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

#### Multi-point gas test data

| Level                              | Reference Value (ppb) | Analyzer Display (ppb) | Difference Error | Percent Error | [% Error ] |
|------------------------------------|-----------------------|------------------------|------------------|---------------|------------|
| Level 1                            | Zero                  | 0.0                    | 0.8              | 0.80          | 0.80       |
| Level 2                            | 20.00%                | 100.0                  | 101.1            | 1.09          | 1.09       |
| Level 3                            | 40.00%                | 200.0                  | 200.7            | 0.35          | 0.35       |
| Level 4                            | 60.00%                | 300.0                  | 300.7            | 0.23          | 0.23       |
| Level 5                            | 80.00%                | 400.0                  | 400.0            | 0.00          | 0.00       |
| Remark : Measuring Range 500.0 ppb |                       |                        |                  |               | 0.49       |
| : Acceptable Limit $\pm$ 5%        |                       |                        |                  |               |            |
| Average Difference (%)             |                       |                        |                  |               | 0.49       |

#### Multi-Point Gas Test Chart



Calculate by

Apichart K.  
01 Nov 2023

Approve by

Patirak  
01 Nov 2023

### MULTI-POINT GAS TEST REPORT

Test Date : Nov 13, 2023

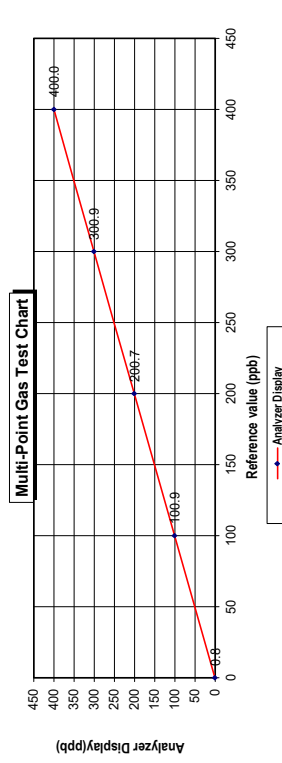
Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : CM19050151

#### Standard Gas Concentration

| Sulphur Dioxide (SO <sub>2</sub> ) | 44.68        | PPM | Manufacturer :  | Thermo Scientific |
|------------------------------------|--------------|-----|-----------------|-------------------|
| Nitric Oxide (NO)                  | 45.94        | PPM | Model :         | 146i              |
| Methane (CH <sub>4</sub> )         | -            | PPM | Serial Number : | 1180540071        |
| Carbon Monoxide (CO)               | 984.8        | PPM |                 |                   |
| Cylinder No. :                     | EB0143262    |     |                 |                   |
| Expiration Date :                  | Jun 21, 2024 |     |                 |                   |

#### Multi-point gas test data

| Reference Value (ppb)      | Analyzer Display (ppb) | Difference Error       | Percent Error | [% Error ] |
|----------------------------|------------------------|------------------------|---------------|------------|
| Level 1 Zero               | 0.0                    | 0.8                    | 0.80          | 0.80       |
| Level 2 20.00%             | 100.0                  | 100.9                  | 0.90          | 0.89       |
| Level 3 40.00%             | 200.0                  | 200.7                  | 0.35          | 0.35       |
| Level 4 60.00%             | 300.0                  | 300.9                  | 0.30          | 0.30       |
| Level 5 80.00%             | 400.0                  | 400.0                  | 0.00          | 0.00       |
| Remark : Measuring Range   | 500.0 ppb              | Average Difference (%) | 0.00          | 0.47       |
| :Acceptable Limit $\pm$ 5% |                        |                        |               |            |



Calculate by

.....  
13 Nov 2023

Approve by

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13 Nov 2023

### MULTI-POINT GAS TEST REPORT

Test Date : Mar 28, 2023

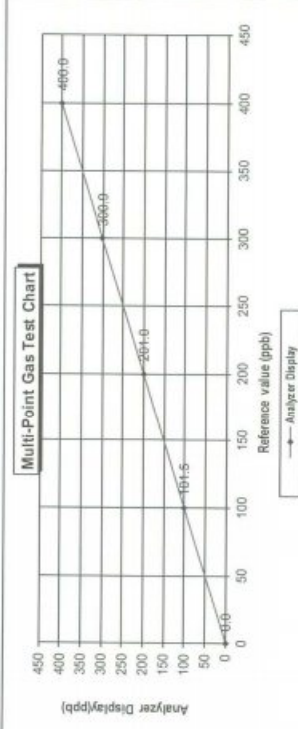
Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : 1200636462

#### Standard Gas Concentration

| Sulphur Dioxide (SO <sub>2</sub> ) | 44.68        | PPM | Manufacturer :  | Thermo Scientific |
|------------------------------------|--------------|-----|-----------------|-------------------|
| Nitric Oxide (NO)                  | 45.94        | PPM | Model :         | 146i              |
| Methane (CH <sub>4</sub> )         | -            | PPM | Serial Number : | 1180540071        |
| Carbon Monoxide (CO)               | 984.8        | PPM |                 |                   |
| Cylinder No. :                     | EB0143262    |     |                 |                   |
| Expiration Date :                  | Jun 21, 2024 |     |                 |                   |

#### Multi-point gas test data

| Reference Value (ppb)      | Analyzer Display (ppb) | Difference Error       | Percent Error | [% Error ] |
|----------------------------|------------------------|------------------------|---------------|------------|
| Level 1 Zero               | 0.0                    | 0.00                   | 0.00          | 0.00       |
| Level 2 20.00%             | 100.0                  | 101.5                  | 1.50          | 1.48       |
| Level 3 40.00%             | 200.0                  | 201.0                  | 1.00          | 0.50       |
| Level 4 60.00%             | 300.0                  | 300.9                  | 0.90          | 0.30       |
| Level 5 80.00%             | 400.0                  | 400.0                  | 0.00          | 0.00       |
| Remark : Measuring Range   | 500.0 ppb              | Average Difference (%) | 0.00          | 0.45       |
| :Acceptable Limit $\pm$ 5% |                        |                        |               |            |



Calculate by

.....  
28 Mar 2023

Approve by

.....  
28 Mar 2023

### MULTI-POINT GAS TEST REPORT

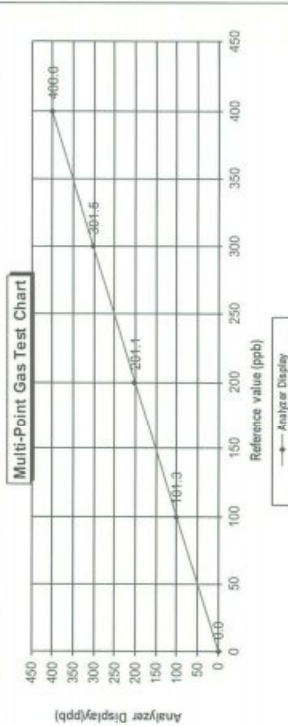
Test Date : May 3, 2023

Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43C  
Manufacturer : Thermo Electron Corporation Serial Number : 43C-0607415779

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM Thermo SCIENTIFIC  
Nitric Oxide (NO) 45.94 PPM 1461  
Methane (CH<sub>4</sub>) - PPM 1180540071  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : EB0143262  
Expiration Date : Jun 24, 2024

### Multi-point gas test data

| Reference Value (ppb)              | Analyzer Display (ppb) | Difference Error       | Percent Error | [% Error ] |
|------------------------------------|------------------------|------------------------|---------------|------------|
| Level 1 Zero 0.0                   | 0.0                    | 0.00                   | 0.00          | 0.00       |
| Level 2 20.00%                     | 101.3                  | 1.30                   | 1.28          | 1.28       |
| Level 3 40.00%                     | 201.1                  | 1.10                   | 0.55          | 0.55       |
| Level 4 60.00%                     | 301.5                  | 1.50                   | 0.50          | 0.50       |
| Level 5 80.00%                     | 400.0                  | 0.00                   | 0.00          | 0.00       |
| Remark : Measuring Range 500.0 ppb |                        | Average Difference (%) |               | 0.47       |
| Acceptable Limit $\pm 5\%$         |                        |                        |               |            |



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Aphivat K.  
3 May 2023

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3 May 2023

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E04N99E15A01D3  
Cylinder Number: EB0143262  
Laboratory: 124 - Durham (SAP) - NC  
PGVP Number: B22021  
Gas Code: CO, NO, NOX, SO<sub>2</sub>, BALN  
Reference Number: 122-402135187-1  
Cylinder Volume: 144.4 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 680  
Certification Date: Jun 21, 2021  
Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gasman Calibration Standards (May 2013)", (document EPA-600/R-12/031), 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               | 45.98 PPM            | G1              | $\pm 1.4\%$ NIST Traceable | 06/14/2021, 06/21/2021 |
| NITRIC OXIDE    | 45.00 PPM               | 45.94 PPM            | G1              | $\pm 1.4\%$ NIST Traceable | 06/14/2021, 06/21/2021 |
| SULFUR DIOXIDE  | 45.00 PPM               | 44.98 PPM            | G1              | $\pm 1.0\%$ NIST Traceable | 06/14/2021, 06/21/2021 |
| CARBON MONOXIDE | 1000 PPM                | 984.3 PPM            | G1              | $\pm 0.7\%$ NIST Traceable | 06/14/2021             |
| NITROGEN        | Balance                 |                      |                 |                            |                        |

### CALIBRATION STANDARDS

| Type   | Lot ID       | Cylinder No | Concentration                       | Uncertainty | Expiration Date |
|--|--------------|-------------|-------------------------------------|-------------|-----------------|
| NTRM   | 20081120     | CC701058    | 43.82 PPM NITRIC OXIDE/NITROGEN     | $\pm 1.2\%$ | Feb 02, 2025    |
| PRM  | 12386        | D689026     | 9.81 PPM NITROGEN DIOXIDE/NO        | $\pm 2.0\%$ | Feb 20, 2020    |
| GMIS   | 407423838102 | CC05581     | 4.348 PPM NITROGEN DIOXIDE/NITROGEN | $\pm 2.1\%$ | Feb 16, 2023    |
| NTRM   | 16011043     | CC473277    | 45.08 PPM SULFUR DIOXIDE/NITROGEN   | $\pm 0.8\%$ | Jun 17, 2022    |
| NTRM   | 14060119     | CC434277    | 980.8 PPM CARBON MONOXIDE/NITROGEN  | $\pm 0.6\%$ | Nov 15, 2025    |
| The SRM, PRM or GMIS noted above is only in reference to the units used in the assay and not part of the analysis. |              |             |                                     |             |                 |

### ANALYTICAL EQUIPMENT

| Instrument/Make/Model                  | Analytical Principle | Last Multi-point Calibration |
|--|----------------------|------------------------------|
| Nicolet 6700 AHR801333 CO              | FTIR                 | Jun 03, 2021                 |
| Nicolet 6700 AHR801333 NO              | FTIR                 | Jun 03, 2021                 |
| Nicolet 6700 AHR801333 NO <sub>2</sub> | FTIR                 | Jun 03, 2021                 |
| Nicolet 6700 AHR801333 SO <sub>2</sub> | FTIR                 | Jun 03, 2021                 |

### Triad Data Available Upon Request

NOTES: PO #521002807  
GROSS WT: 28.40kg  
NET WT: 4.73kg



CERT 3082.01  
เอกสารไม่ควบคุม

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

Approved for Release



**MULTI-POINT GAS TEST REPORT**

Test Date : Nov 3, 2023

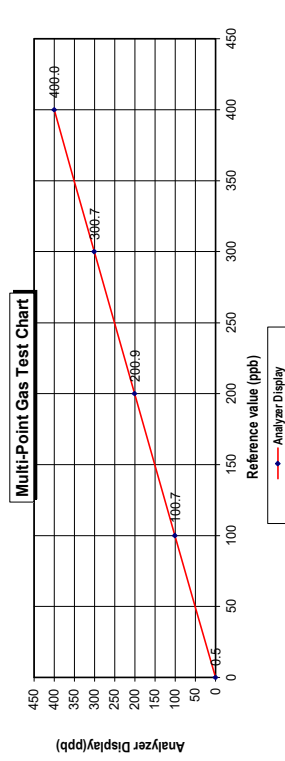
Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387066

**Standard Gas Concentration**

|                                    |              |     |                 |                   |
|------------------------------------|--------------|-----|-----------------|-------------------|
| Sulphur Dioxide (SO <sub>2</sub> ) | 44.68        | PPM | Manufacturer :  | Thermo SCIENTIFIC |
| Nitric Oxide (NO)                  | 45.94        | PPM | Model :         | 146i              |
| Methane (CH <sub>4</sub> )         | -            | PPM | Serial Number : | 1180540071        |
| Carbon Monoxide (CO)               | 984.8        | PPM |                 |                   |
| Cylinder No. :                     | EB0143262    |     |                 |                   |
| Expiration Date :                  | Jun 24, 2024 |     |                 |                   |

**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       |
| Level 2 20.00%           | 100.0                  | 100.7                  | 0.70          | 0.70       |
| Level 3 40.00%           | 200.0                  | 200.9                  | 0.45          | 0.45       |
| Level 4 60.00%           | 300.0                  | 300.7                  | 0.23          | 0.23       |
| Level 5 80.00%           | 400.0                  | 400.0                  | 0.00          | 0.00       |
| Remark : Measuring Range | 500.0 ppb              | Average Difference (%) |               | 0.38       |
| :Acceptable Limit ± 5%   |                        |                        |               |            |



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**MULTI-POINT GAS TEST REPORT**

Test Date : May 3, 2023

Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43C  
Manufacturer : Thermo Environmental Instruments Serial Number : 43C-62236-334

**Standard Gas Concentration**

|                                    |              |     |                 |                   |
|------------------------------------|--------------|-----|-----------------|-------------------|
| Sulphur Dioxide (SO <sub>2</sub> ) | 44.68        | PPM | Manufacturer :  | Thermo SCIENTIFIC |
| Nitric Oxide (NO)                  | 45.94        | PPM | Model :         | 146i              |
| Methane (CH <sub>4</sub> )         | -            | PPM | Serial Number : | 1180540071        |
| Carbon Monoxide (CO)               | 984.8        | PPM |                 |                   |
| Cylinder No. :                     | EB0143262    |     |                 |                   |
| Expiration Date :                  | Jun 24, 2024 |     |                 |                   |

**Multi-point gas test data**

| Reference Value (ppb)    | Analyzer Display (ppb) | Difference Error       | Percent Error | [% Error ] |
|--------------------------|------------------------|------------------------|---------------|------------|
| Level 1 Zero             | 0.0                    | 0.00                   | 0.00          | 0.00       |
| Level 2 20.00%           | 100.0                  | 101.7                  | 1.70          | 1.67       |
| Level 3 40.00%           | 200.0                  | 201.3                  | 1.30          | 0.65       |
| Level 4 60.00%           | 300.0                  | 301.9                  | 1.90          | 0.63       |
| Level 5 80.00%           | 400.0                  | 400.0                  | 0.00          | 0.00       |
| Remark : Measuring Range | 500.0 ppb              | Average Difference (%) |               | 0.59       |
| :Acceptable Limit ± 5%   |                        |                        |               |            |



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### MULTI-POINT GAS TEST REPORT

Test Date : Nov 3, 2023

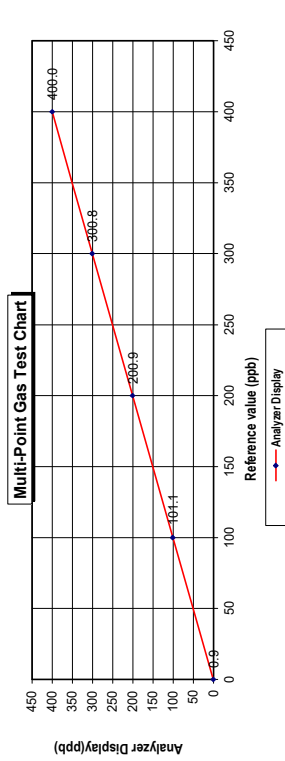
Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778111

#### Standard Gas Concentration

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

#### Multi-point gas test data

| Reference Value (ppb)    | Analyzer Display (ppb) | Difference Error          | Percent Error | [% Error ] |
|--------------------------|------------------------|---------------------------|---------------|------------|
| Level 1 Zero             | 0.0                    | 0.90                      | 0.90          | 0.90       |
| Level 2 20.00%           | 100.0                  | 1.10                      | 1.09          | 1.09       |
| Level 3 40.00%           | 200.0                  | 0.90                      | 0.45          | 0.45       |
| Level 4 60.00%           | 300.0                  | 0.80                      | 0.27          | 0.27       |
| Level 5 80.00%           | 400.0                  | 0.00                      | 0.00          | 0.00       |
| Remark : Measuring Range |                        | 500.0 ppb                 |               | 0.54       |
|                          |                        | Acceptable Limit $\pm$ 5% |               |            |



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03 Nov 2023



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### MULTI-POINT GAS TEST REPORT

Test Date : Nov 3, 2023

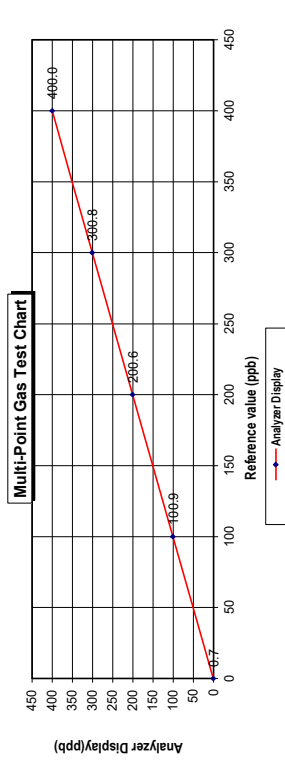
Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387065

#### Standard Gas Concentration

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

#### Multi-point gas test data

| Reference Value (ppb)    | Analyzer Display (ppb) | Difference Error          | Percent Error | [% Error ] |
|--------------------------|------------------------|---------------------------|---------------|------------|
| Level 1 Zero             | 0.0                    | 0.70                      | 0.70          | 0.70       |
| Level 2 20.00%           | 100.0                  | 0.90                      | 0.89          | 0.89       |
| Level 3 40.00%           | 200.0                  | 0.60                      | 0.30          | 0.30       |
| Level 4 60.00%           | 300.0                  | 0.80                      | 0.27          | 0.27       |
| Level 5 80.00%           | 400.0                  | 0.00                      | 0.00          | 0.00       |
| Remark : Measuring Range |                        | 500.0 ppb                 |               | 0.43       |
|                          |                        | Acceptable Limit $\pm$ 5% |               |            |



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03 Nov 2023

03 Nov 2023

**MULTI-POINT GAS TEST REPORT**

**Test Date** : Apr 4, 2023

**Equipment** : Gas Analyzer (SO<sub>2</sub>)  
**Manufacturer** : Thermo SCIENTIFIC  
**Model** : 43i  
**Serial Number** : 1201778116

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM  
Nitric Oxide (NO) 45.94 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : E80143262  
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                   | 0.0                    | 0.00             | 0.00          | 0.00       |
| Level 2 20.00%                     | 100.0                  | 100.7            | 0.70          | 0.70       |
| Level 3 40.00%                     | 200.0                  | 201.5            | 0.74          | 0.74       |
| Level 4 60.00%                     | 300.0                  | 301.3            | 0.43          | 0.43       |
| Level 5 80.00%                     | 400.0                  | 400.0            | 0.00          | 0.00       |
| Remark : Measuring Range 500.0 ppb |                        |                  |               |            |
| Average Difference (%) 0.37        |                        |                  |               |            |
| :Acceptable Limit $\pm$ 5%         |                        |                  |               |            |



**Calculate by**  
Aphivat K.  
25/4/2023

**Approve by**  
Pattana  
4/4/2023

**MULTI-POINT GAS TEST REPORT**

**Test Date** : Apr 25, 2023

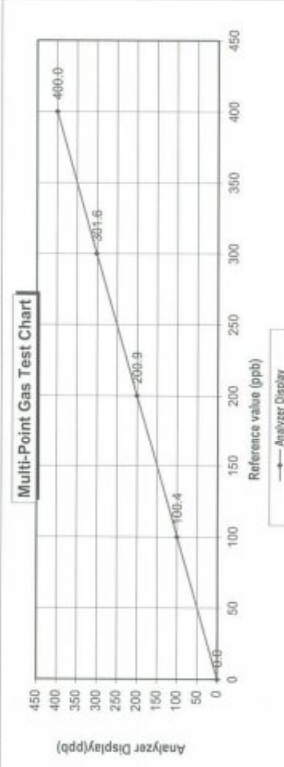
**Equipment** : Gas Analyzer (SO<sub>2</sub>)  
**Manufacturer** : Thermo SCIENTIFIC  
**Model** : 43i  
**Serial Number** : 1201778113

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM  
Nitric Oxide (NO) 45.94 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : E80143262  
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                   | 0.0                    | 0.00             | 0.00          | 0.00       |
| Level 2 20.00%                     | 100.0                  | 100.4            | 0.40          | 0.40       |
| Level 3 40.00%                     | 200.0                  | 200.9            | 0.45          | 0.45       |
| Level 4 60.00%                     | 300.0                  | 301.6            | 0.53          | 0.53       |
| Level 5 80.00%                     | 400.0                  | 400.0            | 0.00          | 0.00       |
| Remark : Measuring Range 500.0 ppb |                        |                  |               |            |
| Average Difference (%) 0.28        |                        |                  |               |            |
| :Acceptable Limit $\pm$ 5%         |                        |                  |               |            |



**Calculate by**  
Aphivat K.  
25/4/2023

**Approve by**  
Pattana  
25/4/2023



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### MULTI-POINT GAS TEST REPORT

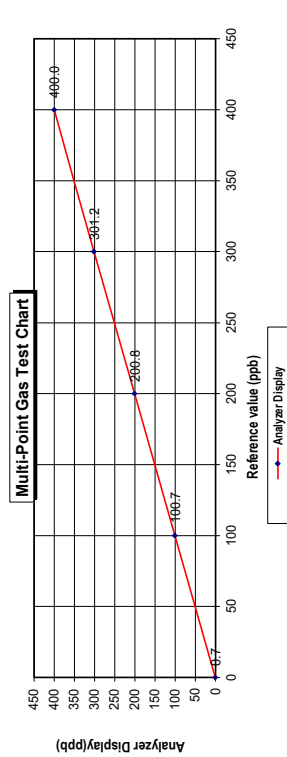
Test Date : Nov 3, 2023

Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387061

| Standard Gas Concentration         |              | Dilutor Detail |                                  |
|------------------------------------|--------------|----------------|----------------------------------|
| Sulphur Dioxide (SO <sub>2</sub> ) | 44.68        | PPM            | Manufacturer : Thermo SCIENTIFIC |
| Nitric Oxide (NO)                  | 45.94        | PPM            | Model : 146i                     |
| Methane (CH <sub>4</sub> )         | -            | PPM            | Serial Number : 1180540071       |
| Carbon Monoxide (CO)               | 984.8        |                |                                  |
| Cylinder No. :                     | EB0143262    |                |                                  |
| Expiration Date :                  | Jun 24, 2024 |                |                                  |

#### 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       |
| Level 2                  | 20.00% | 100.0                  | 100.7            | 0.70                   | 0.70       |
| Level 3                  | 40.00% | 200.0                  | 200.8            | 0.40                   | 0.40       |
| Level 4                  | 60.00% | 300.0                  | 301.2            | 0.40                   | 0.40       |
| Level 5                  | 80.00% | 400.0                  | 400.0            | 0.00                   | 0.00       |
| Remark : Measuring Range |        | 500.0 ppb              |                  | Average Difference (%) |            |
|                          |        |                        |                  | 0.44                   |            |



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### MULTI-POINT GAS TEST REPORT

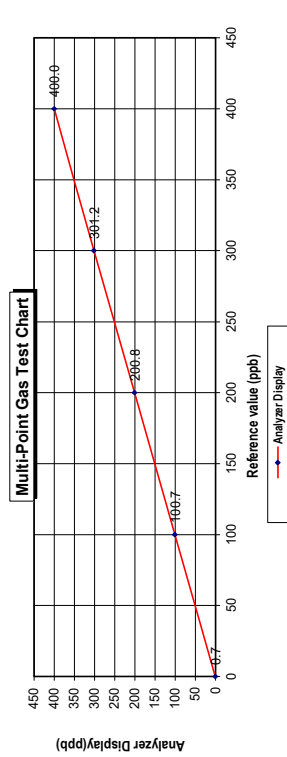
Test Date : Nov 3, 2023

Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387061

| Standard Gas Concentration         |              | Dilutor Detail |                                  |
|------------------------------------|--------------|----------------|----------------------------------|
| Sulphur Dioxide (SO <sub>2</sub> ) | 44.68        | PPM            | Manufacturer : Thermo SCIENTIFIC |
| Nitric Oxide (NO)                  | 45.94        | PPM            | Model : 146i                     |
| Methane (CH <sub>4</sub> )         | -            | PPM            | Serial Number : 1180540071       |
| Carbon Monoxide (CO)               | 984.8        |                |                                  |
| Cylinder No. :                     | EB0143262    |                |                                  |
| Expiration Date :                  | Jun 24, 2024 |                |                                  |

#### 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       |
| Level 2                  | 20.00% | 100.0                  | 100.7                  | 0.70          | 0.70       |
| Level 3                  | 40.00% | 200.0                  | 200.8                  | 0.40          | 0.40       |
| Level 4                  | 60.00% | 300.0                  | 301.2                  | 0.40          | 0.40       |
| Level 5                  | 80.00% | 400.0                  | 400.0                  | 0.00          | 0.00       |
| Remark : Measuring Range |        | 500.0 ppb              | Average Difference (%) |               | 0.44       |



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### Multi-Point Gas Test Report

Test Date : Nov 3, 2023

Equipment : Gas Analyzer (SO<sub>2</sub>)  
Manufacturer : Thermo SCIENTIFIC  
Model : 43i  
Serial Number : 1182920016

### Standard Gas Concentration

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

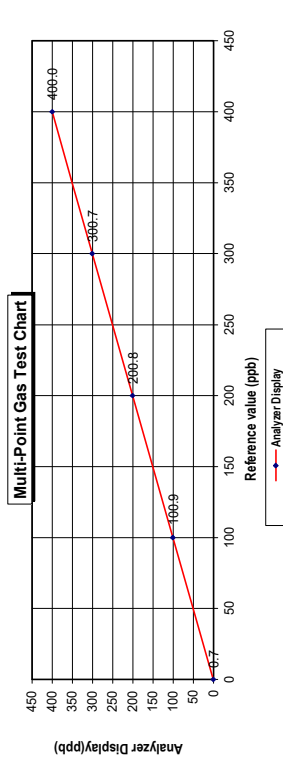
### Dilutor Detail

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

### Multi-point gas test data

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

Remark : Measuring Range 500.0 ppb  
Acceptable Limit  $\pm$  5%



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### Multi-Point Gas Test Report

Test Date : Nov 9, 2023

Equipment : Gas Analyzer (SO<sub>2</sub>)  
Manufacturer : Thermo SCIENTIFIC  
Model : 43i  
Serial Number : 1182920015

### Standard Gas Concentration

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

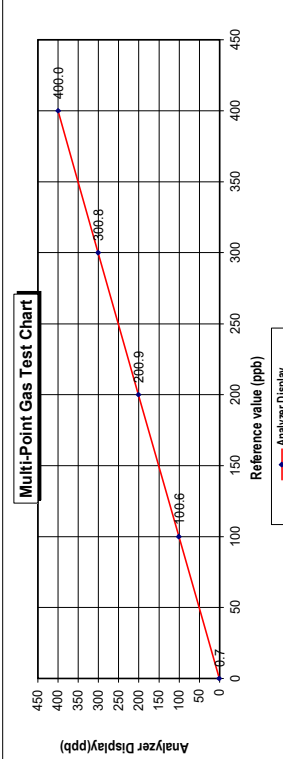
### Dilutor Detail

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

### Multi-point gas test data

| Reference Value (ppb) | Analyzer Display (ppb) | Difference Error | Percent Error | [% Error ] |
|-----------------------|------------------------|------------------|---------------|------------|
| Zero                  | 0.0                    | 0.7              | 0.70          | 0.70       |
| Level 1               | 100.0                  | 100.6            | 0.60          | 0.60       |
| Level 2               | 200.0                  | 200.9            | 0.90          | 0.45       |
| Level 3               | 300.0                  | 300.8            | 0.80          | 0.27       |
| Level 4               | 400.0                  | 400.0            | 0.00          | 0.00       |
| Level 5               | 500.0                  | 500.0            | 0.00          | 0.40       |

Remark : Measuring Range 500.0 ppb  
Acceptable Limit  $\pm$  5%



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09 / Nov / 2023  
..... / Nov / 2023





United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260  
Tel. 0 2763 2828 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

### MULTI-POINT GAS TEST REPORT

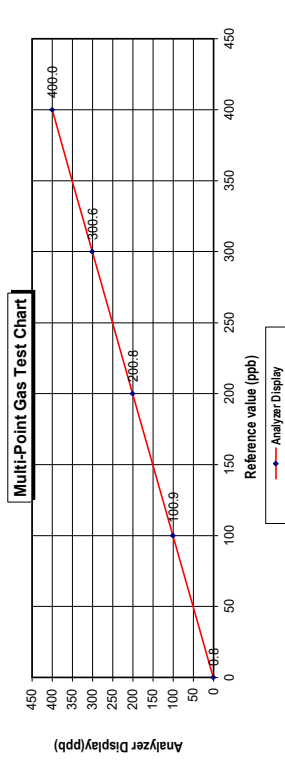
Test Date : Nov 9, 2023

Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : JC1606001758

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM Manufacturer : Thermo SCIENTIFIC  
Nitric Oxide (NO) 45.94 PPM Model : 146i  
Methane (CH<sub>4</sub>) - PPM Serial Number : 1180540071  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : EB0143262  
Expiration Date : Jun 24, 2024

### Multi-point gas test data

| Level                              | Reference Value (ppb) | Analyzer Display (ppb) | Difference Error | Percent Error | [% Error ] |
|------------------------------------|-----------------------|------------------------|------------------|---------------|------------|
| Level 1                            | Zero                  | 0.0                    | 0.80             | 0.80          | 0.80       |
| Level 2                            | 20.00%                | 100.0                  | 100.9            | 0.90          | 0.89       |
| Level 3                            | 40.00%                | 200.0                  | 200.8            | 0.40          | 0.40       |
| Level 4                            | 60.00%                | 300.0                  | 300.6            | 0.20          | 0.20       |
| Level 5                            | 80.00%                | 400.0                  | 400.0            | 0.00          | 0.00       |
| Remark : Measuring Range 500.0 ppb |                       |                        |                  |               | 0.46       |
| : Acceptable Limit $\pm$ 5%        |                       |                        |                  |               |            |



Calculate by

9 / 11 / 66

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9 / Nov / 2023



United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260  
Tel. 0 2763 2828 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

### MULTI-POINT GAS TEST REPORT

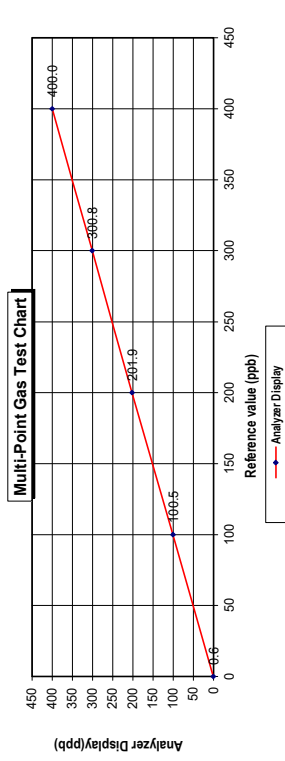
Test Date : Nov 9, 2023

Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : 1200906876

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM Manufacturer : Thermo SCIENTIFIC  
Nitric Oxide (NO) 45.94 PPM Model : 146i  
Methane (CH<sub>4</sub>) - PPM Serial Number : 1180540071  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : EB0143262  
Expiration Date : Jun 24, 2024

### Multi-point gas test data

| Level                              | Reference Value (ppb) | Analyzer Display (ppb) | Difference Error | Percent Error | [% Error ] |
|------------------------------------|-----------------------|------------------------|------------------|---------------|------------|
| Level 1                            | Zero                  | 0.0                    | 0.60             | 0.60          | 0.60       |
| Level 2                            | 20.00%                | 100.0                  | 100.5            | 0.50          | 0.50       |
| Level 3                            | 40.00%                | 200.0                  | 201.9            | 1.90          | 0.94       |
| Level 4                            | 60.00%                | 300.0                  | 300.8            | 0.80          | 0.27       |
| Level 5                            | 80.00%                | 400.0                  | 400.0            | 0.00          | 0.00       |
| Remark : Measuring Range 500.0 ppb |                       |                        |                  |               | 0.46       |
| : Acceptable Limit $\pm$ 5%        |                       |                        |                  |               |            |



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Airgas Specialty Gases  
Airgas USA, LLC  
699 United Drive  
Durham, NC 27713  
Airgas.com

## CERTIFICATE OF ANALYSIS Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3  
Cylinder Number: EB0143262  
Laboratory: 124 - Durham (SAP) - NC  
PGVP Number: B22021  
Gas Code: CO, NO, NOX, SO2, BALN  
Reference Number: 122-402135167-1  
Cylinder Volume: 144.4 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 660  
Certification Date: Jun 21, 2021  
Expiration Date: Jun 21, 2024

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gasman Calibration Standards (May 2013), document EPA-806R-12-031, using the assay procedure listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a valid 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 multiple basis unless otherwise noted.

Do Not Use This Cylinder Below 100 psig, i.e. 6.7 megapascals

| ANALYTICAL RESULTS |                         |                      |                 |                        |
|--------------------|-------------------------|----------------------|-----------------|------------------------|
| Component          | Requested Concentration | Actual Concentration | Protocol Method | Assay Dates            |
| NOX                | 45.00 PPM               | 45.56 PPM            | G1              | 06/14/2021, 06/21/2021 |
| NITRIC OXIDE       | 45.00 PPM               | 46.94 PPM            | G1              | 06/14/2021, 06/21/2021 |
| SULFUR DIOXIDE     | 45.00 PPM               | 44.58 PPM            | G1              | 06/14/2021, 06/21/2021 |
| CARBON MONOXIDE    | 1000 PPM                | 954.8 PPM            | G1              | 06/14/2021             |
| NITROGEN           | Balance                 |                      |                 |                        |

| CALIBRATION STANDARDS  |              |   |
|--|--------------|---|
| Type   | Cylinder No  | Concentration                               |
| NTRM   | 20081120     | 43.82 PPM NITRIC OXIDE/NITROGEN             |
| PRM  | 12366        | 9.91 PPM NITROGEN DIOXIDE/AIR               |
| GMS  | 401423838102 | 4.344 PPM NITROGEN DIOXIDE/NITROGEN         |
| NTRM   | 16011043     | CC473277 49.02 PPM SULFUR DIOXIDE/NITROGEN  |
| NTRM   | 14060119     | CC434277 990.8 PPM CARBON MONOXIDE/NITROGEN |
| The SRM, PRM or RCM values above is only in reference to the GMS used in the assay and not part of the analysis. |              |   |

| ANALYTICAL EQUIPMENT        |                      |                             |
|-----------------------------|----------------------|-----------------------------|
| Instrument/Make/Model       | Analytical Principle | Last Multipoint Calibration |
| Niclett 8700 AHR0801333 CO  | FTIR                 | Jun 03, 2021                |
| Niclett 8700 AHR0801333 NO  | FTIR                 | Jun 03, 2021                |
| Niclett 8700 AHR0801333 NO2 | FTIR                 | Jun 03, 2021                |
| Niclett 8700 AHR0801333 SO2 | FTIR                 | Jun 03, 2021                |

Triad Data Available Upon Request

NOTES: P.O. #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.

Approved for Release

Approved for Release

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United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok 10260  
Tel. 0 2763 2828 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

## MULTI-POINT GAS TEST REPORT

Test Date : Nov 3, 2023

Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : 1200906875

### Standard Gas Concentration

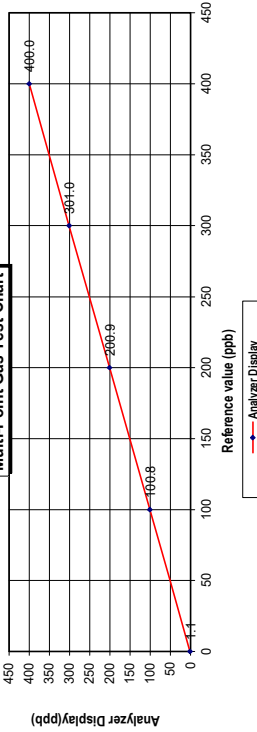
| Dilutor Detail                     |              |
|------------------------------------|--------------|
| Sulphur Dioxide (SO <sub>2</sub> ) | 44.68 PPM    |
| Nitric Oxide (NO)                  | 45.94 PPM    |
| Methane (CH <sub>4</sub> )         | - PPM        |
| Carbon Monoxide (CO)        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

### Multi-point gas test data

| Level                              | Reference Value (ppb) | Analyzer Display (ppb) | Difference Error | Percent Error | % Error ] |
|------------------------------------|-----------------------|------------------------|------------------|---------------|-----------|
| Level 1                            | Zero                  | 0.0                    | 1.1              | 1.10          | 1.10      |
| Level 2                            | 20.00%                | 100.0                  | 100.8            | 0.80          | 0.79      |
| Level 3                            | 40.00%                | 200.0                  | 200.9            | 0.90          | 0.45      |
| Level 4                            | 60.00%                | 300.0                  | 301.0            | 1.00          | 0.33      |
| Level 5                            | 80.00%                | 400.0                  | 400.0            | 0.00          | 0.00      |
| Remark : Measuring Range 500.0 ppb |                       |                        |                  |               | 0.53      |
| Average Difference (%)             |                       |                        |                  |               | 0.53      |

Acceptable Limit  $\pm$  5%

### Multi-Point Gas Test Chart



Calculate by

Approve by

.....  
...03..... / ....Nov. / ....2023



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

13 March, 2024  
Certification No. 119/24  
Page : 2 of 5

| Standard<br>Ultrasonic Anemometer<br>m/sec | HOOK GAGE NO. 1425     |                      | TESTED ANEMOMETER |                     |
|--|------------------------|----------------------|-------------------|---------------------|
|  | Pressure<br>inches H2O | Vacuum<br>inches H2O | Velocity<br>m/sec | Correction<br>m/sec |
| 1.00                                       | -                      | -                    | 1.0               | 0.00                |
| 3.02                                       | -                      | -                    | 3.0               | 0.02                |
| 5.00                                       | -                      | -                    | 5.0               | 0.00                |
| 7.04                                       | -                      | -                    | 7.0               | 0.04                |
| 9.02                                       | -                      | -                    | 8.9               | 0.12                |
| 11.02                                      | -                      | -                    | 11.0              | 0.02                |
| 13.01                                      | -                      | -                    | 13.0              | 0.01                |
| 15.01                                      | -                      | -                    | 14.9              | 0.11                |
| 17.02                                      | -                      | -                    | 17.0              | 0.02                |
| 20.02                                      | -                      | -                    | 20.0              | 0.02                |

| Wind Aloft Plotting Board.                 |                       |
|--|-----------------------|
| U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU |                       |
| WIND DIRECTION                             | TESTED WIND DIRECTION |
| 0  | 0                     |
| 90   | 90                    |
| 180  | 180                   |
| 270  | 270                   |

Calibrated by : *Wathrapol*

Mr. Watcharapol Subwat  
Mechanical Engineer



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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 13 March, 2024  
Certification No. 119/24  
Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2111DR0041

Wind Sensor 2111DT0041

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1010.6 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs F0014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich ; Dry No.8390/04 Wet No. 8389/04

: Testo, testo 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220-NO. V1220015

: Digital Barometer Vaisala Type PTB330-NO. 74320001

Calibrated by : *Wathrapol* Signed : *Mr. Watcharapol Subwat*

Mr. Watcharapol Subwat Mechanical Engineer

(Authorized Signature)

for the Chief

Sub-Standard Instrument

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### The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 4 of 5

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mmHg |
|--------------------------------|------------------------------|--------------------|
| 757.25                         | 757                          | 0.25               |
| 757.15                         | 757                          | 0.15               |
| 757.64                         | 758                          | -0.36              |
| 758.27                         | 758                          | 0.27               |
| 758.66                         | 758                          | 0.66               |
| 758.94                         | 759                          | -0.06              |
| 759.11                         | 759                          | 0.11               |
| 759.84                         | 760                          | -0.16              |
| 759.95                         | 760                          | -0.05              |
| 759.73                         | 760                          | -0.27              |
| 759.96                         | 760                          | -0.04              |
| 760.14                         | 760                          | 0.14               |
| 760.42                         | 761                          | -0.58              |
| 760.70                         | 761                          | -0.30              |
| 762.03                         | 762                          | 0.03               |
| 762.24                         | 762                          | 0.24               |
| 761.79                         | 762                          | -0.21              |
| 761.48                         | 761                          | 0.48               |
| 759.71                         | 760                          | -0.29              |
| 760.28                         | 760                          | 0.28               |

Average

0.02

Calibrated by :

Wathapong

Mr. Watcharapol Subwat

Mechanical Engineer



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### The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 3 of 5

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mbar |
|--------------------------------|------------------------------|--------------------|
| 1009.59                        | 1009                         | 0.59               |
| 1009.45                        | 1009                         | 0.45               |
| 1010.10                        | 1010                         | 0.10               |
| 1010.94                        | 1011                         | -0.06              |
| 1011.46                        | 1011                         | 0.46               |
| 1011.84                        | 1012                         | -0.16              |
| 1012.06                        | 1012                         | 0.06               |
| 1013.04                        | 1013                         | 0.04               |
| 1013.18                        | 1013                         | 0.18               |
| 1012.89                        | 1013                         | -0.11              |
| 1013.20                        | 1013                         | 0.20               |
| 1013.44                        | 1014                         | -0.56              |
| 1013.81                        | 1014                         | -0.19              |
| 1014.19                        | 1014                         | 0.19               |
| 1015.98                        | 1016                         | -0.04              |
| 1016.23                        | 1016                         | 0.23               |
| 1015.64                        | 1016                         | -0.36              |
| 1015.23                        | 1015                         | 0.23               |
| 1012.87                        | 1013                         | -0.13              |
| 1013.63                        | 1014                         | -0.37              |

Average

0.84

Calibrated by :

Wathapong

Mr. Watcharapol Subwat

Mechanical Engineer



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Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 22 February, 2024

Certification No. 098/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2111DR0052

Wind Sensor 2111DT0052

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.5 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs F0014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/84 Wet No. 8389/84

: testo, testo 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB360144, 333200001

Calibrated by :  Signed: (Authorised Signatory)

Mr. Watchapol Subwat

Mr. Pisobd Promaut

Mechanical Engineer



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The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 5 of 5

| Standard Temp.<br>°C | Temperature Sensor Reading |                  |
|----------------------|----------------------------|------------------|
|                      | Reading<br>°C              | Correction<br>°C |
| 45.1                 | 45                         | 0.1              |
| 30.2                 | 30                         | 0.2              |
| 15.4                 | 15                         | 0.4              |

Calibrated by : 

Mr. Watchapol Subwat

Mechanical Engineer



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### The Result of Calibration

22 February, 2024  
Certification No. 098/24  
Page : 3 of 5

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mbar |
|--------------------------------|------------------------------|--------------------|
| 1010.84                        | 1011                         | -0.16              |
| 1010.60                        | 1010                         | 0.60               |
| 1011.71                        | 1012                         | -0.29              |
| 1012.17                        | 1012                         | 0.17               |
| 1012.31                        | 1012                         | 0.31               |
| 1012.25                        | 1012                         | 0.25               |
| 1012.79                        | 1013                         | -0.21              |
| 1012.95                        | 1012                         | 0.95               |
| 1013.52                        | 1014                         | -0.48              |
| 1014.16                        | 1014                         | 0.16               |
| 1015.79                        | 1016                         | -0.21              |
| 1016.02                        | 1016                         | 0.02               |
| 1015.86                        | 1016                         | -0.14              |
| 1015.69                        | 1015                         | 0.69               |
| 1011.51                        | 1012                         | -0.49              |
| 1011.80                        | 1012                         | -0.20              |
| 1012.06                        | 1012                         | 0.06               |
| 1012.81                        | 1013                         | -0.19              |
| 1013.22                        | 1013                         | 0.22               |
| 1013.49                        | 1013                         | 0.49               |
| Average                        |                              | 0.08               |

Calibrated by : **Nahtarapol**  
Mr. Watcharapol Subwat  
Mechanical Engineer



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### The Result of Calibration

22 February, 2024  
Certification No. 098/24  
Page : 2 of 5

| Standard<br>Ultrasonic Anemometer<br>m/sec | HOOK GAGE NO. 1425    |                     |                   | TESTED ANEMOMETER |                     |
|--|-----------------------|---------------------|-------------------|-------------------|---------------------|
|  | Pressure<br>Hecto H2O | Vacuum<br>Hecto H2O | Velocity<br>m/sec | Velocity<br>m/sec | Correction<br>m/sec |
|  | -                     | -                   | -                 | -                 | -                   |
| 1.00                                       | -                     | -                   | -                 | 1.0               | 0.00                |
| 3.02                                       | -                     | -                   | -                 | 3.0               | 0.02                |
| 5.00                                       | -                     | -                   | -                 | 5.0               | 0.00                |
| 7.04                                       | -                     | -                   | -                 | 7.0               | 0.04                |
| 9.02                                       | -                     | -                   | -                 | 9.0               | 0.02                |
| 11.02                                      | -                     | -                   | -                 | 11.0              | 0.02                |
| 13.01                                      | -                     | -                   | -                 | 13.0              | 0.01                |
| 15.01                                      | -                     | -                   | -                 | 15.0              | 0.01                |
| 17.02                                      | -                     | -                   | -                 | 16.9              | 0.12                |
| 20.02                                      | -                     | -                   | -                 | 19.9              | 0.12                |

| Wind Aloft Plotting Board.               |                       |  |
|--|-----------------------|--|
| US.DEPARTMENT OF COMMERCE WEATHER BUREAU |                       |  |
| WIND DIRECTION                           | TESTED WIND DIRECTION |  |
| 0  | 0                     |  |
| 90                                       | 90                    |  |
| 180                                      | 180                   |  |
| 270                                      | 270                   |  |

Calibrated by : **Nahtarapol**  
Mr. Watcharapol Subwat  
Mechanical Engineer



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The Result of Calibration

Certification No. 098/24  
Page : 4 of 5

22 February, 2024

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mmHg |
|--------------------------------|------------------------------|--------------------|
| 758.19                         | 758                          | 0.19               |
| 758.01                         | 758                          | 0.01               |
| 758.84                         | 759                          | -0.16              |
| 759.19                         | 759                          | 0.19               |
| 759.29                         | 759                          | 0.29               |
| 759.25                         | 759                          | 0.25               |
| 759.05                         | 760                          | -0.35              |
| 759.77                         | 760                          | -0.23              |
| 760.20                         | 760                          | 0.20               |
| 760.88                         | 760                          | 0.88               |
| 761.90                         | 762                          | -0.10              |
| 762.08                         | 762                          | 0.08               |
| 761.96                         | 762                          | -0.17              |
| 761.83                         | 762                          | -0.04              |
| 758.69                         | 759                          | -0.31              |
| 758.91                         | 759                          | -0.09              |
| 759.11                         | 759                          | 0.11               |
| 759.67                         | 760                          | -0.33              |
| 759.98                         | 760                          | -0.02              |
| 760.18                         | 760                          | 0.18               |
| Average                        |                              | 0.02               |

Calibrated by : **Natthapol**  
Mr. Watchapol Subwat  
Mechanical Engineer



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The Result of Calibration

Certification No. 098/24  
Page : 5 of 5

22 February, 2024

| Standard<br>Temp.<br>°C | Temperature Sensor Reading |                  |
|-------------------------|----------------------------|------------------|
|                         | Reading<br>°C              | Correction<br>°C |
| 45.2                    | 45                         | 0.2              |
| 30.3                    | 30                         | 0.3              |
| 15.8                    | 15                         | 0.8              |

Calibrated by : **Natthapol**  
Mr. Watchapol Subwat  
Mechanical Engineer



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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration


Certification No. 121/24

13 March, 2024

Page : 2 of 5

| Standard              | HOOK GAGE NO. 1425       |                        | TESTED ANEMOMETER |                     |
|-----------------------|--------------------------|------------------------|-------------------|---------------------|
|                       | Pressure<br>hPa/mbar H2O | Vacuum<br>hPa/mbar H2O | Velocity<br>m/sec | Correction<br>m/sec |
| Ultrasonic Anemometer |                          |                        |                   |                     |
| m/sec                 |                          |                        |                   |                     |
| 1.00                  | -                        | -                      | 1.0               | 0.00                |
| 3.02                  | -                        | -                      | 3.0               | 0.02                |
| 5.00                  | -                        | -                      | 5.0               | 0.00                |
| 7.04                  | -                        | -                      | 7.0               | 0.04                |
| 9.02                  | -                        | -                      | 8.9               | 0.12                |
| 11.02                 | -                        | -                      | 11.0              | 0.02                |
| 13.01                 | -                        | -                      | 13.0              | 0.01                |
| 15.01                 | -                        | -                      | 15.0              | 0.01                |
| 17.02                 | -                        | -                      | 17.0              | 0.02                |
| 20.02                 | -                        | -                      | 19.9              | 0.12                |

| Wind Aloft Plotting Board.                 |                       |    |
|--|-----------------------|----|
| U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU |                       |    |
| WIND DIRECTION                             | TESTED WIND DIRECTION |    |
|  | 0                     | 90 |
| 0  |                       |    |
| 90   |                       |    |
| 180  |                       |    |
| 270  |                       |    |

Calibrated by :   
Mr. Watchapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of issue 13 March, 2024 Certification No. 121/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2111DR0058

Wind Sensor 2111DT0058

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1011.9 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 7317241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB330116 74390001

Calibrated by :   
Mr. Watchapol Subwat  
Mechanical Engineer

(Authorised Signatory)  
for the Chief  
Sub-Standard Instrument

(Authorised Signatory)

(Authorised Signatory)

(Authorised Signatory)

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The Result of Calibration

Certification No. 121/24

13 March, 2024

Page : 4 of 5

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mmHg |
|--------------------------------|------------------------------|--------------------|
| 757.25                         | 757                          | 0.25               |
| 757.15                         | 757                          | 0.15               |
| 757.04                         | 756                          | -0.36              |
| 756.27                         | 756                          | 0.27               |
| 756.66                         | 755                          | 0.66               |
| 756.94                         | 755                          | -0.06              |
| 759.11                         | 759                          | 0.11               |
| 759.84                         | 760                          | -0.16              |
| 759.95                         | 760                          | -0.05              |
| 759.73                         | 760                          | -0.27              |
| 759.96                         | 760                          | -0.04              |
| 760.14                         | 760                          | 0.14               |
| 760.42                         | 761                          | -0.58              |
| 760.70                         | 761                          | -0.30              |
| 762.03                         | 762                          | 0.03               |
| 762.24                         | 762                          | 0.24               |
| 761.79                         | 762                          | -0.21              |
| 761.46                         | 762                          | -0.52              |
| 759.71                         | 760                          | -0.29              |
| 760.26                         | 760                          | 0.26               |

Average

-0.03

Calibrated by :

Watharapol

Mr. Watcharapol Subwat

Mechanical Engineer



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The Result of Calibration

Certification No. 121/24

13 March, 2024

Page : 3 of 5

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mbar |
|--------------------------------|------------------------------|--------------------|
| 1009.59                        | 1009                         | 0.59               |
| 1009.45                        | 1010                         | -0.55              |
| 1010.10                        | 1010                         | 0.10               |
| 1010.94                        | 1011                         | -0.06              |
| 1011.46                        | 1011                         | 0.46               |
| 1011.84                        | 1012                         | -0.16              |
| 1012.06                        | 1012                         | 0.06               |
| 1013.04                        | 1013                         | 0.04               |
| 1013.18                        | 1013                         | 0.18               |
| 1012.89                        | 1013                         | -0.11              |
| 1013.20                        | 1013                         | 0.20               |
| 1013.44                        | 1013                         | 0.44               |
| 1013.81                        | 1014                         | -0.19              |
| 1014.19                        | 1014                         | 0.19               |
| 1015.96                        | 1016                         | -0.04              |
| 1016.23                        | 1016                         | 0.23               |
| 1015.64                        | 1015                         | 0.64               |
| 1015.23                        | 1015                         | 0.23               |
| 1012.87                        | 1013                         | -0.13              |
| 1013.63                        | 1014                         | -0.37              |

Average

0.09

Calibrated by :

Watharapol

Mr. Watcharapol Subwat

Mechanical Engineer



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# Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 22 February, 2024

Certification No. 097124

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2112DR0065

Wind Sensor 2112DT0065

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

81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.8 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs F014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

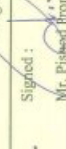
JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02949057 : Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220.No. V1220015

: Digital Barometer Vaisala Type PTB830.No. K4320001

Calibrated by :  Signed :

Mr. Watchapol Subwat

Mechanical Engineer

(Authorized Signatory)

for the Chief

Sub-Standard Instrument

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# The Result of Calibration

Certification No. 121124

Page : 5 of 5

13 March, 2024

| Standard Temp. °C | Temperature Sensor Reading |               |
|-------------------|----------------------------|---------------|
|                   | Reading °C                 | Correction °C |
| 45.1              | 45                         | 0.1           |
| 30.2              | 30                         | 0.2           |
| 15.4              | 16                         | -0.6          |

Calibrated by :



Mr. Watchapol Subwat

Mechanical Engineer



เอกสารไม่ควบคุม



## The Result of Calibration

22 February, 2024  
Certification No. 097/24  
Page : 3 of 5

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mbar |
|--------------------------------|------------------------------|--------------------|
| 1010.84                        | 1011                         | -0.16              |
| 1010.60                        | 1011                         | -0.40              |
| 1011.71                        | 1011                         | 0.71               |
| 1012.17                        | 1012                         | 0.17               |
| 1012.31                        | 1012                         | 0.31               |
| 1012.25                        | 1012                         | 0.25               |
| 1012.79                        | 1013                         | -0.21              |
| 1012.95                        | 1012                         | 0.95               |
| 1013.52                        | 1014                         | -0.48              |
| 1014.16                        | 1014                         | 0.16               |
| 1015.79                        | 1016                         | -0.21              |
| 1016.02                        | 1016                         | 0.02               |
| 1015.86                        | 1016                         | -0.14              |
| 1015.69                        | 1015                         | 0.69               |
| 1011.51                        | 1012                         | -0.49              |
| 1011.80                        | 1012                         | -0.20              |
| 1012.06                        | 1012                         | 0.06               |
| 1012.81                        | 1013                         | -0.19              |
| 1013.22                        | 1013                         | 0.22               |
| 1013.49                        | 1014                         | -0.51              |
| Average                        |                              | 0.03               |

Calibrated by :   
Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม




## The Result of Calibration

22 February, 2024  
Certification No. 097/24  
Page : 2 of 5

| Standard<br>Ultrasonic Anemometer<br>m/sec | HOOK GAGE NO. 1425     |                      |                   | TESTED ANEMOMETER |                     |
|--|------------------------|----------------------|-------------------|-------------------|---------------------|
|  | Pressure<br>inches H2O | Vacuum<br>inches H2O | Velocity<br>m/sec | Velocity<br>m/sec | Correction<br>m/sec |
| 1.00                                       | -                      | -                    | -                 | 1.0               | 0.00                |
| 3.02                                       | -                      | -                    | -                 | 2.9               | 0.12                |
| 5.00                                       | -                      | -                    | -                 | 4.9               | 0.10                |
| 7.04                                       | -                      | -                    | -                 | 7.0               | 0.04                |
| 9.02                                       | -                      | -                    | -                 | 9.0               | 0.02                |
| 11.02                                      | -                      | -                    | -                 | 11.0              | 0.02                |
| 13.01                                      | -                      | -                    | -                 | 13.0              | 0.01                |
| 15.01                                      | -                      | -                    | -                 | 15.0              | 0.01                |
| 17.02                                      | -                      | -                    | -                 | 17.0              | 0.02                |
| 20.02                                      | -                      | -                    | -                 | 20.0              | 0.02                |

| Wind Aloft Plotting Board                |                       |     |
|--|-----------------------|-----|
| US DEPARTMENT OF COMMERCE WEATHER BUREAU |                       |     |
| WIND DIRECTION                           | TESTED WIND DIRECTION |     |
|  | 0                     | 270 |
| 0  | 0                     | 270 |
| 90                                       | 90                    | 270 |
| 180                                      | 180                   | 270 |
| 270                                      | 270                   | 270 |

Calibrated by :   
Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



## The Result of Calibration

Certification No. 097/24  
Page : 4 of 5

22 February, 2024

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mmHg |
|--------------------------------|------------------------------|--------------------|
| 758.19                         | 758                          | 0.19               |
| 758.01                         | 758                          | 0.01               |
| 758.84                         | 758                          | 0.84               |
| 759.19                         | 759                          | 0.19               |
| 759.29                         | 759                          | 0.29               |
| 759.25                         | 759                          | 0.25               |
| 759.65                         | 759                          | 0.65               |
| 759.77                         | 760                          | -0.23              |
| 760.20                         | 760                          | 0.20               |
| 760.66                         | 760                          | 0.66               |
| 761.90                         | 762                          | -0.10              |
| 762.08                         | 762                          | 0.08               |
| 761.96                         | 762                          | -0.04              |
| 761.83                         | 762                          | -0.17              |
| 758.69                         | 759                          | -0.31              |
| 758.91                         | 759                          | -0.09              |
| 759.11                         | 759                          | 0.11               |
| 759.67                         | 760                          | -0.33              |
| 759.98                         | 760                          | -0.02              |
| 760.18                         | 760                          | 0.18               |

Average

0.12

Calibrated by : *Watchapol*

Mr. Watchapol Subwat  
Mechanical Engineer



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## The Result of Calibration

Certification No. 097/24  
Page : 5 of 5

22 February, 2024

| Standard<br>Temp.<br>°C | Temperature Sensor Reading |                  |
|-------------------------|----------------------------|------------------|
|                         | Reading<br>°C              | Correction<br>°C |
| 45.2                    | 45                         | 0.2              |
| 30.3                    | 30                         | 0.3              |
| 15.8                    | 16                         | -0.2             |

Calibrated by : *Watchapol*

Mr. Watchapol Subwat  
Mechanical Engineer



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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

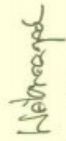
Certification No. 142/23

31 March, 2023

Page : 2 of 5

| Standard<br>Ultrasonic Anemometer<br>m/sec | HOOK GAGE NO. 1425   |                    | TESTED ANEMOMETER |                     |
|--|----------------------|--------------------|-------------------|---------------------|
|  | Pressure<br>hPa/1020 | Vacuum<br>hPa/1020 | Velocity<br>m/sec | Correction<br>m/sec |
| 1.00                                       | -                    | -                  | 1.0               | 0.00                |
| 3.02                                       | -                    | -                  | 3.0               | 0.02                |
| 5.00                                       | -                    | -                  | 5.0               | 0.00                |
| 7.04                                       | -                    | -                  | 6.9               | 0.14                |
| 9.02                                       | -                    | -                  | 9.1               | -0.08               |
| 11.02                                      | -                    | -                  | 10.9              | 0.12                |
| 13.01                                      | -                    | -                  | 12.9              | 0.11                |
| 15.01                                      | -                    | -                  | 14.9              | 0.11                |
| 17.02                                      | -                    | -                  | 17.0              | 0.02                |
| 20.02                                      | -                    | -                  | 20.1              | -0.08               |

| Wind Aloft Plotting Board.               |                       |
|--|-----------------------|
| US DEPARTMENT OF COMMERCE WEATHER BUREAU |                       |
| WIND DIRECTION                           | TESTED WIND DIRECTION |
| 0  | 0                     |
| 90                                       | 90                    |
| 180                                      | 180                   |
| 270                                      |                       |

Calibrated by :   
Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 31 March, 2023

Certification No. 142/23

Page : 1 of 5

Object : WIRELESS ANEMOMETER  
Manufacturer : SCARLET  
Type : WIRELESS RECEIVER : WL-21  
WIND SENSOR : WL-21  
Mfg Code : WIRELESS RECEIVER : 2112DR0072  
WIND SENSOR : 2112DT0072  
Customer : United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.2 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION


STANDARD THERMOMETER : Theodor Friedrich : Dry No. 8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02645057 : Thermoschneider No. 918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. 14320001

Calibrated by :  Signed : 

Mr. Watcharapol Subwat Mr. Wisoot Pimsut

Mechanical Engineer



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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 142/23

31 March, 2023

Page : 4 of 5

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction |
|--------------------------------|------------------------------|------------|
| 760.78                         | 761                          | -0.22      |
| 760.58                         | 760                          | 0.58       |
| 758.66                         | 759                          | -0.34      |
| 758.50                         | 759                          | -0.50      |
| 758.39                         | 758                          | 0.39       |
| 758.60                         | 759                          | -0.40      |
| 758.84                         | 759                          | -0.16      |
| 760.17                         | 760                          | 0.17       |
| 760.42                         | 760                          | 0.42       |
| 760.56                         | 761                          | -0.42      |
| 760.36                         | 760                          | 0.36       |
| 760.05                         | 760                          | 0.05       |
| 761.25                         | 761                          | 0.25       |
| 761.12                         | 761                          | 0.12       |
| 760.85                         | 761                          | -0.15      |
| 760.72                         | 761                          | -0.28      |
| 760.24                         | 760                          | 0.24       |
| 759.82                         | 760                          | -0.18      |
| 758.51                         | 758                          | 0.51       |
| 758.75                         | 759                          | -0.25      |

Average

0.07

Calibrated by :

Wacharapol

Mr. Wacharapol Subwat

Mechanical Engineer



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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 142/23

31 March, 2023

Page : 3 of 5

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction |
|--------------------------------|------------------------------|------------|
| 1014.29                        | 1014                         | 0.29       |
| 1014.02                        | 1014                         | 0.02       |
| 1011.47                        | 1011                         | 0.47       |
| 1011.25                        | 1011                         | 0.25       |
| 1011.11                        | 1011                         | 0.11       |
| 1011.38                        | 1011                         | 0.38       |
| 1011.71                        | 1012                         | -0.29      |
| 1013.48                        | 1013                         | 0.48       |
| 1013.81                        | 1014                         | -0.19      |
| 1014.02                        | 1014                         | 0.02       |
| 1013.73                        | 1014                         | -0.27      |
| 1013.32                        | 1013                         | 0.32       |
| 1014.92                        | 1015                         | -0.08      |
| 1014.75                        | 1015                         | -0.25      |
| 1014.38                        | 1014                         | 0.38       |
| 1014.21                        | 1014                         | 0.21       |
| 1013.57                        | 1013                         | 0.57       |
| 1013.01                        | 1013                         | 0.01       |
| 1011.26                        | 1011                         | 0.26       |
| 1011.59                        | 1012                         | -0.41      |

Average

Calibrated by :

Wacharapol

Mr. Wacharapol Subwat

Mechanical Engineer



เอกสารไม่ควบคุม



# Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 13 March, 2024

Certification No. 123/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2311DR0037

Wind Sensor 2112DT0102

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1013.1 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: Testo, testo 645 Serial No. 02849057 : Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB229-No. V1220015

: Digital Barometer Vaisala Type PTB339-No. R4320001

Calibrated by :  Signed :

Mr. Wacharapol Subwat

Mechanical Engineer

(Authorized Signatory)

for the Chief

Sub-Standard Instrument

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# The Result of Calibration

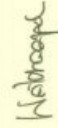
31 March, 2023

Certification No. 142/23

Page : 5 of 5

| Standard Temp. °C | Temperature Sensor Reading |               |
|-------------------|----------------------------|---------------|
|                   | Reading °C                 | Correction °C |
| 45.24             | 45.5                       | -0.26         |
| 32.16             | 32.3                       | -0.14         |
| 16.48             | 16.5                       | -0.02         |

Calibrated by :



Mr. Wacharapol Subwat

Mechanical Engineer



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## The Result of Calibration

13 March, 2024  
Certification No. 123/24  
Page : 3 of 5

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mbar |
|--------------------------------|------------------------------|--------------------|
| 1009.59                        | 1009                         | 0.59               |
| 1009.45                        | 1009                         | 0.45               |
| 1010.10                        | 1010                         | 0.10               |
| 1010.94                        | 1011                         | -0.06              |
| 1011.46                        | 1011                         | 0.46               |
| 1011.84                        | 1012                         | -0.16              |
| 1012.06                        | 1012                         | 0.06               |
| 1013.04                        | 1013                         | 0.04               |
| 1013.18                        | 1013                         | 0.18               |
| 1012.89                        | 1013                         | -0.11              |
| 1013.20                        | 1013                         | 0.20               |
| 1013.44                        | 1014                         | -0.56              |
| 1013.81                        | 1014                         | -0.19              |
| 1014.19                        | 1014                         | 0.19               |
| 1015.96                        | 1016                         | -0.04              |
| 1016.23                        | 1016                         | 0.23               |
| 1015.64                        | 1016                         | -0.36              |
| 1015.23                        | 1015                         | 0.23               |
| 1012.87                        | 1013                         | -0.13              |
| 1013.63                        | 1013                         | 0.63               |
| Average                        |                              | 0.09               |

Calibrated by : *Wachapol*  
Mr. Wachapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



## The Result of Calibration

13 March, 2024  
Certification No. 123/24  
Page : 2 of 5

| Standard<br>Ultrasonic Anemometer<br>m/sec | HOOK GAGE NO. 1425 |            |          | TESTED ANEMOMETER |            |
|--|--------------------|------------|----------|-------------------|------------|
|  | Pressure           | Vacuum     | Velocity | Velocity          | Correction |
|  | inches H2O         | inches H2O | m/sec    | m/sec             | m/sec      |
| 1.00                                       | -                  | -          | -        | 1.0               | 0.00       |
| 3.02                                       | -                  | -          | -        | 3.0               | 0.02       |
| 5.00                                       | -                  | -          | -        | 5.0               | 0.00       |
| 7.04                                       | -                  | -          | -        | 6.9               | 0.14       |
| 9.02                                       | -                  | -          | -        | 9.0               | 0.02       |
| 11.02                                      | -                  | -          | -        | 10.9              | 0.12       |
| 13.01                                      | -                  | -          | -        | 13.0              | 0.01       |
| 15.01                                      | -                  | -          | -        | 15.0              | 0.01       |
| 17.02                                      | -                  | -          | -        | 17.0              | 0.02       |
| 20.02                                      | -                  | -          | -        | 20.0              | 0.02       |

| Wind Aloft Plotting Board.               |                       |
|--|-----------------------|
| US DEPARTMENT OF COMMERCE WEATHER BUREAU |                       |
| WIND DIRECTION                           | TESTED WIND DIRECTION |
| 0  | 0                     |
| 90                                       | 90                    |
| 180                                      | 180                   |
| 270                                      | 270                   |

Calibrated by : *Wachapol*  
Mr. Wachapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



## The Result of Calibration

Certification No. 123/24

13 March, 2024

Page : 5 of 5

| Standard<br>Temp.<br>°C | Temperature Sensor Reading |                  |
|-------------------------|----------------------------|------------------|
|                         | Reading<br>°C              | Correction<br>°C |
| 45.1                    | 45                         | 0.1              |
| 30.2                    | 30                         | 0.2              |
| 15.4                    | 15                         | 0.4              |

Calibrated by : **Wacharapol**

Mr. Wacharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม

Certification No. 123/24

Page : 4 of 5

13 March, 2024

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mmHg |
|--------------------------------|------------------------------|--------------------|
| 757.25                         | 757                          | 0.25               |
| 757.15                         | 757                          | 0.15               |
| 757.64                         | 758                          | -0.36              |
| 758.27                         | 758                          | 0.27               |
| 758.86                         | 759                          | -0.34              |
| 758.94                         | 759                          | -0.06              |
| 759.11                         | 759                          | 0.11               |
| 759.84                         | 760                          | -0.16              |
| 759.95                         | 760                          | -0.05              |
| 759.73                         | 760                          | -0.27              |
| 759.96                         | 760                          | -0.04              |
| 760.14                         | 760                          | 0.14               |
| 760.42                         | 760                          | 0.42               |
| 760.70                         | 761                          | -0.30              |
| 762.03                         | 762                          | 0.03               |
| 762.24                         | 762                          | 0.24               |
| 761.79                         | 762                          | -0.21              |
| 761.48                         | 761                          | 0.48               |
| 759.71                         | 760                          | -0.29              |
| 760.28                         | 760                          | 0.28               |

Average

**Wacharapol**

Calibrated by :  
Mr. Wacharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 122/24

13 March, 2024

Page : 2 of 5

| Standard<br>Ultrasonic Anemometer<br>m/sec | HOOK GAGE NO. 1425     |                      |                   | TESTED ANEMOMETER |                     |
|--|------------------------|----------------------|-------------------|-------------------|---------------------|
|  | Pressure<br>Inches H2O | Vacuum<br>Inches H2O | Velocity<br>m/sec | Velocity<br>m/sec | Correction<br>m/sec |
| 1.00                                       | -                      | -                    | -                 | 1.0               | 0.00                |
| 3.02                                       | -                      | -                    | -                 | 3.0               | 0.02                |
| 5.00                                       | -                      | -                    | -                 | 5.0               | 0.00                |
| 7.04                                       | -                      | -                    | -                 | 7.0               | 0.04                |
| 9.02                                       | -                      | -                    | -                 | 8.9               | 0.12                |
| 11.02                                      | -                      | -                    | -                 | 11.0              | 0.02                |
| 13.01                                      | -                      | -                    | -                 | 13.0              | 0.01                |
| 15.01                                      | -                      | -                    | -                 | 14.9              | 0.11                |
| 17.02                                      | -                      | -                    | -                 | 17.0              | 0.02                |
| 20.02                                      | -                      | -                    | -                 | 20.0              | 0.02                |

| Wind Aloft Plotting Board.               |                       |  |
|--|-----------------------|--|
| US DEPARTMENT OF COMMERCE WEATHER BUREAU |                       |  |
| WIND DIRECTION                           | TESTED WIND DIRECTION |  |
| 0  | 0                     |  |
| 90                                       | 90                    |  |
| 180                                      | 180                   |  |
| 270                                      | 270                   |  |

Calibrated by : *Wattaporn*  
Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 13 March, 2024

Certification No. 122/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger  
Manufacturer : SCARLET/TECH  
Type : WL-21  
Mfg Code : Wireless Receiver 2205DR0008  
Wind Sensor 2205DT0008  
Customer : United Analyst and Engineering Consultant Co.,Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Prakanong, Bangkok 10260.  
Calibration Condition : Temperature 25.1 °C Barometric Pressure 1012.5 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs F014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629596)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02948057 : Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220 No. V4220015

: Digital Barometer Vaisala Type PTB330 No. V4220001

Calibrated by : *Wattaporn* Signed : *Mr. Pirod Promsat*  
Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม





### The Result of Calibration

Certification No. 122/24

13 March, 2024

Page : 4 of 5

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mmHg |
|--------------------------------|------------------------------|--------------------|
| 757.25                         | 757                          | 0.25               |
| 757.15                         | 757                          | 0.15               |
| 757.64                         | 758                          | -0.36              |
| 758.27                         | 758                          | 0.27               |
| 758.66                         | 759                          | -0.34              |
| 758.94                         | 759                          | -0.06              |
| 759.11                         | 759                          | 0.11               |
| 759.84                         | 760                          | -0.16              |
| 759.95                         | 760                          | -0.05              |
| 759.73                         | 760                          | -0.27              |
| 759.96                         | 760                          | -0.04              |
| 760.14                         | 760                          | 0.14               |
| 760.42                         | 760                          | 0.42               |
| 760.70                         | 761                          | -0.30              |
| 762.03                         | 762                          | 0.03               |
| 762.24                         | 762                          | 0.24               |
| 761.79                         | 762                          | -0.21              |
| 761.48                         | 762                          | -0.52              |
| 759.71                         | 760                          | -0.29              |
| 760.26                         | 760                          | 0.26               |

Average

0.03

Calibrated by :

*Nathrapol*

Mr. Watcharapol Subwat

Mechanical Engineer



เอกสารไม่ควบคุม



### The Result of Calibration

Certification No. 122/24

13 March, 2024

Page : 3 of 5

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mbar |
|--------------------------------|------------------------------|--------------------|
| 1009.59                        | 1009                         | 0.59               |
| 1009.45                        | 1009                         | 0.45               |
| 1010.10                        | 1010                         | 0.10               |
| 1010.94                        | 1011                         | -0.06              |
| 1011.46                        | 1012                         | -0.54              |
| 1011.84                        | 1012                         | -0.16              |
| 1012.06                        | 1012                         | 0.06               |
| 1013.04                        | 1013                         | 0.04               |
| 1013.18                        | 1013                         | 0.18               |
| 1012.89                        | 1013                         | -0.11              |
| 1013.20                        | 1013                         | 0.20               |
| 1013.44                        | 1013                         | 0.44               |
| 1013.81                        | 1014                         | -0.19              |
| 1014.19                        | 1014                         | 0.19               |
| 1015.96                        | 1016                         | -0.04              |
| 1016.23                        | 1016                         | 0.23               |
| 1015.64                        | 1015                         | 0.64               |
| 1015.23                        | 1015                         | 0.23               |
| 1012.87                        | 1013                         | -0.13              |
| 1013.63                        | 1013                         | 0.63               |

Average

0.14

Calibrated by :

*Nathrapol*

Mr. Watcharapol Subwat

Mechanical Engineer



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Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 13 March, 2024

Certification No. 120/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2205DR0105

Wind Sensor 2205DT0105

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1011.4 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629596)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220-No. V1220015

: Digital Barometer Vaisala Type P185594-No. 84380001

Calibrated by :  Signed :

Mr. Wacharapol Subwat

Mechanical Engineer

(Authorized Signature)

for the Chief

Sub-Standard Instrument

เอกสารไม่ควบคุม



The Result of Calibration

Certification No. 122/24

Page : 5 of 5

13 March, 2024

| Standard Temp.<br>°C | Temperature Sensor Reading |                  |
|----------------------|----------------------------|------------------|
|                      | Reading<br>°C              | Correction<br>°C |
| 45.1                 | 45                         | 0.1              |
| 30.2                 | 30                         | 0.2              |
| 15.4                 | 15                         | 0.4              |

Calibrated by :



Mr. Wacharapol Subwat

Mechanical Engineer



เอกสารไม่ควบคุม



The Result of Calibration

13 March, 2024  
Certification No. 120/24  
Page : 3 of 5

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mbar |
|--------------------------------|------------------------------|--------------------|
| 1009.59                        | 1009                         | 0.59               |
| 1009.45                        | 1009                         | 0.45               |
| 1010.10                        | 1010                         | 0.10               |
| 1010.94                        | 1011                         | -0.06              |
| 1011.46                        | 1012                         | -0.54              |
| 1011.84                        | 1012                         | -0.16              |
| 1012.06                        | 1012                         | 0.06               |
| 1013.04                        | 1013                         | 0.04               |
| 1013.18                        | 1013                         | 0.18               |
| 1012.89                        | 1013                         | -0.11              |
| 1013.20                        | 1013                         | 0.20               |
| 1013.44                        | 1014                         | -0.56              |
| 1013.81                        | 1014                         | -0.19              |
| 1014.19                        | 1014                         | 0.19               |
| 1015.96                        | 1016                         | -0.04              |
| 1016.23                        | 1016                         | 0.23               |
| 1015.64                        | 1015                         | 0.64               |
| 1015.23                        | 1015                         | 0.23               |
| 1012.87                        | 1013                         | -0.13              |
| 1013.63                        | 1014                         | -0.37              |
| Average                        |                              | 0.04               |



Calibrated by : *Wetthapong*  
Mr. Watcharapol Subwat  
Mechanical Engineer

เอกสารไม่ควบคุม



The Result of Calibration

13 March, 2024  
Certification No. 120/24  
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| Standard<br>Ultrasonic Anemometer<br>m/sec | HOOK GAGE NO. 1425     |                      |                   | TESTED ANEMOMETER |                     |
|--|------------------------|----------------------|-------------------|-------------------|---------------------|
|  | Pressure<br>inches H2O | Vacuum<br>inches H2O | Velocity<br>m/sec | Velocity<br>m/sec | Correction<br>m/sec |
| 1.00                                       | -                      | -                    | -                 | 1.0               | 0.00                |
| 3.02                                       | -                      | -                    | -                 | 3.0               | 0.02                |
| 5.00                                       | -                      | -                    | -                 | 5.0               | 0.00                |
| 7.04                                       | -                      | -                    | -                 | 6.9               | 0.14                |
| 9.02                                       | -                      | -                    | -                 | 8.9               | 0.12                |
| 11.02                                      | -                      | -                    | -                 | 11.0              | 0.02                |
| 13.01                                      | -                      | -                    | -                 | 13.0              | 0.01                |
| 15.01                                      | -                      | -                    | -                 | 15.0              | 0.01                |
| 17.02                                      | -                      | -                    | -                 | 17.0              | 0.02                |
| 20.02                                      | -                      | -                    | -                 | 20.0              | 0.02                |

| Wind Aloft Plotting Board.                 |                       |
|--|-----------------------|
| U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU |                       |
| WIND DIRECTION                             | TESTED WIND DIRECTION |
| 0  | 0                     |
| 90   | 90                    |
| 180  | 180                   |
| 270  | 270                   |

Calibrated by : *Wetthapong*  
Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม





The Result of Calibration

Certification No. 120/24

13 March, 2024

Page : 4 of 5

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mmHg |
|--------------------------------|------------------------------|--------------------|
| 757.25                         | 757                          | 0.25               |
| 757.15                         | 757                          | 0.15               |
| 757.64                         | 758                          | -0.36              |
| 758.27                         | 758                          | 0.27               |
| 758.60                         | 758                          | 0.66               |
| 758.94                         | 759                          | -0.06              |
| 759.11                         | 759                          | 0.11               |
| 759.84                         | 760                          | -0.16              |
| 759.95                         | 760                          | -0.05              |
| 759.73                         | 760                          | -0.27              |
| 759.96                         | 760                          | -0.04              |
| 760.14                         | 760                          | 0.14               |
| 760.42                         | 760                          | 0.42               |
| 760.70                         | 761                          | -0.30              |
| 762.03                         | 762                          | 0.03               |
| 762.24                         | 762                          | 0.24               |
| 761.79                         | 762                          | -0.21              |
| 761.48                         | 762                          | -0.52              |
| 759.71                         | 760                          | -0.29              |
| 760.28                         | 760                          | 0.28               |

Average

8.02

Calibrated by : *Watchapol*

Mr. Watchapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



The Result of Calibration

Certification No. 120/24

13 March, 2024

Page : 5 of 5

| Standard<br>Temp.<br>°C | Temperature Sensor |                  |
|-------------------------|--------------------|------------------|
|                         | Reading<br>°C      | Correction<br>°C |
| 45.1                    | 45                 | 0.1              |
| 30.2                    | 30                 | 0.2              |
| 15.4                    | 15                 | 0.4              |

Calibrated by : *Watchapol*

Mr. Watchapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

27 February, 2024 Certification No. 102/24 Page : 2 of 5

| Standard              | HOOK GAGE NO. 1425     |                      | TESTED ANEMOMETER |                     |
|-----------------------|------------------------|----------------------|-------------------|---------------------|
|                       | Pressure<br>Inches H2O | Vacuum<br>Inches H2O | Velocity<br>m/sec | Correction<br>m/sec |
| Ultrasonic Anemometer |                        |                      |                   |                     |
| 1.00                  | -                      | -                    | 1.0               | 0.00                |
| 3.02                  | -                      | -                    | 3.0               | 0.02                |
| 5.00                  | -                      | -                    | 5.0               | 0.00                |
| 7.04                  | -                      | -                    | 7.0               | 0.04                |
| 9.02                  | -                      | -                    | 9.0               | 0.02                |
| 11.02                 | -                      | -                    | 11.0              | 0.02                |
| 13.01                 | -                      | -                    | 13.0              | 0.01                |
| 15.01                 | -                      | -                    | 15.0              | 0.01                |
| 17.02                 | -                      | -                    | 17.1              | -0.08               |
| 20.02                 | -                      | -                    | 20.1              | -0.08               |

| Wind Aloft Plotting Board.                 |                       |
|--|-----------------------|
| U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU |                       |
| WIND DIRECTION                             | TESTED WIND DIRECTION |
| 0  | 0                     |
| 90   | 90                    |
| 180  | 180                   |
| 270  |                       |

Calibrated by :   
Mr. Watchapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 27 February, 2024 Certification No. 102/24 Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger  
Manufacturer : SCARLET/TECH  
Type : WL-21  
Mfg Code : Wireless Receiver 2205DR0106  
Wind Sensor 2205DT0106  
Customer : United Analyst and Engineering Consultant Co.,Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Prakanong, Bangkok 10260.  
Calibration Condition : Temperature 25.1 ° C Barometric Pressure 1011.2 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 7317241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

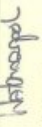
JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB220 No. V1220015

Calibrated by :   
Mr. Watchapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



## The Result of Calibration

Certification No. 102/24


27 February, 2024

Page : 4 of 5

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mmHg |
|--------------------------------|------------------------------|--------------------|
| 757.25                         | 757                          | 0.25               |
| 757.15                         | 757                          | 0.15               |
| 757.64                         | 757                          | 0.64               |
| 758.27                         | 758                          | 0.27               |
| 758.66                         | 759                          | -0.34              |
| 758.94                         | 759                          | -0.06              |
| 759.11                         | 759                          | 0.11               |
| 759.84                         | 760                          | -0.16              |
| 759.95                         | 760                          | -0.05              |
| 759.73                         | 760                          | -0.27              |
| 759.96                         | 760                          | -0.04              |
| 760.14                         | 760                          | 0.14               |
| 760.42                         | 761                          | -0.58              |
| 760.70                         | 761                          | -0.30              |
| 762.03                         | 762                          | 0.03               |
| 762.24                         | 762                          | 0.24               |
| 761.79                         | 762                          | -0.21              |
| 761.48                         | 761                          | 0.48               |
| 759.71                         | 760                          | -0.29              |
| 760.28                         | 760                          | 0.28               |

Average

0.02

Calibrated by : 

Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



## The Result of Calibration


Certification No. 102/24

27 February, 2024

Page : 3 of 5

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mbar |
|--------------------------------|------------------------------|--------------------|
| 1009.59                        | 1009                         | 0.59               |
| 1009.45                        | 1009                         | 0.45               |
| 1010.10                        | 1010                         | 0.10               |
| 1010.94                        | 1011                         | -0.06              |
| 1011.46                        | 1011                         | 0.46               |
| 1011.84                        | 1012                         | -0.16              |
| 1012.06                        | 1012                         | 0.06               |
| 1013.04                        | 1013                         | 0.04               |
| 1013.18                        | 1013                         | 0.18               |
| 1012.89                        | 1013                         | -0.11              |
| 1013.20                        | 1013                         | 0.20               |
| 1013.44                        | 1014                         | -0.56              |
| 1013.81                        | 1014                         | -0.19              |
| 1014.19                        | 1014                         | 0.19               |
| 1015.96                        | 1016                         | -0.04              |
| 1016.23                        | 1016                         | 0.23               |
| 1015.64                        | 1015                         | 0.64               |
| 1015.23                        | 1015                         | 0.23               |
| 1012.87                        | 1013                         | -0.13              |
| 1013.63                        | 1014                         | -0.37              |

Average

Calibrated by : 

Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม





# Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 1 November, 2023

Certification No. 390/23

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2205DR0113

Wind Sensor 2205DT0113

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1013.5 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 SN 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: Testo, testo 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB350 No.9420001

Calibrated by : *Watrangol* Signed :

Mr. Watcharapol Subwat

Mechanical Engineer



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# The Result of Calibration

Certification No. 102/24

27 February, 2024

Page : 5 of 5

| Standard Temp.<br>°C | Temperature Sensor Reading |                  |
|----------------------|----------------------------|------------------|
|                      | Reading<br>°C              | Correction<br>°C |
| 45.5                 | 45                         | 0.5              |
| 30.1                 | 30                         | 0.1              |
| 15.3                 | 15                         | 0.3              |

Calibrated by :

*Watrangol*

Mr. Watcharapol Subwat

Mechanical Engineer



เอกสารไม่ควบคุม



## The Result of Calibration

Certification No. 390/23

1 November, 2023

Page : 3 of 5

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction |
|--------------------------------|------------------------------|------------|
| 1009.68                        | 1009                         | 0.68       |
| 1007.51                        | 1007                         | 0.51       |
| 1007.13                        | 1007                         | 0.13       |
| 1006.90                        | 1007                         | -0.10      |
| 1006.72                        | 1007                         | -0.28      |
| 1006.59                        | 1006                         | 0.59       |
| 1006.28                        | 1006                         | 0.28       |
| 1006.05                        | 1006                         | 0.05       |
| 1005.84                        | 1006                         | -0.16      |
| 1005.48                        | 1005                         | 0.48       |
| 1009.61                        | 1010                         | -0.39      |
| 1009.76                        | 1010                         | -0.24      |
| 1009.69                        | 1009                         | 0.69       |
| 1009.45                        | 1009                         | 0.45       |
| 1009.24                        | 1009                         | 0.24       |
| 1008.89                        | 1009                         | -0.11      |
| 1007.66                        | 1008                         | -0.34      |
| 1006.99                        | 1007                         | -0.01      |
| 1006.29                        | 1006                         | 0.29       |
| 1004.56                        | 1005                         | -0.44      |
| Average                        |                              | 0.42       |

Calibrated by : *Wathapol*

Mr. Watchapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



## The Result of Calibration

Certification No. 390/23

1 November, 2023

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| Standard<br>Ultrasonic Anemometer<br>m/sec | HOOK GAGE NO. 1425                  |                                   |                   | TESTED ANEMOMETER |                     |
|--|-------------------------------------|-----------------------------------|-------------------|-------------------|---------------------|
|  | Pressure<br>inches H <sub>2</sub> O | Vacuum<br>inches H <sub>2</sub> O | Velocity<br>m/sec | Velocity<br>m/sec | Correction<br>m/sec |
| 1.00                                       | -                                   | -                                 | -                 | 1.0               | 0.0                 |
| 3.02                                       | -                                   | -                                 | -                 | 3.0               | 0.02                |
| 5.00                                       | -                                   | -                                 | -                 | 5.0               | 0.0                 |
| 7.04                                       | -                                   | -                                 | -                 | 7.0               | 0.04                |
| 9.02                                       | -                                   | -                                 | -                 | 8.9               | 0.12                |
| 11.02                                      | -                                   | -                                 | -                 | 9.0               | 2.02                |
| 13.01                                      | -                                   | -                                 | -                 | 13.0              | 0.01                |
| 15.01                                      | -                                   | -                                 | -                 | 14.9              | 0.11                |
| 17.02                                      | -                                   | -                                 | -                 | 17.0              | 0.02                |
| 20.02                                      | -                                   | -                                 | -                 | 19.9              | 0.12                |

Wind Aloft Plotting Board.

| US DEPARTMENT OF COMMERCE WEATHER BUREAU |                       |
|--|-----------------------|
| WIND DIRECTION                           | TESTED WIND DIRECTION |
| 0  | 0                     |
| 90                                       | 90                    |
| 180                                      | 180                   |
| 270                                      | 270                   |

Calibrated by : *Wathapol*

Mr. Watchapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



## The Result of Calibration

Certification No. 390/23

1 November, 2023

Page : 5 of 5

| Standard<br>Temp.<br>°C | Temperature Sensor Reading |                  |
|-------------------------|----------------------------|------------------|
|                         | Reading<br>°C              | Correction<br>°C |
| 45.12                   | 45                         | 0.12             |
| 30.21                   | 30                         | 0.21             |
| 15.42                   | 15                         | 0.42             |

Calibrated by : *Watchapol*

Mr. Watchapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม

1 November, 2023

Certification No. 390/23

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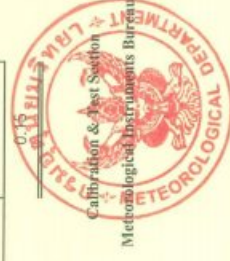
## The Result of Calibration

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction |
|--------------------------------|------------------------------|------------|
| 757.32                         | 757                          | 0.32       |
| 755.69                         | 756                          | -0.31      |
| 755.41                         | 755                          | 0.41       |
| 755.24                         | 755                          | 0.24       |
| 755.10                         | 755                          | 0.10       |
| 755.00                         | 755                          | 0.00       |
| 754.77                         | 755                          | -0.23      |
| 754.60                         | 754                          | 0.60       |
| 754.44                         | 754                          | 0.44       |
| 754.17                         | 754                          | 0.17       |
| 757.27                         | 757                          | 0.27       |
| 757.38                         | 757                          | 0.38       |
| 757.33                         | 757                          | 0.33       |
| 757.15                         | 757                          | 0.15       |
| 756.99                         | 757                          | -0.01      |
| 756.73                         | 757                          | -0.27      |
| 755.81                         | 756                          | -0.19      |
| 755.30                         | 755                          | 0.30       |
| 754.78                         | 755                          | -0.22      |
| 753.48                         | 753                          | 0.48       |

Average

Calibrated by : *Watchapol*

Mr. Watchapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม





THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

22 February, 2024

Certification No. 099/24

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| Standard              | HOOK GAGE NO. 1425   |                    | TESTED ANEMOMETER |                     |
|-----------------------|----------------------|--------------------|-------------------|---------------------|
|                       | Pressure<br>mbar h2O | Vacuum<br>mbar h2O | Velocity<br>m/sec | Correction<br>m/sec |
| Ultrasonic Anemometer |                      |                    |                   |                     |
| 1.00                  | -                    | -                  | 1.0               | 0.00                |
| 3.02                  | -                    | -                  | 3.0               | 0.02                |
| 5.00                  | -                    | -                  | 5.0               | 0.00                |
| 7.04                  | -                    | -                  | 7.0               | 0.04                |
| 9.02                  | -                    | -                  | 9.0               | 0.02                |
| 11.02                 | -                    | -                  | 11.0              | 0.02                |
| 13.01                 | -                    | -                  | 13.0              | 0.01                |
| 15.01                 | -                    | -                  | 15.0              | 0.01                |
| 17.02                 | -                    | -                  | 17.0              | 0.02                |
| 20.02                 | -                    | -                  | 20.0              | 0.02                |

| Wind Aloft Plotting Board.               |                       |
|--|-----------------------|
| US DEPARTMENT OF COMMERCE WEATHER BUREAU |                       |
| WIND DIRECTION                           | TESTED WIND DIRECTION |
| 0  | 0                     |
| 90                                       | 90                    |
| 180                                      | 180                   |
| 270                                      | 270                   |

Calibrated by : **Wattapol**  
Mr. Wattapol Subwat  
Mechanical Engineer



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 22 February, 2024

Certification No. 099/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger  
Manufacturer : SCARLET/TECH  
Type : WL-21  
Mfg Code : Wireless Receiver 2205DR0114  
Wind Sensor 2205DT0114  
Customer : United Analyst and Engineering Consultant Co.,Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Prakanong, Bangkok 10260.  
Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.1 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs F0014 Serial No. 9310119 : HOOK GAGE NO 1425  
N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec  
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)  
Serial Number 110730029 (sensor 120629566)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec  
STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94  
: testo, testo 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220 No. V1220015  
: Digital Barometer Vaisala Type PTB330 No. V1220001

Calibrated by : **Wattapol** Signed : **Mr. Piakod Promsut**  
Mr. Wattapol Subwat  
Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 099/24  
Page : 4 of 5

22 February, 2024

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mmHg |
|--------------------------------|------------------------------|--------------------|
| 758.19                         | 758                          | 0.19               |
| 758.01                         | 758                          | 0.01               |
| 758.84                         | 759                          | -0.16              |
| 759.19                         | 759                          | 0.19               |
| 759.29                         | 759                          | 0.29               |
| 759.25                         | 759                          | 0.25               |
| 759.85                         | 760                          | -0.35              |
| 759.77                         | 760                          | -0.23              |
| 760.20                         | 760                          | 0.20               |
| 760.88                         | 761                          | -0.32              |
| 761.90                         | 762                          | -0.10              |
| 762.08                         | 762                          | 0.08               |
| 761.96                         | 762                          | -0.04              |
| 761.83                         | 762                          | -0.17              |
| 758.69                         | 758                          | 0.69               |
| 758.91                         | 759                          | -0.09              |
| 759.11                         | 759                          | 0.11               |
| 759.67                         | 760                          | -0.33              |
| 759.98                         | 760                          | -0.02              |
| 760.18                         | 760                          | 0.18               |

Average 0.02

Calibrated by : Wathrapol

Mr. Watcharapol Subwat  
Mechanical Engineer



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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 099/24  
Page : 3 of 5

22 February, 2024

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mbar |
|--------------------------------|------------------------------|--------------------|
| 1010.84                        | 1011                         | -0.16              |
| 1010.60                        | 1011                         | -0.40              |
| 1011.71                        | 1012                         | -0.29              |
| 1012.17                        | 1012                         | 0.17               |
| 1012.31                        | 1012                         | 0.31               |
| 1012.25                        | 1012                         | 0.25               |
| 1012.79                        | 1013                         | -0.21              |
| 1012.95                        | 1013                         | -0.05              |
| 1013.52                        | 1014                         | -0.48              |
| 1014.16                        | 1014                         | 0.16               |
| 1015.79                        | 1016                         | -0.21              |
| 1016.02                        | 1016                         | 0.02               |
| 1015.86                        | 1016                         | -0.14              |
| 1015.69                        | 1016                         | -0.31              |
| 1011.51                        | 1011                         | 0.51               |
| 1011.80                        | 1012                         | -0.20              |
| 1012.06                        | 1012                         | 0.06               |
| 1012.81                        | 1013                         | -0.19              |
| 1013.22                        | 1013                         | 0.22               |
| 1013.49                        | 1013                         | 0.49               |

Average

Calibrated by : Wathrapol

Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



# Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 22 February, 2024

Certification No. 100/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2205DR0116

Wind Sensor 2205DT0116

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.1 hPa

NATIONAL STANDARD WIND TUNNEL

: Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs F0014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460

: Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629566)

JAPAN QUALITY ASSURANCE ORGANIZATION

: Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02948057 : Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220.No. V1220015

: Digital Barometer Vaisala Type PTB330.No. 64390001

Calibrated by : *Watchapol* Signed :

Mr. Watchapol Subwat

Mr. Pisong Plomsut

Mechanical Engineer



เอกสารไม่ควบคุม



# The Result of Calibration

22 February, 2024

Certification No. 099/24

Page : 5 of 5

| Standard Temp. °C | Temperature Sensor Reading |               |
|-------------------|----------------------------|---------------|
|                   | Reading °C                 | Correction °C |
| 45.2              | 45                         | 0.2           |
| 30.3              | 31                         | -0.7          |
| 15.8              | 16                         | -0.2          |

Calibrated by :

*Watchapol*

Mr. Watchapol Subwat

Mechanical Engineer



เอกสารไม่ควบคุม





## The Result of Calibration

22 February, 2024  
Certification No. 100/24  
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| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mbar |
|--------------------------------|------------------------------|--------------------|
| 1010.84                        | 1011                         | -0.16              |
| 1010.60                        | 1011                         | -0.40              |
| 1011.71                        | 1012                         | -0.29              |
| 1012.17                        | 1012                         | 0.17               |
| 1012.31                        | 1012                         | 0.31               |
| 1012.25                        | 1012                         | 0.25               |
| 1012.79                        | 1013                         | -0.21              |
| 1012.95                        | 1013                         | -0.05              |
| 1013.52                        | 1014                         | -0.48              |
| 1014.16                        | 1014                         | 0.16               |
| 1015.79                        | 1016                         | -0.21              |
| 1016.02                        | 1016                         | 0.02               |
| 1015.86                        | 1016                         | -0.14              |
| 1015.69                        | 1016                         | -0.31              |
| 1011.51                        | 1012                         | -0.49              |
| 1011.80                        | 1012                         | -0.20              |
| 1012.06                        | 1012                         | 0.06               |
| 1012.81                        | 1013                         | -0.19              |
| 1013.22                        | 1013                         | 0.22               |
| 1013.49                        | 1014                         | -0.51              |
| Average                        |                              | -0.12              |

Calibrated by : *Nathrapol*  
Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



## The Result of Calibration

22 February, 2024  
Certification No. 100/24  
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| Standard<br>Ultrasonic Anemometer<br>m/sec | HOOK GAGE NO. 1425     |                      |                   | TESTED ANEMOMETER |                     |
|--|------------------------|----------------------|-------------------|-------------------|---------------------|
|  | Pressure<br>Inches H2O | Vacuum<br>Inches H2O | Velocity<br>m/sec | Velocity<br>m/sec | Correction<br>m/sec |
| 1.00                                       | -                      | -                    | -                 | 1.0               | 0.00                |
| 3.02                                       | -                      | -                    | -                 | 3.0               | 0.02                |
| 5.00                                       | -                      | -                    | -                 | 5.0               | 0.00                |
| 7.04                                       | -                      | -                    | -                 | 7.0               | 0.04                |
| 9.02                                       | -                      | -                    | -                 | 9.0               | 0.02                |
| 11.02                                      | -                      | -                    | -                 | 11.0              | 0.02                |
| 13.01                                      | -                      | -                    | -                 | 12.9              | 0.11                |
| 15.01                                      | -                      | -                    | -                 | 14.9              | 0.11                |
| 17.02                                      | -                      | -                    | -                 | 17.0              | 0.02                |
| 20.02                                      | -                      | -                    | -                 | 20.0              | 0.02                |

| Wind Aloft Plotting Board                |                       |
|--|-----------------------|
| US DEPARTMENT OF COMMERCE WEATHER BUREAU |                       |
| WIND DIRECTION                           | TESTED WIND DIRECTION |
| 0  | 0                     |
| 90                                       | 90                    |
| 180                                      | 180                   |
| 270                                      | 270                   |

Calibrated by : *Nathrapol*  
Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



The Result of Calibration

Certification No. 100/24

22 February, 2024

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| Standard<br>Temp.<br>°C | Temperature Sensor |                  |
|-------------------------|--------------------|------------------|
|                         | Reading<br>°C      | Correction<br>°C |
| 45.2                    | 45                 | 0.2              |
| 30.3                    | 30                 | 0.3              |
| 15.8                    | 16                 | -0.2             |

Calibrated by : *Watthaporn*

Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม

22 February, 2024

Certification No. 100/24

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The Result of Calibration

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mmHg |
|--------------------------------|------------------------------|--------------------|
| 758.19                         | 758                          | 0.19               |
| 758.01                         | 758                          | 0.01               |
| 758.84                         | 759                          | -0.16              |
| 759.19                         | 759                          | 0.19               |
| 759.29                         | 759                          | 0.29               |
| 759.25                         | 759                          | 0.25               |
| 759.65                         | 760                          | -0.35              |
| 759.77                         | 760                          | -0.23              |
| 760.20                         | 760                          | 0.20               |
| 760.68                         | 761                          | -0.32              |
| 761.90                         | 762                          | -0.10              |
| 762.08                         | 762                          | 0.08               |
| 761.96                         | 762                          | -0.04              |
| 761.83                         | 762                          | -0.17              |
| 758.69                         | 758                          | 0.69               |
| 758.91                         | 759                          | -0.09              |
| 759.11                         | 759                          | 0.11               |
| 759.67                         | 759                          | 0.67               |
| 759.98                         | 760                          | -0.02              |
| 760.18                         | 760                          | 0.18               |

Average

0.07

Calibrated by : *Watthaporn*

Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration


Certification No. 096/24

22 February, 2024

Page : 2 of 5

| Standard              | HOOK GAGE NO. 1425     |                      | TESTED ANEMOMETER |                     |
|-----------------------|------------------------|----------------------|-------------------|---------------------|
|                       | Pressure<br>Inches H2O | Vacuum<br>Inches H2O | Velocity<br>m/sec | Correction<br>m/sec |
| Ultrasonic Anemometer |                        |                      |                   |                     |
| m/sec                 |                        |                      |                   |                     |
| 1.00                  | -                      | -                    | 1.0               | 0.00                |
| 3.02                  | -                      | -                    | 3.0               | 0.02                |
| 5.00                  | -                      | -                    | 5.0               | 0.00                |
| 7.04                  | -                      | -                    | 7.0               | 0.04                |
| 9.02                  | -                      | -                    | 9.0               | 0.02                |
| 11.02                 | -                      | -                    | 10.9              | 0.12                |
| 13.01                 | -                      | -                    | 12.9              | 0.11                |
| 15.01                 | -                      | -                    | 14.9              | 0.11                |
| 17.02                 | -                      | -                    | 17.0              | 0.02                |
| 20.02                 | -                      | -                    | 19.9              | 0.12                |

| Wind Aloft Plotting Board.               |                       |  |
|--|-----------------------|--|
| US DEPARTMENT OF COMMERCE WEATHER BUREAU |                       |  |
| WIND DIRECTION                           | TESTED WIND DIRECTION |  |
| 0  | 0                     |  |
| 90                                       | 90                    |  |
| 180                                      | 180                   |  |
| 270                                      | 270                   |  |

Calibrated by :   
Mr. Watchapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 22 February, 2024

Certification No. 096/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2301DR0024  
Wind Sensor 2301DT0024

Customer : United Analyst and Engineering Consultant Co.,Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1010.1 hPa

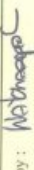
NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs F0014 Serial No. 9310119 : HOOK GAGE NO 1425  
N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec  
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)  
Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec  
STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94  
: testo, testo 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220 No. V1220015  
Digital Barometer Vaisala Type PTB350 No. 49320001

Calibrated by :   
Mr. Watchapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



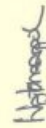


## The Result of Calibration

22 February, 2024  
Certification No. 096/24  
Page : 4 of 5

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mmHg |
|--------------------------------|------------------------------|--------------------|
| 758.19                         | 758                          | 0.19               |
| 758.01                         | 758                          | 0.01               |
| 758.84                         | 759                          | -0.16              |
| 759.19                         | 759                          | 0.19               |
| 759.29                         | 759                          | 0.29               |
| 759.25                         | 759                          | 0.25               |
| 759.65                         | 760                          | -0.35              |
| 759.77                         | 760                          | -0.23              |
| 760.20                         | 760                          | 0.20               |
| 760.66                         | 761                          | -0.32              |
| 761.90                         | 762                          | -0.10              |
| 762.08                         | 762                          | 0.08               |
| 761.96                         | 762                          | -0.04              |
| 761.83                         | 762                          | -0.17              |
| 758.69                         | 759                          | -0.31              |
| 758.91                         | 759                          | -0.09              |
| 759.11                         | 759                          | 0.11               |
| 759.67                         | 760                          | -0.33              |
| 759.98                         | 760                          | -0.02              |
| 760.18                         | 760                          | 0.18               |

Average -0.03

Calibrated by : 

Mr. Watchapol Subwat  
Mechanical Engineer



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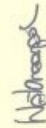


## The Result of Calibration

22 February, 2024  
Certification No. 096/24  
Page : 3 of 5

| Standard Barometer<br>Pressure | Tested Barometer<br>Pressure | Correction<br>mbar |
|--------------------------------|------------------------------|--------------------|
| 1010.84                        | 1011                         | -0.16              |
| 1010.60                        | 1011                         | -0.40              |
| 1011.71                        | 1012                         | -0.29              |
| 1012.17                        | 1012                         | 0.17               |
| 1012.31                        | 1012                         | 0.31               |
| 1012.25                        | 1012                         | 0.25               |
| 1012.79                        | 1013                         | -0.21              |
| 1012.95                        | 1013                         | -0.05              |
| 1013.52                        | 1014                         | -0.48              |
| 1014.16                        | 1014                         | 0.16               |
| 1015.79                        | 1016                         | -0.21              |
| 1016.02                        | 1016                         | 0.02               |
| 1015.86                        | 1016                         | -0.14              |
| 1015.69                        | 1015                         | 0.69               |
| 1011.51                        | 1012                         | -0.49              |
| 1011.80                        | 1012                         | -0.20              |
| 1012.06                        | 1012                         | 0.06               |
| 1012.81                        | 1013                         | -0.19              |
| 1013.22                        | 1013                         | 0.22               |
| 1013.49                        | 1013                         | 0.49               |

Average

Calibrated by : 

Mr. Watchapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม

THAI METEOROLOGICAL DEPARTMENT



4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 15 August, 2023

Certification No. 284/23

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : LSI

Type : Data Logger E-LOG 305 wind speed and wind direction DNA 821

Serial No. : Data Logger 20070022 wind speed and wind direction 20040186

ID No. : No.16

Customer : United Analyst and Engineering Consultant Co.,Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1012.5 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

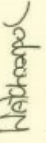
: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023


N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629588)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by :   
Mr. Watcharapol Subwat  
Mechanical Engineer

Signed :   
Mr. Bisood Plomsut  
Mechanical Engineer



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

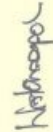
The Result of Calibration

22 February, 2024

Certification No. 096/24

Page : 5 of 5

| Standard<br>Temp.<br>°C | Temperature Sensor Reading |                  |
|-------------------------|----------------------------|------------------|
|                         | Reading<br>°C              | Correction<br>°C |
| 45.2                    | 45                         | 0.2              |
| 30.3                    | 30                         | 0.3              |
| 15.8                    | 16                         | -0.2             |

Calibrated by :   
Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม





Certificate No : 23-SLM-227  
Request No : Req-2023-1416

1. Indication at the calibration check frequency

| UUC Setting        | Nominal Level (dB) | Before Adjust |          | After Adjust |          | Acceptance Limit (± dB) |
|--------------------|--------------------|---------------|----------|--------------|----------|-------------------------|
|                    |                    | UUC (dB)      | ERR (dB) | UUC (dB)     | ERR (dB) |                         |
| FAST / A / 37-139  |                    |               |          |              |          |                         |
| Calibrator Setting |                    |               |          |              |          |                         |
| 1000 Hz 114 dB     | 113.77             | 114.0         | +0.23    | 113.8        | +0.03    | 0.3                     |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 73246

2. Self-generated noise, Microphone installed

| UUC Setting   | Measured (dB) | UNCERTAINTY (± dB) |
|---------------|---------------|--------------------|
| FAST / 37-139 |               |                    |
| UUC Weighting |               |                    |
| A             | 31.1          | 0.1                |

3. Self-generated noise, Microphone replaced by the electrical input signal device

| UUC Setting   | Measured (dB) | UNCERTAINTY (± dB) |
|---------------|---------------|--------------------|
| FAST / 37-139 |               |                    |
| UUC Weighting |               |                    |
| A             | 30.9          | 0.1                |
| C             | 30.4          | 0.1                |
| Z             | 34.7          | 0.1                |

4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting   | Deviation from various Frequency Weighting Response curve |           |           |  | UNCERTAINTY<br>(± dB) | Acceptance Limit<br>(± dB) |
|---------------|---|-----------|-----------|--|-----------------------|----------------------------|
|               | A<br>(dB)   | C<br>(dB) | Z<br>(dB) |  |                       |                            |
|               |   |           |           |  |                       |                            |
| FAST / 37-139 |   |           |           |  |                       |                            |
| STD Setting   |   |           |           |  |                       |                            |
| 125 Hz        | 0.0   | 0.2       | 0.1       |  | 0.6                   | 2.0                        |
| 1000 Hz       | 0.0   | 0.0       | 0.0       |  | 0.6                   | 1.0                        |
| 4000 Hz       | 1.1   | 0.7       | 1.2       |  | 0.6                   | 3.0                        |
| 8000 Hz       | 2.8   | 1.0       | 2.9       |  | 3.2                   | 5.0                        |

Certificate of Calibration

Customer

Name UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 23-SLM-227  
Address 81 Soi Udomsak 41, Sukhumvit Road, Bangthek, Prakanong, Bangkok 10260 Request No : Req-2023-1416

Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2  
Manufacturer : LARSON DAVIS Microphone Model : 375B02  
Model : LX72 Microphone S/N : 011740  
Serial Number : 0005266 Preamplifier Model : PRMLX72B  
ID : UAE.EFM.102.2562 Preamplifier S/N : 056087  
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 26 June 2023  
Calibrated Date : 28 June 2023  
Calibration Procedure : In-house method CPS-SLM-01 based on IEC 61673-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

Reference Standard

| Instrument                 | Brand | Model     | S/N       | Due calibration | Traceability |
|----------------------------|-------|-----------|-----------|-----------------|--------------|
| Standard Microphone        | GRAS  | 40AN      | 188273    | 6 October 2023  | GRAS         |
| Multi-frequency Calibrator | Quest | Quest-cal | EFA000234 | 29 June 2023    | TSI          |
| Audio Generator            | Svank | Svan401   | 131       | 12 October 2023 | WK Electric  |

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. Noppakorn Luangant  
Calibration Officer

Approved By : 

Mr. Paet Malhavorn  
Calibration Engineer Supervisor  
Issue Date : 28 June 2023



Certificate No : 23-SLM-227  
Request No : Req-2023-1416

7. Long Term Stability

| UUC Setting       | Measured | UNCERTAINTY | Acceptance Limit |
|-------------------|----------|-------------|------------------|
| FAST / A / 37-139 | UUC (dB) | ( $\pm$ dB) | ( $\pm$ dB)      |
| STD Setting       |          |             |                  |
| Initial           | 114.0    |             |                  |
| Final             | 114.0    |             |                  |
| Deviated          | 0.0      | 0.1         | 0.3              |

8. Level linearity on the reference level range

| UUC Setting       | Anticipated | Deviation         | UNCERTAINTY | Acceptance Limit |
|-------------------|-------------|-------------------|-------------|------------------|
| FAST / A / 37-139 | REF (dB)    | UUC (dB) ERR (dB) | ( $\pm$ dB) | ( $\pm$ dB)      |
| STD dB            |             |                   |             |                  |
| 141.00            | 141         | 141.0 0.0         |             | 0.8              |
| 143.00            | 143         | 143.0 0.0         |             | 0.8              |
| 139.00            | 139         | 139.0 0.0         |             | 1.1              |
| 134.00            | 134         | 134.0 0.0         |             | 1.1              |
| 129.00            | 129         | 129.0 0.0         |             | 1.1              |
| 124.00            | 124         | 124.0 0.0         |             | 1.1              |
| 119.00            | 119         | 119.0 0.0         |             | 1.1              |
| 114.00            | 114         | 114.0 0.0         |             | 1.1              |
| 109.00            | 109         | 109.0 0.0         |             | 1.1              |
| 104.00            | 104         | 104.0 0.0         |             | 1.1              |
| 99.00             | 99          | 98.9 -0.1         |             | 1.1              |
| 94.00             | 94          | 94.0 0.0          |             | 1.1              |
| 89.00             | 89          | 89.0 0.0          |             | 1.1              |
| 84.00             | 84          | 84.0 0.0          |             | 1.1              |
| 79.00             | 79          | 79.0 0.0          |             | 1.1              |
| 74.00             | 74          | 74.0 0.0          |             | 1.1              |
| 69.00             | 69          | 69.0 0.0          |             | 1.1              |
| 64.00             | 64          | 64.0 0.0          |             | 1.1              |
| 59.00             | 59          | 59.0 0.0          |             | 1.1              |
| 54.00             | 54          | 54.0 0.0          |             | 1.1              |
| 49.00             | 49          | 49.0 0.0          |             | 1.1              |
| 44.00             | 44          | 44.2 0.2          |             | 1.1              |
| 41.00             | 43          | 43.3 0.3          |             | 1.1              |
| 42.00             | 42          | 42.3 0.3          |             | 1.1              |
| 41.00             | 41          | 41.4 0.4          |             | 1.1              |

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Certificate No : 23-SLM-227  
Request No : Req-2023-1416

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

| UUC Setting   | Deviation from various Frequency | UNCERTAINTY | Acceptance Limit |
|---------------|----------------------------------|-------------|------------------|
| FAST / 37-139 | Weighting Response curve         | ( $\pm$ dB) | ( $\pm$ dB)      |
| STD Setting   | A (dB) C (dB) Z (dB)             |             |                  |
| 63 Hz         | -0.2 -0.1 0.0                    |             | 2.0              |
| 125 Hz        | -0.1 0.0 0.0                     |             | 1.5              |
| 250 Hz        | -0.1 0.0 0.0                     |             | 1.5              |
| 500 Hz        | -0.1 0.0 0.0                     |             | 1.5              |
| 1000 Hz       | 0.0 0.0 0.0                      | 0.2         | 1.0              |
| 2000 Hz       | 0.0 0.0 0.0                      |             | 2.0              |
| 4000 Hz       | 0.0 0.0 0.0                      |             | 3.0              |
| 8000 Hz       | -0.1 -0.1 0.0                    |             | 5                |
| 16000 Hz      | -0.1 -0.1 -0.1                   |             | +5, -INF.        |

6. Frequency and time weightings at 1kHz

| UUC Setting   | STD      | Measured          | UNCERTAINTY | Acceptance Limit |
|---------------|----------|-------------------|-------------|------------------|
| FAST / 37-139 | REF (dB) | UUC (dB) ERR (dB) | ( $\pm$ dB) | ( $\pm$ dB)      |
| UUC Weighting |          |                   |             |                  |
| A             | 114.00   | 114.0 0.0         |             | 0.2              |
| C             | 114.00   | 114.0 0.0         | 0.2         | 0.2              |
| Z             | 114.00   | 114.0 0.0         |             | 0.2              |

| UUC Setting       | STD      | Measured          | UNCERTAINTY | Acceptance Limit |
|-------------------|----------|-------------------|-------------|------------------|
| 37-139 / A        | REF (dB) | UUC (dB) ERR (dB) | ( $\pm$ dB) | ( $\pm$ dB)      |
| UUC Time Response |          |                   |             |                  |
| Fast              | 114.00   | 114.0 0.0         |             | 0.1              |
| Slow              | 114.00   | 114.0 0.0         | 0.2         | 0.1              |
| Leq               | 114.00   | 114.0 0.0         |             | 0.1              |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.  
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Certificate No : 23-SLM-227  
Request No : Req-2023-1416

12. Overload indication

| UUC Setting             | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139       | UUC<br>(dB) |                            |                                    |
| STD Setting             | 145.2       |                            |                                    |
| Positive one-half cycle | 145.2       |                            |                                    |
| Negative one-half cycle |             |                            |                                    |
| Deviated                | 0.0         | 0.2                        | 1.5                                |

13. High Level Stability

| UUC Setting       | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139 | UUC<br>(dB) |                            |                                    |
| STD Setting       | 138.0       |                            |                                    |
| Initial           | 138.0       |                            |                                    |
| Final             |             |                            |                                    |
| Deviated          | 0.0         | 0.1                        | 0.3                                |

End of Certificate

Certificate No : 23-SLM-227  
Request No : Req-2023-1416

9. Level linearity including the level range control

| UUC Setting | STD         | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------|-------------|-------------|----------------------------|------------------------------------|
| FAST / A    | REF<br>(dB) | UUC<br>(dB) |                            |                                    |
| UUC Range   | 46.2        | 46.3        | 0.1                        | 1.1                                |
| 37-139      | 114         | 114.0       | 0.0                        | 1.1                                |

10. Tone burst response

| UUC Setting       | STD               | Anticipated | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------------|-------------|-------------|----------------------------|------------------------------------|
| A / 37-139        | Toneburst<br>(ms) | Ref<br>(dB) | UUC<br>(dB) | ERR<br>(dB)                |                                    |
| UUC Time Response | 200               | 135.0       | 135.0       | 0.0                        | 1                                  |
| Fast              | 2                 | 118.0       | 117.9       | -0.1                       | +1.0, -2.5                         |
|                   | 0.25              | 109.0       | 108.8       | -0.2                       | +1.5, -5.0                         |
| Slow              | 200               | 128.6       | 128.5       | -0.1                       | 1                                  |
|                   | 2                 | 109.0       | 108.9       | -0.1                       | +1.0, -5.0                         |
|                   | 200               | 129.0       | 129.1       | +0.1                       | 1                                  |
|                   | 2                 | 109.0       | 109.1       | +0.1                       | +1.0, -2.5                         |
| SEL               | 0.25              | 100.0       | 100.1       | +0.1                       | +1.5, -5.0                         |

11. Peak C Sound level

| UUC Setting         | Anticipated | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|---------------------|-------------|-------------|----------------------------|------------------------------------|
| FAST / C / 95-142   | REF<br>(dB) | UUC<br>(dB) |                            |                                    |
| STD Setting         | 137.4       | 136.8       | -0.60                      | 3.0                                |
| Complete cycle      |             |             |                            |                                    |
| Positive half cycle | 136.4       | 136.1       | -0.30                      | 2.0                                |
| Negative half cycle | 136.4       | 136.1       | -0.30                      | 2.0                                |



Certificate No : 23-SLM-187  
Request No : Req-2023-1166

1. Indication at the calibration check frequency

| UUC Setting        | Nominal Level (dB) | Before Adjust |          | After Adjust |          | UNCERTAINTY (± dB) | Acceptance Limit (± dB) |
|--------------------|--------------------|---------------|----------|--------------|----------|--------------------|-------------------------|
|                    |                    | UUC (dB)      | ERR (dB) | UUC (dB)     | ERR (dB) |                    |                         |
| FAST / A / 37-139  |                    |               |          |              |          |                    |                         |
| Calibrator Setting |                    |               |          |              |          |                    |                         |
| 1000 Hz 114 dB     | 114.54             | 114.6         | -0.06    | 114.5        | -0.04    | 0.2                | 0.3                     |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand 3M, Model AC-300, SN. AC-300001087

2. Self-generated noise, Microphone installed

| UUC Setting   | Measured (dB) | UNCERTAINTY (± dB) |
|---------------|---------------|--------------------|
| FAST / 37-139 |               |                    |
| UUC Weighting |               |                    |
| A             | 30.7          | 0.1                |

3. Self-generated noise, Microphone replaced by the electrical input signal device

| UUC Setting   | Measured (dB) | UNCERTAINTY (± dB) |
|---------------|---------------|--------------------|
| FAST / 37-139 |               |                    |
| UUC Weighting |               |                    |
| A             | 30.5          | 0.1                |
| C             | 30.1          | 0.1                |
| Z             | 34.1          | 0.1                |

4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting   | Deviation from various Frequency Weighting Response curve |     |     |           | UNCERTAINTY<br>(± dB) | Acceptance Limit<br>(± dB) |
|---------------|---|-----|-----|-----------|-----------------------|----------------------------|
|               | A<br>(dB)   | C   |     | Z<br>(dB) |                       |                            |
|               |   |     |     |           |                       |                            |
| FAST / 37-139 |   |     |     |           |                       |                            |
| STD Setting   |   |     |     |           |                       |                            |
| 125 Hz        | 0.0   | 0.1 | 0.0 | 0.0       | 0.6                   | 2.0                        |
| 1000 Hz       | 0.0   | 0.0 | 0.0 | 0.0       | 0.6                   | 1.0                        |
| 4000 Hz       | 1.2   | 1.2 | 1.2 | 1.2       | 0.6                   | 3.0                        |
| 8000 Hz       | 2.9   | 2.8 | 2.9 | 2.9       | 0.7                   | 5.0                        |

Certificate of Calibration

Customer

Name UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 23-SLM-187  
Address 81 Soi Udomsak 41, Sukhumvit Road, Bangteak, Prakanong, Bangkok Request No : Req-2023-1166  
10260

Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2  
Manufacturer : LARSON DAVIS Microphone Model : 375902  
Model : LX72 Microphone SN : 011731  
Serial Number : 0005288 Preamplifier Model : PBM1x12B  
ID : UAE1FM1042562 Preamplifier SN : 056075  
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 26 May 2023  
Calibrated Date : 2 June 2023  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic


Reference Standard

| Instrument                 | Brand   | Model     | SN        | Due calibration | Traceability |
|----------------------------|---------|-----------|-----------|-----------------|--------------|
| Standard Microphone        | GRAS    | 40AN      | 188273    | 6 October 2023  | GRAS         |
| Multi-frequency Calibrator | Quest   | Quest-cal | EFA000234 | 29 June 2023    | TSI          |
| Audio Generator            | Svanick | Svan401   | 131       | 12 October 2023 | WK Electric  |


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. Noppadol Luangart  
Calibration Officer

Approved By :

  
Mr. Paet Malhavorn  
Calibration Engineer/ Supervisor  
Issue Date : 2 June 2023



Certificate No : 23-SLM-187

Request No : Req-2023-1166

7. Long Term Stability

| UUC Setting       | Measured    |  | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------|--|----------------------------|------------------------------------|
|                   | UUC<br>(dB) |  |                            |                                    |
| FAST / A / 37-139 |             |  |                            |                                    |
| STD Setting       |             |  |                            |                                    |
| Initial           | 114.0       |  |                            |                                    |
| Final             | 114.0       |  |                            |                                    |
| Deviated          | 0.0         |  | 0.1                        | 0.3                                |

8. Level linearity on the reference level range

| UUC Setting       | Anticipated |  | Deviation   |             | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------|--|-------------|-------------|----------------------------|------------------------------------|
|                   | REF<br>(dB) |  | UUC<br>(dB) | ERR<br>(dB) |                            |                                    |
| FAST / A / 37-139 |             |  |             |             |                            |                                    |
| STD dB            |             |  |             |             |                            |                                    |
| 139.00            | 139         |  | 139.0       | 0.0         |                            | 1.1                                |
| 134.00            | 134         |  | 134.0       | 0.0         |                            | 1.1                                |
| 129.00            | 129         |  | 129.0       | 0.0         |                            | 1.1                                |
| 124.00            | 124         |  | 124.0       | 0.0         |                            | 1.1                                |
| 119.00            | 119         |  | 119.0       | 0.0         |                            | 1.1                                |
| 114.00            | 114         |  | 114.0       | 0.0         |                            | 1.1                                |
| 109.00            | 109         |  | 109.0       | 0.0         |                            | 1.1                                |
| 104.00            | 104         |  | 104.0       | 0.0         |                            | 1.1                                |
| 99.00             | 99          |  | 99.0        | 0.0         |                            | 1.1                                |
| 94.00             | 94          |  | 94.0        | 0.0         |                            | 1.1                                |
| 89.00             | 89          |  | 89.0        | 0.0         |                            | 1.1                                |
| 84.00             | 84          |  | 84.0        | 0.0         |                            | 1.1                                |
| 79.00             | 79          |  | 79.0        | 0.0         |                            | 1.1                                |
| 74.00             | 74          |  | 74.0        | 0.0         |                            | 1.1                                |
| 69.00             | 69          |  | 69.0        | 0.0         |                            | 1.1                                |
| 64.00             | 64          |  | 64.0        | 0.0         |                            | 1.1                                |
| 59.00             | 59          |  | 59.0        | 0.0         |                            | 1.1                                |
| 54.00             | 54          |  | 54.1        | 0.1         |                            | 1.1                                |
| 49.00             | 49          |  | 49.1        | 0.1         |                            | 1.1                                |
| 44.00             | 44          |  | 44.2        | 0.2         |                            | 1.1                                |
| 39.00             | 39          |  | 39.7        | 0.7         |                            | 1.1                                |

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Certificate No : 23-SLM-187

Request No : Req-2023-1166

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

| UUC Setting   | Deviation from various Frequency |        |        |  | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|---------------|----------------------------------|--------|--------|--|----------------------------|------------------------------------|
|               | Weighting Response curve         |        |        |  |                            |                                    |
| FAST / 37-139 | A (dB)                           | C (dB) | Z (dB) |  |                            |                                    |
| STD Setting   |                                  |        |        |  |                            |                                    |
| 63 Hz         | -0.1                             | 0.0    | 0.0    |  |                            | 2.0                                |
| 125 Hz        | -0.1                             | 0.0    | 0.0    |  |                            | 1.5                                |
| 250 Hz        | 0.0                              | 0.0    | 0.0    |  |                            | 1.5                                |
| 500 Hz        | 0.0                              | 0.0    | 0.0    |  |                            | 1.5                                |
| 1000 Hz       | 0.0                              | 0.0    | 0.0    |  | 0.2                        | 1.0                                |
| 2000 Hz       | 0.1                              | 0.1    | 0.0    |  |                            | 2.0                                |
| 4000 Hz       | 0.0                              | 0.1    | 0.0    |  |                            | 3.0                                |
| 8000 Hz       | 0.0                              | 0.1    | 0.0    |  |                            | 5                                  |
| 16000 Hz      | 0.0                              | -0.1   | 0.0    |  |                            | +5, -INF.                          |

6. Frequency and time weightings at 1kHz

| UUC Setting   | STD         |  | Measured    |             | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|---------------|-------------|--|-------------|-------------|----------------------------|------------------------------------|
|               | REF<br>(dB) |  | UUC<br>(dB) | ERR<br>(dB) |                            |                                    |
| FAST / 37-139 |             |  |             |             |                            |                                    |
| UUC Weighting |             |  |             |             |                            |                                    |
| A             | 114.00      |  | 114.0       | 0.0         |                            | 0.2                                |
| C             | 114.00      |  | 114.0       | 0.0         | 0.2                        | 0.2                                |
| Z             | 114.00      |  | 114.0       | 0.0         |                            | 0.2                                |

| UUC Setting       | STD         |  | Measured    |             | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------|--|-------------|-------------|----------------------------|------------------------------------|
|                   | REF<br>(dB) |  | UUC<br>(dB) | ERR<br>(dB) |                            |                                    |
| 37-139 / A        |             |  |             |             |                            |                                    |
| UUC Time Response |             |  |             |             |                            |                                    |
| Fast              | 114.00      |  | 114.0       | 0.0         |                            | 0.1                                |
| Slow              | 114.00      |  | 114.0       | 0.0         | 0.2                        | 0.1                                |
| Leq               | 114.00      |  | 114.0       | 0.0         |                            | 0.1                                |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

เอกสารไม่ควบคุม



Certificate No : 23-SLM-187  
Request No : Req-2023-1166

12. Overload indication

| UUC Setting             | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139       | UUC<br>(dB) |                            |                                    |
| STD Setting             | 142.3       |                            |                                    |
| Positive one-half cycle | 142.5       |                            |                                    |
| Negative one-half cycle | -0.2        | 0.2                        | 1.5                                |

13. High Level Stability

| UUC Setting       | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139 | UUC<br>(dB) |                            |                                    |
| STD Setting       | 138.0       |                            |                                    |
| Initial           | 138.0       |                            |                                    |
| Final             | 0.0         | 0.1                        | 0.3                                |

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

เอกสารไม่ควบคุม



Certificate No : 23-SLM-187  
Request No : Req-2023-1166

9. Level linearity including the level range control

| UUC Setting | STD  | REF  | UUC   | ERR  | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------|------|------|-------|------|----------------------------|------------------------------------|
| FAST / A    |      | (dB) | (dB)  | (dB) |                            |                                    |
| UUC Range   | 45.0 |      | 45.2  | 0.2  |                            | 1.1                                |
| 37-139      | 114  |      | 114.0 | 0.0  | 0.3                        | 1.1                                |

10. Tone burst response

| UUC Setting       | STD               | Anticipated | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------------|-------------|-------------|----------------------------|------------------------------------|
| A / 37-139        | Toneburst<br>(ms) | Ref<br>(dB) | UUC<br>(dB) | ERR<br>(dB)                |                                    |
| UUC Time Response |                   |             |             |                            |                                    |
| Fast              | 200               | 135.0       | 135.0       | 0.0                        | 1                                  |
|                   | 2                 | 118.0       | 117.9       | -0.1                       | +1.0, -2.5                         |
|                   | 0.25              | 109.0       | 108.8       | -0.2                       | +1.5, -5.0                         |
| Slow              | 200               | 128.6       | 128.5       | -0.1                       | 1                                  |
|                   | 2                 | 109.0       | 108.9       | -0.1                       | +1.0, -5.0                         |
|                   | 200               | 129.0       | 129.0       | 0.0                        | 1                                  |
| SEL               | 2                 | 109.0       | 108.9       | -0.1                       | +1.0, -2.5                         |
|                   | 0.25              | 100.0       | 99.9        | -0.1                       | +1.5, -5.0                         |

11. Peak C Sound level

| UUC Setting         | Anticipated | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|---------------------|-------------|-------------|----------------------------|------------------------------------|
| FAST / C / 95-142   | REF<br>(dB) | UUC<br>(dB) | ERR<br>(dB)                |                                    |
| STD Setting         |             |             |                            |                                    |
| Complete cycle      | 137.4       | 136.9       | -0.50                      | 3.0                                |
| Positive half cycle | 136.4       | 136.3       | -0.10                      | 2.0                                |
| Negative half cycle | 136.4       | 136.3       | -0.10                      | 2.0                                |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

เอกสารไม่ควบคุม



Certificate No : 23-SLM-210  
Request No : Req-2023-1387

1. Indication at the calibration check frequency

| UUC Setting        | Nominal Level (dB) | Before Adjust |          | After Adjust |          | UNCERTAINTY (± dB) | Acceptance Limit (± dB) |
|--------------------|--------------------|---------------|----------|--------------|----------|--------------------|-------------------------|
|                    |                    | UUC (dB)      | ERR (dB) | UUC (dB)     | ERR (dB) |                    |                         |
| FAST / A / 37-139  |                    |               |          |              |          |                    |                         |
| Calibrator Setting |                    |               |          |              |          |                    |                         |
| 1000 Hz 114 dB     | 114.54             | 114.5         | -0.04    | 114.5        | -0.04    | 0.2                | 0.3                     |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand 3M, Model AC-300, SN. AC-300001087

2. Self-generated noise, Microphone installed

| UUC Setting   | Measured (dB) | UNCERTAINTY (± dB) |
|---------------|---------------|--------------------|
| FAST / 37-139 |               |                    |
| UUC Weighting |               |                    |
| A             | 24.1          | 0.1                |

3. Self-generated noise, Microphone replaced by the electrical input signal device

| UUC Setting   | Measured (dB) | UNCERTAINTY (± dB) |
|---------------|---------------|--------------------|
| FAST / 37-139 |               |                    |
| UUC Weighting |               |                    |
| A             | 23.5          | 0.1                |
| C             | 23.0          | 0.1                |
| Z             | 27.5          | 0.1                |

4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting   | Deviation from various Frequency Weighting Response curve (dB) | UNCERTAINTY (± dB) |      | Acceptance Limit (± dB) |
|---------------|--|--------------------|------|-------------------------|
|               |  | A                  | C    |                         |
| FAST / 37-139 |  |                    |      |                         |
| STD Setting   |  |                    |      |                         |
| 125 Hz        | 0.0  | 0.1                | 0.1  | 0.6                     |
| 1000 Hz       | 0.0  | 0.0                | 0.0  | 0.6                     |
| 4000 Hz       | 0.0  | 0.0                | 0.1  | 0.6                     |
| 8000 Hz       | -0.6   | -0.6               | -0.5 | 5.0                     |

Certificate of Calibration

Customer

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

Certificate No : 23-SLM-210  
Request No : Req-2023-1387

Unit Under Calibration Details

Measurement item : Sound Level Meter  
Manufacturer : LARSON DAVIS  
Model : LX72  
Serial Number : 0005293  
ID : UAE.EFM.1082562  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : 375A04  
Microphone S/N : 346386  
Preamplifier Model : PPM1xT2B  
Preamplifier S/N : 056084  
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 21 June 2023  
Calibrated Date : 23 June 2023  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

Reference Standard

| Instrument                 | Brand  | Model     | SN        | Due calibration | Traceability |
|----------------------------|--------|-----------|-----------|-----------------|--------------|
| Standard Microphone        | GRAS   | 40AN      | 188273    | 6 October 2023  | GRAS         |
| Multi-frequency Calibrator | Quest  | Quest-cal | EFA000234 | 29 June 2023    | TSI          |
| Audio Generator            | Svante | Sva401    | 131       | 12 October 2023 | WK Electric  |

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 Luangt  
Calibration Officer

Approved By : 

Mr. Paet Mahavorn  
Calibration Engineer Supervisor

Issue Date : 23 June 2023

Certificate No : 23-SLM-210  
Request No : Req-2023-1387

7. Long Term Stability

| UUC Setting       | Measured | UNCERTAINTY | Acceptance Limit |
|-------------------|----------|-------------|------------------|
| FAST / A / 37-139 | UUC (dB) | (± dB)      | (± dB)           |
| STD Setting       |          |             |                  |
| Initial           | 114.0    |             |                  |
| Final             | 114.0    |             |                  |
| Deviated          | 0.0      | 0.1         | 0.3              |

8. Level linearity on the reference level range

| UUC Setting       | Anticipated | Deviation         | UNCERTAINTY | Acceptance Limit |
|-------------------|-------------|-------------------|-------------|------------------|
| FAST / A / 37-139 | REF (dB)    | UUC (dB) ERR (dB) | (± dB)      | (± dB)           |
| STD dB            |             |                   |             |                  |
| 139.00            | 139         | 139.0 0.0         |             | 1.1              |
| 134.00            | 134         | 134.0 0.0         |             | 1.1              |
| 129.00            | 129         | 129.0 0.0         |             | 1.1              |
| 124.00            | 124         | 124.0 0.0         |             | 1.1              |
| 119.00            | 119         | 119.0 0.0         |             | 1.1              |
| 114.00            | 114         | 114.0 0.0         |             | 1.1              |
| 109.00            | 109         | 109.0 0.0         |             | 1.1              |
| 104.00            | 104         | 104.0 0.0         |             | 1.1              |
| 99.00             | 99          | 99.0 0.0          |             | 1.1              |
| 94.00             | 94          | 93.9 -0.1         |             | 1.1              |
| 89.00             | 89          | 88.9 -0.1         |             | 1.1              |
| 84.00             | 84          | 83.9 -0.1         | 0.3         | 1.1              |
| 79.00             | 79          | 78.9 -0.1         |             | 1.1              |
| 74.00             | 74          | 73.9 -0.1         |             | 1.1              |
| 69.00             | 69          | 68.9 -0.1         |             | 1.1              |
| 64.00             | 64          | 63.9 -0.1         |             | 1.1              |
| 59.00             | 59          | 58.9 -0.1         |             | 1.1              |
| 54.00             | 54          | 53.9 -0.1         |             | 1.1              |
| 49.00             | 49          | 49.0 0.0          |             | 1.1              |
| 44.00             | 44          | 44.0 0.0          |             | 1.1              |
| 39.00             | 39          | 39.1 0.1          |             | 1.1              |
| 34.00             | 34          | 34.4 0.4          |             | 1.1              |

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

| UUC Setting   | Deviation from various Frequency | UNCERTAINTY | Acceptance Limit |
|---------------|----------------------------------|-------------|------------------|
| FAST / 37-139 | Weighting Response curve         | (± dB)      | (± dB)           |
| STD Setting   | A (dB) C (dB) Z (dB)             |             |                  |
| 63 Hz         | -0.2 -0.1 -0.1                   |             | 2.0              |
| 125 Hz        | -0.1 0.0 -0.1                    |             | 1.5              |
| 250 Hz        | -0.1 -0.1 -0.1                   |             | 1.5              |
| 500 Hz        | -0.1 0.0 -0.1                    |             | 1.5              |
| 1000 Hz       | 0.0 0.0 -0.1                     | 0.2         | 1.0              |
| 2000 Hz       | 0.0 0.0 0.0                      |             | 2.0              |
| 4000 Hz       | 0.0 0.0 0.0                      |             | 3.0              |
| 8000 Hz       | -0.1 -0.1 0.0                    |             | 5                |
| 16000 Hz      | -0.1 -0.1 -0.1                   |             | +5, -INF.        |

6. Frequency and time weightings at 1kHz

| UUC Setting   | STD      | Measured          | UNCERTAINTY | Acceptance Limit |
|---------------|----------|-------------------|-------------|------------------|
| FAST / 37-139 | REF (dB) | UUC (dB) ERR (dB) | (± dB)      | (± dB)           |
| UUC Weighting |          |                   |             |                  |
| A             | 114.00   | 114.0 0.0         |             | 0.2              |
| C             | 114.00   | 114.0 0.0         | 0.2         | 0.2              |
| Z             | 114.00   | 114.0 0.0         |             | 0.2              |

| UUC Setting       | STD      | Measured          | UNCERTAINTY | Acceptance Limit |
|-------------------|----------|-------------------|-------------|------------------|
| 37-139 / A        | REF (dB) | UUC (dB) ERR (dB) | (± dB)      | (± dB)           |
| UUC Time Response |          |                   |             |                  |
| Fast              | 114.00   | 114.0 0.0         |             | 0.1              |
| Slow              | 114.00   | 114.0 0.0         | 0.2         | 0.1              |
| Leq               | 114.00   | 114.0 0.0         |             | 0.1              |

Certificate No : 23-SLM-210  
Request No : Req-2023-1387

12. Overload indication

| UUC Setting             | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139       | UUC<br>(dB) |                            |                                    |
| STD Setting             | 142.5       |                            |                                    |
| Positive one-half cycle | 142.7       |                            |                                    |
| Negative one-half cycle | -0.2        | 0.2                        | 1.5                                |
| Deviated                |             |                            |                                    |

13. High Level Stability

| UUC Setting       | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139 | UUC<br>(dB) |                            |                                    |
| STD Setting       | 138.0       |                            |                                    |
| Initial           | 138.0       |                            |                                    |
| Final             | 138.0       | 0.1                        | 0.3                                |
| Deviated          |             |                            |                                    |

End of Certificate

Certificate No : 23-SLM-210  
Request No : Req-2023-1387

9. Level linearity including the level range control

| UUC Setting | STD         | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------|-------------|-------------|----------------------------|------------------------------------|
| FAST / A    | REF<br>(dB) | UUC<br>(dB) |                            |                                    |
| UUC Range   | 39.3        | 39.5        | 0.2                        | 1.1                                |
| 37-139      | 114         | 114.0       | 0.3                        | 1.1                                |

10. Tone burst response

| UUC Setting       | STD               | Anticipated | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------------|-------------|-------------|----------------------------|------------------------------------|
| A / 37-139        | Toneburst<br>(ms) | Ref<br>(dB) | UUC<br>(dB) | ERR<br>(dB)                |                                    |
| UUC Time Response | 200               | 135.0       | 135.0       | 0.0                        | 1                                  |
| Fast              | 2                 | 118.0       | 117.9       | -0.1                       | +1.0, -2.5                         |
|                   | 0.25              | 109.0       | 108.6       | -0.4                       | +1.5, -5.0                         |
| Slow              | 200               | 128.6       | 128.5       | -0.1                       | 1                                  |
|                   | 2                 | 109.0       | 108.9       | -0.1                       | +1.0, -5.0                         |
|                   | 200               | 129.0       | 129.0       | 0.0                        | 1                                  |
| SEL               | 2                 | 109.0       | 109.1       | +0.1                       | +1.0, -2.5                         |
|                   | 0.25              | 100.0       | 99.8        | -0.2                       | +1.5, -5.0                         |

11. Peak C Sound level

| UUC Setting         | Anticipated | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|---------------------|-------------|-------------|----------------------------|------------------------------------|
| FAST / C / 95-142   | REF<br>(dB) | UUC<br>(dB) |                            |                                    |
| STD Setting         | 137.4       | 136.6       | -0.80                      | 3.0                                |
| Complete cycle      | 136.4       | 136.2       | -0.20                      | 2.0                                |
| Positive half cycle | 136.4       | 136.2       | -0.20                      | 2.0                                |
| Negative half cycle | 136.4       | 136.2       | -0.20                      | 2.0                                |



Certificate No : 23-SLM-222  
Request No : Req-2023-1410

1. Indication at the calibration check frequency

| UUC Setting        | Nominal Level (dB) | Before Adjust |          | After Adjust |          | UNCERTAINTY (± dB) | Acceptance Limit (± dB) |
|--------------------|--------------------|---------------|----------|--------------|----------|--------------------|-------------------------|
|                    |                    | UUC (dB)      | ERR (dB) | UUC (dB)     | ERR (dB) |                    |                         |
| FAST / A / 37-139  |                    |               |          |              |          |                    |                         |
| Calibrator Setting |                    |               |          |              |          |                    |                         |
| 1000 Hz 114 dB     | 113.77             | 114.0         | +0.23    | 113.8        | +0.03    | 0.2                | 0.3                     |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SV/ANTEK, Model SV 25A, SN. 73246

2. Self-generated noise, Microphone installed

| UUC Setting   | Measured (dB) | UNCERTAINTY (± dB) |
|---------------|---------------|--------------------|
| FAST / 37-139 |               |                    |
| UUC Weighting |               |                    |
| A             | 30.5          | 0.1                |

3. Self-generated noise, Microphone replaced by the electrical input signal device

| UUC Setting   | Measured (dB) | UNCERTAINTY (± dB) |
|---------------|---------------|--------------------|
| FAST / 37-139 |               |                    |
| UUC Weighting |               |                    |
| A             | 30.0          | 0.1                |
| C             | 29.6          | 0.1                |
| Z             | 33.8          | 0.1                |

4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting   | Deviation from various Frequency Weighting Response curve |      |      |      | UNCERTAINTY<br>(± dB) | Acceptance Limit<br>(± dB) |
|---------------|---|------|------|------|-----------------------|----------------------------|
|               | A C Z   |      |      |      |                       |                            |
|               | (dB)  | (dB) | (dB) | (dB) |                       |                            |
| FAST / 37-139 |   |      |      |      |                       |                            |
| STD Setting   |   |      |      |      |                       |                            |
| 125 Hz        | 0.1   | 0.1  | 0.1  | 0.1  | 0.6                   | 2.0                        |
| 1000 Hz       | 0.0   | 0.0  | 0.0  | 0.0  | 0.6                   | 1.0                        |
| 4000 Hz       | 1.1   | 1.1  | 1.1  | 1.1  | 0.6                   | 3.0                        |
| 8000 Hz       | 2.7   | 2.7  | 2.7  | 2.7  | 0.7                   | 5.0                        |

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangteak, Prakanong, Bangkok 10260  
Certificate No : 23-SLM-222  
Request No : Req-2023-1410

Unit Under Calibration Details


Measurement Item : : Sound Level Meter  
Manufacturer : : LARSON DAVIS  
Model : : LxT2  
Serial Number : : 0005294  
ID : : UAE.FPM.109/2562  
Resolution : : 0.1 dB  
Calibration Environment and Details  
Temperature : : 23 °C ± 2 °C  
Humidity : : 50 %RH ± 20 %RH  
Barometric Pressure : : 1013 hPa ± 10 hPa  
Received Date : : 26 June 2023  
Calibrated Date : : 28 June 2023  
Calibration Procedure : : In-house method CP-SLM-01 based on IEC 61672-3 ; 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : : Lab Acoustic  
Microphone Class : : 2  
Microphone Model : : 375B02  
Microphone S/N : : 011736  
Preamplifier Model : : PRM1.xT2B  
Preamplifier S/N : : 056083  
Instrument Status : : Used


Reference Standard

| Instrument                 | Brand    | Model     | S/N       | Due calibration | Traceability |
|----------------------------|----------|-----------|-----------|-----------------|--------------|
| Standard Microphone        | GRAS     | 40AN      | 188273    | 6 October 2023  | GRAS         |
| Multi-frequency Calibrator | Quest    | Quest-cal | EFA000234 | 29 June 2023    | TSI          |
| Audio Generator            | Svanteck | Svan401   | 131       | 12 October 2023 | W/K Electric |

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. Noppadol Luangtan  
Calibration Officer

Approved By :   
Mr. Pait Matluavorn  
Calibration Engineer Supervisor  
Issue Date : 28 June 2023



Certificate No : 23-SLM-222  
Request No : Req-2023-1410

7. Long Term Stability

| UUC Setting | Measured          |             | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------|-------------------|-------------|----------------------------|------------------------------------|
|             | FAST / A / 37-139 | UUC<br>(dB) |                            |                                    |
| STD Setting |                   |             |                            |                                    |
| Initial     |                   | 114.0       |                            |                                    |
| Final       |                   | 114.0       |                            |                                    |
| Deviated    |                   | 0.0         | 0.1                        | 0.3                                |

8. Level linearity on the reference level range

| UUC Setting | Anticipated       |             | Deviation   |             | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------|-------------------|-------------|-------------|-------------|----------------------------|------------------------------------|
|             | FAST / A / 37-139 | REF<br>(dB) | UUC<br>(dB) | ERR<br>(dB) |                            |                                    |
| STD dB      |                   |             |             |             |                            |                                    |
| 143.00      |                   | 143         | 142.9       | -0.1        |                            | 0.3                                |
| 139.00      |                   | 139         | 139.0       | 0.0         |                            | 1.1                                |
| 134.00      |                   | 134         | 134.0       | 0.0         |                            | 1.1                                |
| 129.00      |                   | 129         | 129.0       | 0.0         |                            | 1.1                                |
| 124.00      |                   | 124         | 124.0       | 0.0         |                            | 1.1                                |
| 119.00      |                   | 119         | 119.0       | 0.0         |                            | 1.1                                |
| 114.00      |                   | 114         | 114.0       | 0.0         |                            | 1.1                                |
| 109.00      |                   | 109         | 109.0       | 0.0         |                            | 1.1                                |
| 104.00      |                   | 104         | 104.0       | 0.0         |                            | 1.1                                |
| 99.00       |                   | 99          | 99.0        | 0.0         |                            | 1.1                                |
| 94.00       |                   | 94          | 94.0        | 0.0         |                            | 1.1                                |
| 89.00       |                   | 89          | 89.0        | 0.0         |                            | 1.1                                |
| 84.00       |                   | 84          | 84.0        | 0.0         |                            | 1.1                                |
| 79.00       |                   | 79          | 79.0        | 0.0         |                            | 1.1                                |
| 74.00       |                   | 74          | 74.0        | 0.0         |                            | 1.1                                |
| 69.00       |                   | 69          | 69.0        | 0.0         |                            | 1.1                                |
| 64.00       |                   | 64          | 64.0        | 0.0         |                            | 1.1                                |
| 59.00       |                   | 59          | 59.0        | 0.0         |                            | 1.1                                |
| 54.00       |                   | 54          | 54.0        | 0.0         |                            | 1.1                                |
| 49.00       |                   | 49          | 49.1        | 0.1         |                            | 1.1                                |
| 44.00       |                   | 44          | 44.2        | 0.2         |                            | 1.1                                |
| 43.00       |                   | 43          | 43.2        | 0.2         |                            | 1.1                                |
| 42.00       |                   | 42          | 42.4        | 0.4         |                            | 1.1                                |
| 41.00       |                   | 41          | 41.3        | 0.3         |                            | 1.1                                |
| 40.00       |                   | 40          | 40.5        | 0.5         |                            | 1.1                                |



Certificate No : 23-SLM-222  
Request No : Req-2023-1410

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

| UUC Setting | Deviation from various Frequency<br>Weighting Response curve |        |        |        | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------|--|--------|--------|--------|----------------------------|------------------------------------|
|             | FAST / 37-139  | A (dB) | C (dB) | Z (dB) |                            |                                    |
| STD Setting |  |        |        |        |                            |                                    |
| 63 Hz       |  | -0.1   | 0.0    | 0.0    |                            | 2.0                                |
| 125 Hz      |  | -0.1   | 0.1    | 0.0    |                            | 1.5                                |
| 250 Hz      |  | 0.0    | 0.0    | 0.0    |                            | 1.5                                |
| 500 Hz      |  | 0.0    | 0.1    | 0.0    |                            | 1.5                                |
| 1000 Hz     |  | 0.0    | 0.0    | 0.0    | 0.2                        | 1.0                                |
| 2000 Hz     |  | 0.1    | 0.1    | 0.0    |                            | 2.0                                |
| 4000 Hz     |  | 0.0    | 0.0    | 0.0    |                            | 3.0                                |
| 8000 Hz     |  | 0.0    | 0.0    | 0.1    |                            | 5                                  |
| 16000 Hz    |  | 0.0    | -0.1   | -0.1   |                            | +5, -INF.                          |

6. Frequency and time weightings at 1kHz

| UUC Setting   | STD    | Measured    |             | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|---------------|--------|-------------|-------------|----------------------------|------------------------------------|
|               |        | REF<br>(dB) | UUC<br>(dB) |                            |                                    |
| FAST / 37-139 |        |             |             |                            |                                    |
| UUC Weighting |        |             |             |                            |                                    |
| A             | 114.00 | 114.00      | 114.0       | 0.0                        | 0.2                                |
| C             | 114.00 | 114.00      | 114.0       | 0.0                        | 0.2                                |
| Z             | 114.00 | 114.00      | 114.0       | 0.0                        | 0.2                                |

| UUC Setting       | STD    | Measured    |             | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|--------|-------------|-------------|----------------------------|------------------------------------|
|                   |        | REF<br>(dB) | UUC<br>(dB) |                            |                                    |
| 37-139 / A        |        |             |             |                            |                                    |
| UUC Time Response |        |             |             |                            |                                    |
| Fast              | 114.00 | 114.00      | 114.0       | 0.0                        | 0.1                                |
| Slow              | 114.00 | 114.00      | 114.0       | 0.0                        | 0.1                                |
| Leq               | 114.00 | 114.00      | 114.0       | 0.0                        | 0.1                                |



Certificate No : 2J-SLM-222  
Request No : Req-2023-1410

#### 12. Overload Indication

| UUC Setting             | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139       | UUC<br>(dB) |                            |                                    |
| STD Setting             | 144.5       |                            |                                    |
| Positive one-half cycle | 144.5       |                            |                                    |
| Negative one-half cycle |             |                            |                                    |
| Deviated                | 0.0         | 0.2                        | 1.5                                |

#### 13. High Level Stability

| UUC Setting       | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139 | UUC<br>(dB) |                            |                                    |
| STD Setting       | 138.0       |                            |                                    |
| Initial           | 138.0       |                            |                                    |
| Final             |             |                            |                                    |
| Deviated          | 0.0         | 0.1                        | 0.3                                |

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

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Certificate No : 2J-SLM-222  
Request No : Req-2023-1410

#### 9. Level linearity including the level range control

| UUC Setting | STD  | REF | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------|------|-----|-------------|----------------------------|------------------------------------|
| FAST / A    |      |     | UUC<br>(dB) |                            |                                    |
| UUC Range   |      |     | ERR<br>(dB) |                            |                                    |
|             | 45.4 |     | 0.2         |                            | 1.1                                |
| 37-139      | 114  |     | 114.0       | 0.3                        | 1.1                                |

#### 10. Tone burst response

| UUC Setting       | STD               | Anticipated | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------------|-------------|-------------|----------------------------|------------------------------------|
| A / 37-139        | Toneburst<br>(ms) | Ref<br>(dB) | UUC<br>(dB) |                            |                                    |
| UUC Time Response |                   |             | ERR<br>(dB) |                            |                                    |
|                   | 200               | 135.0       | 135.0       | 0.0                        | 1                                  |
| Fast              | 2                 | 118.0       | 117.6       | -0.4                       | +1.0, -2.5                         |
|                   | 0.25              | 109.0       | 108.5       | -0.5                       | +1.5, -5.0                         |
| Slow              | 200               | 128.6       | 128.5       | -0.1                       | 1                                  |
|                   | 2                 | 109.0       | 108.9       | -0.1                       | +1.0, -5.0                         |
|                   | 200               | 129.0       | 129.0       | 0.0                        | 1                                  |
| SEL               | 2                 | 109.0       | 108.9       | -0.1                       | +1.0, -2.5                         |
|                   | 0.25              | 100.0       | 99.7        | -0.3                       | +1.5, -5.0                         |

#### 11. Peak C Sound level

| UUC Setting         | Anticipated | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|---------------------|-------------|-------------|----------------------------|------------------------------------|
| FAST / C / 95-142   | REF<br>(dB) | UUC<br>(dB) |                            |                                    |
| STD Setting         |             | ERR<br>(dB) |                            |                                    |
| Complete cycle      | 137.4       | 136.7       | -0.70                      | 3.0                                |
| Positive half cycle | 136.4       | 136.2       | -0.20                      | 2.0                                |
| Negative half cycle | 136.4       | 136.2       | -0.20                      | 2.0                                |

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Certificate No : 2J-SLM-209

Request No : Req-2023-1386

#### 1. Indication at the calibration check frequency

| UUC Setting        | Nominal Level (dB) | Before Adjust |          | After Adjust |          | UNCERTAINTY (± dB) | Acceptance Limit (± dB) |
|--------------------|--------------------|---------------|----------|--------------|----------|--------------------|-------------------------|
|                    |                    | UUC (dB)      | ERR (dB) | UUC (dB)     | ERR (dB) |                    |                         |
| FAST / A / 37-139  |                    |               |          |              |          |                    |                         |
| Calibrator Setting |                    |               |          |              |          |                    |                         |
| 1000 Hz 114 dB     | 114.54             | 114.6         | +0.06    | 114.5        | -0.04    | 0.2                | 0.3                     |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand 3M, Model AC-300, SN. AC-300001087

#### 2. Self-generated noise, Microphone installed

| UUC Setting   | Measured (dB) | UNCERTAINTY (± dB) |
|---------------|---------------|--------------------|
| FAST / 37-139 |               |                    |
| UUC Weighting |               |                    |
| A             | 29.9          | 0.1                |

#### 3. Self-generated noise, Microphone replaced by the electrical input signal device

| UUC Setting   | Measured (dB) | UNCERTAINTY (± dB) |
|---------------|---------------|--------------------|
| FAST / 37-139 |               |                    |
| UUC Weighting |               |                    |
| A             | 29.7          | 0.1                |
| C             | 29.0          | 0.1                |
| Z             | 33.4          | 0.1                |

#### 4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting   | Deviation from various Frequency Weighting Response curve | UNCERTAINTY |      |      | Acceptance Limit |
|---------------|---|-------------|------|------|------------------|
|               |   | A C Z       |      |      |                  |
|               |   | (dB)        | (dB) | (dB) |                  |
| FAST / 37-139 |   |             |      |      |                  |
| STD Setting   |   |             |      |      |                  |
| 125 Hz        | 0.1   | 0.1         | 0.1  | 0.6  | 2.0              |
| 1000 Hz       | 0.0   | 0.0         | 0.0  | 0.6  | 1.0              |
| 4000 Hz       | 1.0   | 1.0         | 1.0  | 0.6  | 3.0              |
| 8000 Hz       | 2.0   | 1.9         | 2.0  | 0.7  | 5.0              |

#### Certificate of Calibration

##### Customer

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

Certificate No : 2J-SLM-209

Address : 81 Soi Udomsuk 41, Sakhumvit Road, Bangluek, Prakanong, Bangkok

Request No : Req-2023-1386

##### Unit Under Calibration Details

Measurement item : Sound Level Meter

Microphone Class : 2

Manufacturer : LARSON DAVIS

Microphone Model : 375B02

Model : LX72

Microphone S/N : 011739

Serial Number : 0005296

Preamplifier Model : P9MILxT2B

ID : UAE-ETM.111/2562

Preamplifier S/N : 056086

Resolution : 0.1 dB

Instrument Status : Used

##### Calibration Environment and Details

Temperature : 23 °C ± 2 °C

Humidity : 50 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 21 June 2023

Calibrated Date : 23 June 2023

Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests

Location of Calibration : Lab Acoustic

##### Reference Standard

| Instrument                | Brand  | Model     | SN        | Due calibration | Traceability |
|---------------------------|--------|-----------|-----------|-----------------|--------------|
| Standard Microphone       | GRAS   | 40AN      | 185273    | 6 October 2023  | GRAS         |
| Multifrequency Calibrator | Quest  | Quest-cal | EFA000234 | 29 June 2023    | TSI          |
| Audio Generator           | Svante | Svan401   | 131       | 12 October 2023 | WK Electric  |

##### 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. Noppadol Luangtan

Approved By :

Mr. Pait Malhavorn

Calibration Officer

Calibration Engineer Supervisor

Issue Date : 23 June 2023



Certificate No : 23-SLM-209  
Request No : Req-2023-1386

7. Long Term Stability

| UUC Setting       | Measured    |     | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------|-----|----------------------------|------------------------------------|
|                   | UUC<br>(dB) |     |                            |                                    |
| FAST / A / 37-139 |             |     |                            |                                    |
| STD Setting       |             |     |                            |                                    |
| Initial           | 114.0       |     |                            |                                    |
| Final             | 114.0       |     |                            |                                    |
| Deviated          | 0.0         | 0.1 | 0.3                        |                                    |

8. Level linearity on the reference level range

| UUC Setting       | Anticipated<br>REF<br>(dB) | Deviation   |             | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|----------------------------|-------------|-------------|----------------------------|------------------------------------|
|                   |                            | UUC<br>(dB) | ERR<br>(dB) |                            |                                    |
| FAST / A / 37-139 |                            |             |             |                            |                                    |
| STD dB            |                            |             |             |                            |                                    |
| 139.00            | 139                        | 139.0       | 0.0         |                            | 1.1                                |
| 134.00            | 134                        | 134.0       | 0.0         |                            | 1.1                                |
| 129.00            | 129                        | 129.0       | 0.0         |                            | 1.1                                |
| 124.00            | 124                        | 124.0       | 0.0         |                            | 1.1                                |
| 119.00            | 119                        | 119.0       | 0.0         |                            | 1.1                                |
| 114.00            | 114                        | 114.0       | 0.0         |                            | 1.1                                |
| 109.00            | 109                        | 109.0       | 0.0         |                            | 1.1                                |
| 104.00            | 104                        | 104.0       | 0.0         |                            | 1.1                                |
| 99.00             | 99                         | 99.0        | 0.0         |                            | 1.1                                |
| 94.00             | 94                         | 94.0        | 0.0         |                            | 1.1                                |
| 89.00             | 89                         | 89.0        | 0.0         |                            | 1.1                                |
| 84.00             | 84                         | 84.0        | 0.0         | 0.3                        | 1.1                                |
| 79.00             | 79                         | 79.0        | 0.0         |                            | 1.1                                |
| 74.00             | 74                         | 74.0        | 0.0         |                            | 1.1                                |
| 69.00             | 69                         | 69.0        | 0.0         |                            | 1.1                                |
| 64.00             | 64                         | 64.0        | 0.0         |                            | 1.1                                |
| 59.00             | 59                         | 59.0        | 0.0         |                            | 1.1                                |
| 54.00             | 54                         | 54.1        | 0.1         |                            | 1.1                                |
| 49.00             | 49                         | 49.1        | 0.1         |                            | 1.1                                |
| 44.00             | 44                         | 44.2        | 0.2         |                            | 1.1                                |
| 39.00             | 39                         | 39.5        | 0.5         |                            | 1.1                                |



Certificate No : 23-SLM-209  
Request No : Req-2023-1386

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

| UUC Setting   | Deviation from various Frequency<br>Weighting Response curve |        |        |  | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|---------------|--|--------|--------|--|----------------------------|------------------------------------|
|               | A (dB)   | C (dB) | Z (dB) |  |                            |                                    |
| FAST / 37-139 |  |        |        |  |                            |                                    |
| STD Setting   |  |        |        |  |                            |                                    |
| 63 Hz         | -0.2   | -0.1   | -0.1   |  |                            | 2.0                                |
| 125 Hz        | -0.1   | 0.0    | -0.1   |  |                            | 1.5                                |
| 250 Hz        | -0.1   | -0.1   | -0.1   |  |                            | 1.5                                |
| 500 Hz        | -0.1   | 0.0    | -0.1   |  |                            | 1.5                                |
| 1000 Hz       | 0.0  | 0.0    | -0.1   |  | 0.2                        | 1.0                                |
| 2000 Hz       | 0.0  | 0.0    | 0.0    |  |                            | 2.0                                |
| 4000 Hz       | 0.0  | 0.0    | 0.0    |  |                            | 3.0                                |
| 8000 Hz       | -0.1   | -0.1   | 0.0    |  |                            | 5                                  |
| 16000 Hz      | -0.1   | -0.1   | -0.1   |  |                            | +5, -INF.                          |

6. Frequency and time weightings at 1kHz

| UUC Setting       | STD<br>REF<br>(dB) | Measured    |             | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|--------------------|-------------|-------------|----------------------------|------------------------------------|
|                   |                    | UUC<br>(dB) | ERR<br>(dB) |                            |                                    |
| FAST / 37-139     |                    |             |             |                            |                                    |
| UUC Weighting     |                    |             |             |                            |                                    |
| A                 | 114.00             | 114.0       | 0.0         |                            | 0.2                                |
| C                 | 114.00             | 114.0       | 0.0         | 0.2                        | 0.2                                |
| Z                 | 114.00             | 114.0       | 0.0         |                            | 0.2                                |
| UUC Setting       |                    |             |             |                            |                                    |
| 37-139 / A        |                    |             |             |                            |                                    |
| UUC Time Response |                    |             |             |                            |                                    |
| Fast              | 114.00             | 114.0       | 0.0         |                            | 0.1                                |
| Slow              | 114.00             | 114.0       | 0.0         | 0.2                        | 0.1                                |
| Leq               | 114.00             | 114.0       | 0.0         |                            | 0.1                                |

Certificate No : 23-SLM-209  
Request No : Req-2023-1386

12. Overload indication

| UUC Setting             | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139       | UUC<br>(dB) |                            |                                    |
| STD Setting             |             |                            |                                    |
| Positive one-half cycle | 143.8       |                            |                                    |
| Negative one-half cycle | 143.9       |                            |                                    |
| Deviated                | -0.1        | 0.2                        | 1.5                                |

13. High Level Stability

| UUC Setting       | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139 | UUC<br>(dB) |                            |                                    |
| STD Setting       |             |                            |                                    |
| Initial           | 138.0       |                            |                                    |
| Final             | 138.0       |                            |                                    |
| Deviated          | 0.0         | 0.1                        | 0.3                                |

End of Certificate

Certificate No : 23-SLM-209  
Request No : Req-2023-1386

9. Level linearity including the level range control

| UUC Setting | STD         | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------|-------------|-------------|----------------------------|------------------------------------|
| FAST / A    | REF<br>(dB) | UUC<br>(dB) |                            |                                    |
| UUC Range   |             | ERR<br>(dB) |                            |                                    |
|             | 44.7        | 44.8        | 0.1                        | 1.1                                |
| 37-139      | 114         | 114.0       | 0.3                        | 1.1                                |

10. Tone burst response

| UUC Setting       | STD<br>Toneburst<br>(ms) | Anticipated<br>Ref<br>(dB) | Measured<br>UUC<br>(dB) | ERR<br>(dB) | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|--------------------------|----------------------------|-------------------------|-------------|----------------------------|------------------------------------|
| A / 37-139        |                          |                            |                         |             |                            |                                    |
| UUC Time Response |                          |                            |                         |             |                            |                                    |
|                   | 200                      | 135.0                      | 134.9                   | -0.1        |                            | 1                                  |
| Fast              | 2                        | 118.0                      | 117.6                   | -0.4        |                            | +1.0, -2.5                         |
|                   | 0.25                     | 109.0                      | 108.6                   | -0.4        |                            | +1.5, -5.0                         |
| Slow              | 200                      | 128.6                      | 128.4                   | -0.2        | 0.2                        | 1                                  |
|                   | 2                        | 109.0                      | 108.8                   | -0.2        |                            | +1.0, -5.0                         |
|                   | 200                      | 129.0                      | 129.0                   | 0.0         |                            | 1                                  |
| SEL               | 2                        | 109.0                      | 108.8                   | -0.2        |                            | +1.0, -2.5                         |
|                   | 0.25                     | 100.0                      | 99.8                    | -0.2        |                            | +1.5, -5.0                         |

11. Peak C Sound level

| UUC Setting         | Anticipated<br>REF<br>(dB) | Measured<br>UUC<br>(dB) | ERR<br>(dB) | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|---------------------|----------------------------|-------------------------|-------------|----------------------------|------------------------------------|
| FAST / C / 95-142   |                            |                         |             |                            |                                    |
| STD Setting         |                            |                         |             |                            |                                    |
| Complete cycle      | 137.4                      | 136.8                   | -0.60       |                            | 3.0                                |
| Positive half cycle | 136.4                      | 136.2                   | -0.20       | 0.2                        | 2.0                                |
| Negative half cycle | 136.4                      | 136.2                   | -0.20       |                            | 2.0                                |



Certificate No : 22-ACT-249  
Request No : Req-2022-0629

1. Indication at the calibration check frequency

| UUC Setting        | Nominal |      | Before Adjust |       | Adjust |      | Acceptance Limit |
|--------------------|---------|------|---------------|-------|--------|------|------------------|
|                    | Level   | (dB) | UUC           | ERR   | UUC    | ERR  |                  |
| FAST / A / 37-139  |         |      |               |       |        |      |                  |
| Calibrator Setting |         |      |               |       |        |      |                  |
| 1000 Hz 114.00 dB  | 113.85  | (dB) | 113.8         | -0.05 | 113.9  | 0.05 | 0.3              |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN:38079

2. Self-generated noise, Microphone installed

| UUC Setting   | Measured | UNCERTAINTY |
|---------------|----------|-------------|
| FAST / 37-139 |          |             |
| UUC Weighting | (dB)     | ( $\pm$ dB) |
| A             | 24.7     | 0.10        |

3. Self-generated noise, Microphone replaced by the electrical input signal device

| UUC Setting   | Measured | UNCERTAINTY |
|---------------|----------|-------------|
| FAST / 37-139 |          |             |
| UUC Weighting | (dB)     | ( $\pm$ dB) |
| A             | 24.1     | 0.10        |
| C             | 23.5     | 0.10        |
| Z             | 27.8     | 0.10        |

4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting   | Deviation from various Frequency Weighting Response curve |      |      |             | Acceptance Limit |
|---------------|---|------|------|-------------|------------------|
|               | A   | C    | Z    | ( $\pm$ dB) |                  |
| FAST / 37-139 |   |      |      |             |                  |
| STD Setting   |   |      |      |             |                  |
| 125 Hz        | 0.1   | 0.1  | 0.1  | 0.50        | 2.0              |
| 1000 Hz       | 0.0   | 0.0  | 0.0  | 0.60        | 1.0              |
| 4000 Hz       | 0.4   | 0.3  | 0.3  | 0.60        | 3.0              |
| 8000 Hz       | -0.2  | -0.3 | -0.1 | 0.70        | 5.0              |

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 22-ACT-249  
Address : 81 Soi Ukonuk 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok Request No : Req-2022-0629  
10260

Unit Under Calibration Details

Measurement Item : Sound Level Meter Microphone Class : 2  
Manufacturer : LARSON DAVIS Microphone Model : 375A04  
Model : LX72 Microphone SN : 329356  
Serial Number : 0005304 Preampifier Model : PRMLX12B  
ID : UAE.EFM.1152562 Preampifier SN : 056099  
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C  $\pm$  2 °C  
Humidity : 50 %RH  $\pm$  20 %RH  
Barometric Pressure : 1013 hPa  $\pm$  10 hPa  
Received Date : 23 March 2022  
Calibrated Date : 1 April 2022  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

Reference Standard

| Instrument                 | Brand   | Model     | SN        | Due calibration   | Traceability |
|----------------------------|---------|-----------|-----------|-------------------|--------------|
| Standard Microphone        | GRAS    | 40AN      | 188273    | 15 September 2022 | GRAS         |
| Multi-frequency Calibrator | Quest   | Quest-cal | EFA000234 | 14 June 2022      | TSI          |
| Audio Generator            | Svaneck | Svan401   | 131       | 18 October 2022   | WK Electric  |

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 : 

Approved By : 

Mr. Noppadol Luangrat  
Calibration Officer

Mr. Paet Muthavorn  
Calibration Engineer Supervisor

Issue Date : 1 April 2022

Certificate No : 22-ACT-249  
Request No : Req-2022-0629

7. Long Term Stability

| UUC Setting       | Measured | UUC<br>(dB) | UNCERTAINTY<br>(± dB) | Acceptance<br>Limit<br>(± dB) |
|-------------------|----------|-------------|-----------------------|-------------------------------|
|                   |          |             |                       |                               |
| FAST / A / 37-139 |          |             |                       |                               |
| STD Setting       |          |             |                       |                               |
| Initial           |          | 114.0       |                       |                               |
| Final             |          | 114.0       |                       |                               |
| Deviated          |          | 0.0         | 0.1                   | 0.3                           |

8. Level linearity on the reference level range

| UUC Setting       | Anticipated | Deviation   |             | UNCERTAINTY<br>(± dB) | Acceptance<br>Limit<br>(± dB) |
|-------------------|-------------|-------------|-------------|-----------------------|-------------------------------|
|                   |             | REF<br>(dB) | UUC<br>(dB) |                       |                               |
| FAST / A / 37-139 |             |             |             |                       |                               |
| STD dB            |             |             |             |                       |                               |
| 139.00            | 139         | 139         | 139.0       | 0.0                   | 1.1                           |
| 134.00            | 134         | 134         | 134.0       | 0.0                   | 1.1                           |
| 129.00            | 129         | 129         | 129.0       | 0.0                   | 1.1                           |
| 124.00            | 124         | 124         | 124.0       | 0.0                   | 1.1                           |
| 119.00            | 119         | 119         | 119.0       | 0.0                   | 1.1                           |
| 114.00            | 114         | 114         | 114.0       | 0.0                   | 1.1                           |
| 109.00            | 109         | 109         | 109.0       | 0.0                   | 1.1                           |
| 104.00            | 104         | 104         | 104.0       | 0.0                   | 1.1                           |
| 99.00             | 99          | 99          | 98.9        | -0.1                  | 1.1                           |
| 94.00             | 94          | 94          | 94.0        | 0.0                   | 1.1                           |
| 89.00             | 89          | 89          | 89.0        | 0.0                   | 1.1                           |
| 84.00             | 84          | 84          | 84.0        | 0.0                   | 1.1                           |
| 79.00             | 79          | 79          | 79.0        | 0.0                   | 1.1                           |
| 74.00             | 74          | 74          | 74.0        | 0.0                   | 1.1                           |
| 69.00             | 69          | 69          | 69.0        | 0.0                   | 1.1                           |
| 64.00             | 64          | 64          | 64.0        | 0.0                   | 1.1                           |
| 59.00             | 59          | 59          | 59.0        | 0.0                   | 1.1                           |
| 54.00             | 54          | 54          | 54.0        | 0.0                   | 1.1                           |
| 49.00             | 49          | 49          | 49.0        | 0.0                   | 1.1                           |
| 44.00             | 44          | 44          | 44.1        | 0.1                   | 1.1                           |
| 39.00             | 39          | 39          | 39.3        | 0.3                   | 1.1                           |
| 38.00             | 38          | 38          | 38.4        | 0.4                   | 1.1                           |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the laboratory. Date: 03/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-249  
Request No : Req-2022-0629

5. Electrical signal test of frequency weightings. Weighting network response with relative to 1 kHz

| 2. Deviation against test frequency | UUC Setting | Deviation from various Frequency |        |        |      | UNCERTAINTY<br>(± dB) | Acceptance<br>Limit<br>(± dB) |
|-------------------------------------|-------------|----------------------------------|--------|--------|------|-----------------------|-------------------------------|
|                                     |             | Weighting Response curve         |        |        |      |                       |                               |
|                                     |             | A (dB)                           | C (dB) | Z (dB) |      |                       |                               |
| FAST / 37-139                       | STD Setting |                                  |        |        |      |                       |                               |
|                                     | 63 Hz       | -0.1                             | -0.1   | -0.1   | -0.1 |                       | 2.0                           |
|                                     | 125 Hz      | -0.1                             | 0.0    | 0.0    | 0.0  |                       | 1.5                           |
|                                     | 250 Hz      | 0.0                              | 0.0    | 0.0    | 0.0  |                       | 1.5                           |
|                                     | 500 Hz      | 0.0                              | 0.0    | 0.0    | 0.0  |                       | 1.5                           |
|                                     | 1000 Hz     | 0.0                              | 0.0    | 0.0    | 0.0  | 0.2                   | 1.0                           |
|                                     | 2000 Hz     | 0.0                              | 0.0    | 0.0    | 0.0  |                       | 2.0                           |
|                                     | 4000 Hz     | 0.0                              | 0.0    | 0.0    | 0.0  |                       | 3.0                           |
|                                     | 8000 Hz     | -0.1                             | -0.1   | 0.0    | 0.0  |                       | 5.0                           |
| 16000 Hz                            | -0.1        | -0.1                             | -0.1   | -0.1   |      | +5, -INF.             |                               |

6. Frequency and time weightings at 1kHz

| UUC Setting   | STD    | Measured    |             | UNCERTAINTY<br>(± dB) | Acceptance<br>Limit<br>(± dB) |
|---------------|--------|-------------|-------------|-----------------------|-------------------------------|
|               |        | REF<br>(dB) | ERR<br>(dB) |                       |                               |
| FAST / 37-139 |        |             |             |                       |                               |
| UUC Weighting |        |             |             |                       |                               |
| A             | 114.00 | 114.0       | 0.0         |                       | 0.2                           |
| C             | 114.00 | 114.1       | 0.1         | 0.2                   | 0.2                           |
| Z             | 114.00 | 114.1       | 0.1         |                       | 0.2                           |

| UUC Setting       | STD    | Measured    |             | UNCERTAINTY<br>(± dB) | Acceptance<br>Limit<br>(± dB) |
|-------------------|--------|-------------|-------------|-----------------------|-------------------------------|
|                   |        | REF<br>(dB) | ERR<br>(dB) |                       |                               |
| 37-139 / A        |        |             |             |                       |                               |
| UUC Time Response |        |             |             |                       |                               |
| Fast              | 114.00 | 114.0       | 0.0         |                       | 0.1                           |
| Slow              | 114.00 | 114.0       | 0.0         | 0.2                   | 0.1                           |
| Leq               | 114.00 | 114.0       | 0.0         |                       | 0.1                           |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the laboratory. Date: 03/07/19

เอกสารไม่ควบคุม





Certificate No : 25-SLM-225  
Request No : Req-2023-1413

1. Indication at the calibration check frequency

| UUC Setting        | Nominal Level (dB) | Before Adjust |          | After Adjust |          | UNCERTAINTY (± dB) | Acceptance Limit (± dB) |
|--------------------|--------------------|---------------|----------|--------------|----------|--------------------|-------------------------|
|                    |                    | UUC (dB)      | ERR (dB) | UUC (dB)     | ERR (dB) |                    |                         |
| FAST / A / 37-139  |                    |               |          |              |          |                    |                         |
| Calibrator Setting |                    |               |          |              |          |                    |                         |
| 1000 Hz 114 dB     | 113.77             | 114.0         | +0.23    | 113.8        | +0.03    | 0.2                | 0.3                     |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 25A, SN. 73246

2. Self-generated noise, Microphone installed

| UUC Setting   | Measured (dB) | UNCERTAINTY (± dB) |
|---------------|---------------|--------------------|
|               |               |                    |
| FAST / 37-139 |               |                    |
| UUC Weighting |               |                    |
| A             | 30.9          | 0.1                |

3. Self-generated noise, Microphone replaced by the electrical input signal device

| UUC Setting   | Measured (dB) | UNCERTAINTY (± dB) |
|---------------|---------------|--------------------|
|               |               |                    |
| FAST / 37-139 |               |                    |
| UUC Weighting |               |                    |
| A             | 30.6          | 0.1                |
| C             | 30.1          | 0.1                |
| Z             | 34.5          | 0.1                |

4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting   | Deviation from various Frequency Weighting Response curve |     |     |           | UNCERTAINTY<br>(± dB) | Acceptance Limit<br>(± dB) |
|---------------|---|-----|-----|-----------|-----------------------|----------------------------|
|               | A<br>(dB)   | C   |     | Z<br>(dB) |                       |                            |
|               |   |     |     |           |                       |                            |
| FAST / 37-139 |   |     |     |           |                       |                            |
| STD Setting   |   |     |     |           |                       |                            |
| 125 Hz        | 0.0   | 0.0 | 0.1 | 0.0       | 0.6                   | 2.0                        |
| 1000 Hz       | 0.0   | 0.0 | 0.0 | 0.0       | 0.6                   | 1.0                        |
| 4000 Hz       | 1.0   | 1.0 | 1.1 | 1.0       | 0.6                   | 3.0                        |
| 8000 Hz       | 2.1   | 2.1 | 2.1 | 2.1       | 0.7                   | 5.0                        |

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD. Certificate No : 25-SLM-225  
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bungehak, Prakanong, Bangkok Request No : Req-2023-1413  
10260

Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2  
Manufacturer : LARSON DAVIS Microphone Model : 375B02  
Model : LX12 Microphone SN : 011769  
Serial Number : 0005305 Preamplifier Model : PRMLX172B  
ID : UAE-EFM-1162562 Preamplifier SN : 056100  
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 26 June 2023  
Calibrated Date : 28 June 2023  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

Reference Standard

| Instrument                | Brand   | Model     | SN        | Due calibration | Traceability |
|---------------------------|---------|-----------|-----------|-----------------|--------------|
| Standard Microphone       | GRAS    | 40AN      | 188273    | 6 October 2023  | GRAS         |
| Multifrequency Calibrator | Quest   | Quest-cal | EFA000234 | 29 June 2023    | TSI          |
| Audio Generator           | Svantek | Svan401   | 131       | 12 October 2023 | WK Electric  |

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. Paet Maithavorn  
Calibration Engineer Supervisor  
Issue Date : 28 June 2023



Certificate No : 23-SLM-225

Request No : Req-2023-1413

### 7. Long Term Stability

| UUC Setting       | Measured | UNCERTAINTY | Acceptance Limit |
|-------------------|----------|-------------|------------------|
| FAST / A / 37-139 | UUC (dB) | ( $\pm$ dB) | ( $\pm$ dB)      |
| STD Setting       | 114.0    |             |                  |
| Initial           | 114.0    |             |                  |
| Final             | 114.0    |             |                  |
| Deviated          | 0.0      | 0.1         | 0.3              |

### 8. Level linearity on the reference level range

| UUC Setting       | Anticipated | Deviation         | UNCERTAINTY | Acceptance Limit |
|-------------------|-------------|-------------------|-------------|------------------|
| FAST / A / 37-139 | REF (dB)    | UUC (dB) ERR (dB) | ( $\pm$ dB) | ( $\pm$ dB)      |
| STD dB            |             |                   |             |                  |
| 143.00            | 143         | 143.0 0.0         |             | 0.8              |
| 139.00            | 139         | 139.0 0.0         |             | 1.1              |
| 134.00            | 134         | 134.0 0.0         |             | 1.1              |
| 129.00            | 129         | 129.0 0.0         |             | 1.1              |
| 124.00            | 124         | 124.0 0.0         |             | 1.1              |
| 119.00            | 119         | 119.0 0.0         |             | 1.1              |
| 114.00            | 114         | 114.0 0.0         |             | 1.1              |
| 109.00            | 109         | 109.0 0.0         |             | 1.1              |
| 104.00            | 104         | 104.0 0.0         |             | 1.1              |
| 99.00             | 99          | 98.9 -0.1         |             | 1.1              |
| 94.00             | 94          | 94.0 0.0          |             | 1.1              |
| 89.00             | 89          | 89.0 0.0          |             | 1.1              |
| 84.00             | 84          | 84.0 0.0          |             | 1.1              |
| 79.00             | 79          | 79.0 0.0          |             | 1.1              |
| 74.00             | 74          | 74.0 0.0          |             | 1.1              |
| 69.00             | 69          | 69.0 0.0          |             | 1.1              |
| 64.00             | 64          | 64.0 0.0          |             | 1.1              |
| 59.00             | 59          | 59.0 0.0          |             | 1.1              |
| 54.00             | 54          | 54.0 0.0          |             | 1.1              |
| 49.00             | 49          | 49.1 0.1          |             | 1.1              |
| 44.00             | 44          | 44.2 0.2          |             | 1.1              |
| 43.00             | 43          | 43.2 0.2          |             | 1.1              |
| 42.00             | 42          | 42.3 0.3          |             | 1.1              |
| 41.00             | 41          | 41.4 0.4          |             | 1.1              |
| 40.00             | 40          | 40.5 0.5          |             | 1.1              |

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Certificate No : 23-SLM-225

Request No : Req-2023-1413

### 5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

| UUC Setting   | Deviation from various Frequency | UNCERTAINTY | Acceptance Limit |
|---------------|----------------------------------|-------------|------------------|
| FAST / 37-139 | A (dB) C (dB) Z (dB)             | ( $\pm$ dB) | ( $\pm$ dB)      |
| STD Setting   | -0.2 0.0 0.0                     |             | 2.0              |
| 63 Hz         | -0.1 0.0 0.0                     |             | 1.5              |
| 125 Hz        | -0.1 0.0 0.0                     |             | 1.5              |
| 250 Hz        | -0.1 0.0 0.0                     |             | 1.5              |
| 500 Hz        | -0.1 0.0 0.0                     |             | 1.5              |
| 1000 Hz       | 0.0 0.0 0.0                      | 0.2         | 1.0              |
| 2000 Hz       | 0.0 0.0 0.0                      |             | 2.0              |
| 4000 Hz       | 0.0 0.0 0.0                      |             | 3.0              |
| 8000 Hz       | 0.0 0.0 0.0                      |             | 5                |
| 16000 Hz      | -0.1 -0.1 -0.1                   |             | +5, -INF.        |

### 6. Frequency and time weightings at 1kHz

| UUC Setting   | STD      | Measured          | UNCERTAINTY | Acceptance Limit |
|---------------|----------|-------------------|-------------|------------------|
| FAST / 37-139 | REF (dB) | UUC (dB) ERR (dB) | ( $\pm$ dB) | ( $\pm$ dB)      |
| UUC Weighting |          |                   |             |                  |
| A             | 114.00   | 114.0 0.0         |             | 0.2              |
| C             | 114.00   | 114.0 0.0         | 0.2         | 0.2              |
| Z             | 114.00   | 114.0 0.0         |             | 0.2              |

| UUC Setting       | STD      | Measured          | UNCERTAINTY | Acceptance Limit |
|-------------------|----------|-------------------|-------------|------------------|
| 37-139 / A        | REF (dB) | UUC (dB) ERR (dB) | ( $\pm$ dB) | ( $\pm$ dB)      |
| UUC Time Response |          |                   |             |                  |
| Fast              | 114.00   | 114.0 0.0         |             | 0.1              |
| Slow              | 114.00   | 114.0 0.0         | 0.2         | 0.1              |
| Leq               | 114.00   | 114.0 0.0         |             | 0.1              |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

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Certificate No : 23-SLM-225  
Request No : Req-2023-1413

12. Overload indication

| UUC Setting             | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139       | UUC<br>(dB) |                            |                                    |
| STD Setting             | 144.9       |                            |                                    |
| Positive one-half cycle | 144.8       |                            |                                    |
| Negative one-half cycle |             |                            |                                    |
| Deviated                | 0.1         | 0.2                        | 1.5                                |

13. High Level Stability

| UUC Setting       | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139 | UUC<br>(dB) |                            |                                    |
| STD Setting       | 138.0       |                            |                                    |
| Initial           | 138.0       |                            |                                    |
| Final             | 138.0       |                            |                                    |
| Deviated          | 0.0         | 0.1                        | 0.3                                |

End of Certificate

Certificate No : 23-SLM-225  
Request No : Req-2023-1413

9. Level linearity including the level range control

| UUC Setting | STD         | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------|-------------|-------------|----------------------------|------------------------------------|
| FAST / A    | REF<br>(dB) | UUC<br>(dB) |                            |                                    |
| UUC Range   | 45.9        | 46.0        | 0.1                        | 1.1                                |
| 37-139      | 114         | 114.0       | 0.0                        | 1.1                                |

10. Tone burst response

| UUC Setting       | STD               | Anticipated | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------------|-------------|-------------|----------------------------|------------------------------------|
| A / 37-139        | Toneburst<br>(ms) | Ref<br>(dB) | ERR<br>(dB) |                            |                                    |
| UUC Time Response | 200               | 135.0       | 134.9       | -0.1                       | 1                                  |
| Fast              | 2                 | 118.0       | 117.8       | -0.2                       | +1.0, -2.5                         |
|                   | 0.25              | 109.0       | 108.8       | -0.2                       | +1.5, -5.0                         |
| Slow              | 200               | 128.6       | 128.4       | -0.2                       | 1                                  |
|                   | 2                 | 109.0       | 108.8       | -0.2                       | +1.0, -5.0                         |
|                   | 200               | 129.0       | 129.0       | 0.0                        | 1                                  |
| SEL               | 2                 | 109.0       | 109.0       | 0.0                        | +1.0, -2.5                         |
|                   | 0.25              | 100.0       | 100.0       | 0.0                        | +1.5, -5.0                         |

11. Peak C Sound level

| UUC Setting         | Anticipated | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|---------------------|-------------|-------------|----------------------------|------------------------------------|
| FAST / C / 95-142   | REF<br>(dB) | UUC<br>(dB) | ERR<br>(dB)                |                                    |
| STD Setting         |             |             |                            |                                    |
| Complete cycle      | 137.4       | 136.8       | -0.60                      | 3.0                                |
| Positive half cycle | 136.4       | 136.2       | -0.20                      | 2.0                                |
| Negative half cycle | 136.4       | 136.2       | -0.20                      | 2.0                                |



Certificate No : 23-SLM-223  
Request No : Req-2023-1411

1. Indication at the calibration check frequency

| UUC Setting        | Nominal Level<br>(dB) | Before Adjust |             | After Adjust |             | Acceptance Limit<br>(± dB) |
|--------------------|-----------------------|---------------|-------------|--------------|-------------|----------------------------|
|                    |                       | UUC<br>(dB)   | ERR<br>(dB) | UUC<br>(dB)  | ERR<br>(dB) |                            |
| FAST / A / 37-139  |                       |               |             |              |             |                            |
| Calibrator Setting |                       |               |             |              |             |                            |
| 1000 Hz 114 dB     | 113.77                | 114.3         | +0.53       | 113.8        | -0.03       | 0.3                        |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 73246

2. Self-generated noise, Microphone installed

| UUC Setting   | Measured | UNCERTAINTY<br>(± dB) |
|---------------|----------|-----------------------|
| FAST / 37-139 |          |                       |
| UUC Weighting |          |                       |
| A             | 28.0     | 0.1                   |

3. Self-generated noise, Microphone replaced by the electrical input signal device

| UUC Setting   | Measured | UNCERTAINTY<br>(± dB) |
|---------------|----------|-----------------------|
| FAST / 37-139 |          |                       |
| UUC Weighting |          |                       |
| A             | 27.3     | 0.1                   |
| C             | 27.2     | 0.1                   |
| Z             | 31.5     | 0.1                   |

4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting   | Deviation from various Frequency Weighting Response curve |           |           |  | UNCERTAINTY<br>(± dB) | Acceptance Limit<br>(± dB) |
|---------------|---|-----------|-----------|--|-----------------------|----------------------------|
|               | A<br>(dB)   | C<br>(dB) | Z<br>(dB) |  |                       |                            |
|               |   |           |           |  |                       |                            |
| FAST / 37-139 |   |           |           |  |                       |                            |
| STD Setting   |   |           |           |  |                       |                            |
| 125 Hz        | 1.2   | 1.3       | 1.3       |  | 0.6                   | 2.0                        |
| 1000 Hz       | 0.0   | 0.0       | 0.0       |  | 0.6                   | 1.0                        |
| 4000 Hz       | 0.2   | 0.2       | 0.2       |  | 0.6                   | 3.0                        |
| 8000 Hz       | 0.3   | 0.3       | 0.4       |  | 0.7                   | 5.0                        |

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 23-SLM-223  
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bungehak, Prakanong, Bangkok 10260 Request No : Req-2023-1411

Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2  
Manufacturer : LARSON DAVIS Microphone Model : 375B02  
Model : LAT2 Microphone SN : 11791  
Serial Number : 0005339 Preamplifier Model : PRMLAT72B  
ID : UAE-EFM-0362563 Preamplifier SN : 056131  
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 26 June 2023  
Calibrated Date : 28 June 2023  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61673-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

Reference Standard

| Instrument                | Brand   | Model     | SN        | Due calibration | Traceability |
|---------------------------|---------|-----------|-----------|-----------------|--------------|
| Standard Microphone       | GRAS    | 40AN      | 188273    | 6 October 2023  | GRAS         |
| Multifrequency Calibrator | Quest   | Quest-cal | EFA000234 | 29 June 2023    | TSI          |
| Audio Generator           | Svanick | Svan401   | 131       | 12 October 2023 | WK Electric  |

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. Noppakorn Luangrit**

Mr. Noppakorn Luangrit  
Calibration Officer

Approved By : **Mr. Pait Mathavorn**

Mr. Pait Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 28 June 2023



Certificate No : 23-SLM-223

Request No : Req-2023-1411

### 7. Long Term Stability

| UUC Setting       | Measured | UUC   | UNCERTAINTY | Acceptance  |
|-------------------|----------|-------|-------------|-------------|
| FAST / A / 37-139 |          | (dB)  | ( $\pm$ dB) | Limit       |
| STD Setting       |          |       |             | ( $\pm$ dB) |
| Initial           |          | 114.0 |             |             |
| Final             |          | 114.0 |             |             |
| Deviated          | 0.0      |       | 0.1         | 0.3         |

### 8. Level linearity on the reference level range

| UUC Setting       | Anticipated | Deviation | UNCERTAINTY | Acceptance  |
|-------------------|-------------|-----------|-------------|-------------|
| FAST / A / 37-139 | REF         | UUC       | ERR         | Limit       |
| STD dB            | (dB)        | (dB)      | (dB)        | ( $\pm$ dB) |
| 140.00            | 140         | 139.9     | -0.1        | 0.8         |
| 139.00            | 139         | 139.0     | 0.0         | 1.1         |
| 134.00            | 134         | 134.0     | 0.0         | 1.1         |
| 129.00            | 129         | 129.0     | 0.0         | 1.1         |
| 124.00            | 124         | 124.0     | 0.0         | 1.1         |
| 119.00            | 119         | 119.0     | 0.0         | 1.1         |
| 114.00            | 114         | 114.0     | 0.0         | 1.1         |
| 109.00            | 109         | 109.0     | 0.0         | 1.1         |
| 104.00            | 104         | 104.0     | 0.0         | 1.1         |
| 99.00             | 99          | 99.0      | 0.0         | 1.1         |
| 94.00             | 94          | 94.0      | 0.0         | 1.1         |
| 89.00             | 89          | 89.0      | 0.0         | 1.1         |
| 84.00             | 84          | 84.0      | 0.0         | 1.1         |
| 79.00             | 79          | 79.0      | 0.0         | 1.1         |
| 74.00             | 74          | 74.0      | 0.0         | 1.1         |
| 69.00             | 69          | 69.0      | 0.0         | 1.1         |
| 64.00             | 64          | 64.0      | 0.0         | 1.1         |
| 59.00             | 59          | 59.0      | 0.0         | 1.1         |
| 54.00             | 54          | 54.0      | 0.0         | 1.1         |
| 49.00             | 49          | 49.0      | 0.0         | 1.1         |
| 44.00             | 44          | 44.1      | 0.1         | 1.1         |
| 39.00             | 39          | 39.3      | 0.3         | 1.1         |
| 34.00             | 34          | 34.4      | 0.4         | 1.1         |
| 29.00             | 29          | 29.5      | 0.5         | 1.1         |

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Certificate No : 23-SLM-223

Request No : Req-2023-1411

### 5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

| UUC Setting   | Deviation from various Frequency | UNCERTAINTY | Acceptance  |
|---------------|----------------------------------|-------------|-------------|
| FAST / 37-139 | A (dB)                           | ( $\pm$ dB) | Limit       |
| STD Setting   | C (dB)                           |             | ( $\pm$ dB) |
| 63 Hz         | -0.1                             | 0.0         | 2.0         |
| 125 Hz        | -0.1                             | 0.0         | 1.5         |
| 250 Hz        | -0.1                             | 0.0         | 1.5         |
| 500 Hz        | 0.0                              | 0.0         | 1.5         |
| 1000 Hz       | 0.0                              | 0.0         | 1.0         |
| 2000 Hz       | 0.0                              | 0.1         | 2.0         |
| 4000 Hz       | 0.0                              | 0.0         | 3.0         |
| 8000 Hz       | 0.0                              | 0.0         | 5           |
| 16000 Hz      | 0.0                              | -0.1        | +5, -INF.   |

### 6. Frequency and time weightings at 1kHz

| UUC Setting   | STD    | Measured | UNCERTAINTY | Acceptance  |
|---------------|--------|----------|-------------|-------------|
| FAST / 37-139 | REF    | UUC      | ERR         | Limit       |
| UUC Weighting | (dB)   | (dB)     | (dB)        | ( $\pm$ dB) |
| A             | 114.00 | 114.0    | 0.0         | 0.2         |
| C             | 114.00 | 114.0    | 0.0         | 0.2         |
| Z             | 114.00 | 114.0    | 0.0         | 0.2         |

| UUC Setting       | STD    | Measured | UNCERTAINTY | Acceptance  |
|-------------------|--------|----------|-------------|-------------|
| 37-139 / A        | REF    | UUC      | ERR         | Limit       |
| UUC Time Response | (dB)   | (dB)     | (dB)        | ( $\pm$ dB) |
| Fast              | 114.00 | 114.0    | 0.0         | 0.1         |
| Slow              | 114.00 | 114.0    | 0.0         | 0.1         |
| Leq               | 114.00 | 114.0    | 0.0         | 0.1         |

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Certificate No : 23-SLM-223  
Request No : Req-2023-1411

12. Overload indication

| UUC Setting             | Measured | UNCERTAINTY | Acceptance Limit |
|-------------------------|----------|-------------|------------------|
| FAST / A / 37-139       | UUC (dB) | ( $\pm$ dB) | ( $\pm$ dB)      |
| STD Setting             |          |             |                  |
| Positive one-half cycle | 141.4    |             |                  |
| Negative one-half cycle | 141.5    |             |                  |
| Deviated                | -0.1     | 0.2         | 1.5              |

13. High Level Stability

| UUC Setting       | Measured | UNCERTAINTY | Acceptance Limit |
|-------------------|----------|-------------|------------------|
| FAST / A / 37-139 | UUC (dB) | ( $\pm$ dB) | ( $\pm$ dB)      |
| STD Setting       |          |             |                  |
| Initial           | 138.0    |             |                  |
| Final             | 138.0    |             |                  |
| Deviated          | 0.0      | 0.1         | 0.3              |

End of Certificate



Certificate No : 23-SLM-223  
Request No : Req-2023-1411

9. Level linearity including the level range control

| UUC Setting | STD  | REF   | UUC  | ERR  | UNCERTAINTY | Acceptance Limit |
|-------------|------|-------|------|------|-------------|------------------|
| FAST / A    | (dB) | (dB)  | (dB) | (dB) | ( $\pm$ dB) | ( $\pm$ dB)      |
| UUC Range   |      |       |      |      |             |                  |
|             | 42.5 | 42.6  | 0.1  |      |             | 1.1              |
| 37-139      | 114  | 114.0 | 0.0  |      | 0.3         | 1.1              |

10. Tone burst response

| UUC Setting       | STD            | Anticipated | Measured | UNCERTAINTY | Acceptance Limit |
|-------------------|----------------|-------------|----------|-------------|------------------|
| A / 37-139        | Toneburst (ms) | Ref (dB)    | UUC (dB) | ERR (dB)    | ( $\pm$ dB)      |
| UUC Time Response |                |             |          |             |                  |
|                   | 200            | 135.0       | 134.9    | -0.1        |                  |
| Fast              | 2              | 118.0       | 117.6    | -0.4        |                  |
|                   | 0.25           | 109.0       | 108.6    | -0.4        |                  |
| Slow              | 200            | 128.6       | 128.5    | -0.1        |                  |
|                   | 2              | 109.0       | 108.8    | -0.2        |                  |
|                   | 200            | 129.0       | 129.0    | 0.0         |                  |
| SEL               | 2              | 109.0       | 109.0    | 0.0         |                  |
|                   | 0.25           | 100.0       | 99.8     | -0.2        |                  |

11. Peak C Sound level

| UUC Setting         | Anticipated | Measured | UNCERTAINTY | Acceptance Limit |
|---------------------|-------------|----------|-------------|------------------|
| FAST / C / 95-142   | REF (dB)    | UUC (dB) | ERR (dB)    | ( $\pm$ dB)      |
| STD Setting         |             |          |             |                  |
| Complete cycle      | 137.4       | 136.8    | -0.60       |                  |
| Positive half cycle | 136.4       | 136.2    | -0.20       |                  |
| Negative half cycle | 136.4       | 136.2    | -0.20       |                  |



Certificate No : 23-SLM-228  
Request No : Req-2023-1409

1. Indication at the calibration check frequency

| UUC Setting        | Nominal Level<br>(dB) | Before Adjust |             | After Adjust |             | UNCERTAINTY<br>( $\pm$ dB) | Acceptance Limit<br>( $\pm$ dB) |
|--------------------|-----------------------|---------------|-------------|--------------|-------------|----------------------------|---------------------------------|
|                    |                       | UUC<br>(dB)   | ERR<br>(dB) | UUC<br>(dB)  | ERR<br>(dB) |                            |                                 |
| FAST / A / 37-139  |                       |               |             |              |             |                            |                                 |
| Calibrator Setting |                       |               |             |              |             |                            |                                 |
| 1000 Hz 114 dB     | 113.77                | 114.7         | +0.93       | 113.8        | +0.03       | 0.2                        | 0.3                             |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN: 73246

2. Self-generated noise, Microphone installed

| UUC Setting   | Measured<br>(dB) | UNCERTAINTY<br>( $\pm$ dB) |
|---------------|------------------|----------------------------|
|               |                  |                            |
| FAST / 37-139 |                  |                            |
| UUC Weighting |                  |                            |
| A             | 29.3             | 0.1                        |

3. Self-generated noise, Microphone replaced by the electrical input signal device

| UUC Setting   | Measured<br>(dB) | UNCERTAINTY<br>( $\pm$ dB) |
|---------------|------------------|----------------------------|
|               |                  |                            |
| FAST / 37-139 |                  |                            |
| UUC Weighting |                  |                            |
| A             | 28.9             | 0.1                        |
| C             | 28.5             | 0.1                        |
| Z             | 32.6             | 0.1                        |

4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting   | Deviation from various Frequency Weighting Response curve | UNCERTAINTY   |      |             | Acceptance Limit |
|---------------|---|---|------|-------------|------------------|
|               |   | Deviation from various Frequency Weighting Response curve |      |             |                  |
|               |   | A   | C    | Z           |                  |
| FAST / 37-139 | (dB)  | (dB)  | (dB) | ( $\pm$ dB) |                  |
| STD Setting   |   |   |      |             |                  |
| 125 Hz        | 0.0   | 0.1   | 0.1  | 0.6         | 2.0              |
| 1000 Hz       | 0.0   | 0.0   | 0.0  | 0.6         | 1.0              |
| 4000 Hz       | 0.7   | 0.6   | 0.7  | 0.6         | 3.0              |
| 8000 Hz       | 1.2   | 1.1   | 1.2  | 0.7         | 5.0              |

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260  
Certificate No : 23-SLM-228  
Request No : Req-2023-1409

Unit Under Calibration Details

Measurement Item : Sound Level Meter  
Manufacturer : LARSON DAVIS  
Model : LX72  
Serial Number : 0005341  
ID : UAEFPM.038.2563  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : 375B02  
Microphone SN : 11793  
Preamplifier Model : PBM1x72B  
Preamplifier SN : 056133  
Instrument Status : Used

Calibration Environment and Details

Temperature :  $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$   
Humidity :  $50\% \text{RH} \pm 20\% \text{RH}$   
Barometric Pressure :  $1013 \text{ hPa} \pm 10 \text{ hPa}$   
Received Date : 26 June 2023  
Calibrated Date : 28 June 2023  
Calibration Procedure : In-house method (CPS-SLM-01) based on IEC 61673-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

Reference Standard

| Instrument                 | Brand   | Model     | SN         | Due calibration | Traceability |
|----------------------------|---------|-----------|------------|-----------------|--------------|
| Standard Microphone        | GRAS    | 40AN      | 188273     | 6 October 2023  | GRAS         |
| Multi-frequency Calibrator | Quest   | Quest-cal | EEFA000234 | 29 June 2023    | TSI          |
| Audio Generator            | Svanick | Svan401   | 131        | 12 October 2023 | WK Electric  |

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. Noppakorn Luangtan  
Calibration Officer

Approved By : 

Mr. Paet Malhavorn  
Calibration Engineer Supervisor  
Issue Date : 28 June 2023

Certificate No : 23-SLM-228  
Request No : Req-2023-1409

7. Long Term Stability

| UUC Setting       | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139 | UUC<br>(dB) |                            |                                    |
| STD Setting       |             |                            |                                    |
| Initial           | 114.0       |                            |                                    |
| Final             | 114.0       |                            |                                    |
| Deviated          | 0.0         | 0.1                        | 0.3                                |

8. Level linearity on the reference level range

| UUC Setting       | Anticipated | Deviation   | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139 | REF<br>(dB) | UUC<br>(dB) | ERR<br>(dB)                |                                    |
| STD dB            |             |             |                            |                                    |
| 141.00            | 141         | 141.0       | 0.0                        | 0.3                                |
| 140.00            | 140         | 140.0       | 0.0                        | 0.3                                |
| 139.00            | 139         | 139.0       | 0.0                        | 1.1                                |
| 134.00            | 134         | 134.0       | 0.0                        | 1.1                                |
| 129.00            | 129         | 129.0       | 0.0                        | 1.1                                |
| 124.00            | 124         | 124.0       | 0.0                        | 1.1                                |
| 119.00            | 119         | 119.0       | 0.0                        | 1.1                                |
| 114.00            | 114         | 114.0       | 0.0                        | 1.1                                |
| 109.00            | 109         | 109.0       | 0.0                        | 1.1                                |
| 104.00            | 104         | 104.0       | 0.0                        | 1.1                                |
| 99.00             | 99          | 99.0        | 0.0                        | 1.1                                |
| 94.00             | 94          | 94.0        | 0.0                        | 1.1                                |
| 89.00             | 89          | 89.0        | 0.0                        | 1.1                                |
| 84.00             | 84          | 84.0        | 0.0                        | 1.1                                |
| 79.00             | 79          | 79.0        | 0.0                        | 1.1                                |
| 74.00             | 74          | 74.0        | 0.0                        | 1.1                                |
| 69.00             | 69          | 69.0        | 0.0                        | 1.1                                |
| 64.00             | 64          | 64.0        | 0.0                        | 1.1                                |
| 59.00             | 59          | 59.0        | 0.0                        | 1.1                                |
| 54.00             | 54          | 54.1        | 0.1                        | 1.1                                |
| 49.00             | 49          | 49.1        | 0.1                        | 1.1                                |
| 44.00             | 44          | 44.2        | 0.2                        | 1.1                                |
| 39.00             | 39          | 39.4        | 0.4                        | 1.1                                |
| 38.00             | 38          | 38.6        | 0.6                        | 1.1                                |

Certificate No : 23-SLM-228  
Request No : Req-2023-1409

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

| UUC Setting   | Deviation from various Frequency | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|---------------|----------------------------------|----------------------------|------------------------------------|
| FAST / 37-139 | Weighting Response curve         |                            |                                    |
| STD Setting   | A (dB) C (dB) Z (dB)             |                            |                                    |
| 63 Hz         | -0.1 0.0 0.0                     |                            | 2.0                                |
| 125 Hz        | -0.1 0.1 0.0                     |                            | 1.5                                |
| 250 Hz        | 0.0 0.0 0.0                      |                            | 1.5                                |
| 500 Hz        | 0.0 0.1 0.0                      |                            | 1.5                                |
| 1000 Hz       | 0.0 0.0 0.0                      | 0.2                        | 1.0                                |
| 2000 Hz       | 0.1 0.1 0.0                      |                            | 2.0                                |
| 4000 Hz       | 0.0 0.1 0.0                      |                            | 3.0                                |
| 8000 Hz       | 0.0 0.0 0.0                      |                            | 5                                  |
| 16000 Hz      | 0.0 0.0 0.0                      |                            | +5, -INF.                          |

6. Frequency and time weightings at 1kHz

| UUC Setting   | STD         | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|---------------|-------------|-------------|----------------------------|------------------------------------|
| FAST / 37-139 | REF<br>(dB) | UUC<br>(dB) | ERR<br>(dB)                |                                    |
| UUC Weighting |             |             |                            |                                    |
| A             | 114.00      | 114.0       | 0.0                        | 0.2                                |
| C             | 114.00      | 114.0       | 0.0                        | 0.2                                |
| Z             | 114.00      | 114.0       | 0.0                        | 0.2                                |

| UUC Setting       | STD         | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------|-------------|----------------------------|------------------------------------|
| 37-139 / A        | REF<br>(dB) | UUC<br>(dB) | ERR<br>(dB)                |                                    |
| UUC Time Response |             |             |                            |                                    |
| Fast              | 114.00      | 114.0       | 0.0                        | 0.1                                |
| Slow              | 114.00      | 114.0       | 0.0                        | 0.1                                |
| Leq               | 114.00      | 114.0       | 0.0                        | 0.1                                |



Certificate No : 23-SLM-228  
Request No : Req-2023-1409

#### 12. Overload indication

| UUC Setting             | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139       | UUC<br>(dB) |                            |                                    |
| STD Setting             |             |                            |                                    |
| Positive one-half cycle | 142.7       |                            |                                    |
| Negative one-half cycle | 142.8       |                            |                                    |
| Deviated                | -0.1        | 0.2                        | 1.5                                |

#### 13. High Level Stability

| UUC Setting       | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139 | UUC<br>(dB) |                            |                                    |
| STD Setting       |             |                            |                                    |
| Initial           | 138.0       |                            |                                    |
| Final             | 138.0       |                            |                                    |
| Deviated          | 0.0         | 0.1                        | 0.3                                |

End of Certificate

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Certificate No : 23-SLM-228  
Request No : Req-2023-1409

#### 9. Level linearity including the level range control

| UUC Setting | STD         | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------|-------------|-------------|----------------------------|------------------------------------|
| FAST / A    | REF<br>(dB) | UUC<br>(dB) |                            |                                    |
| UUC Range   |             |             |                            |                                    |
|             | 43.7        | 43.9        | 0.2                        | 1.1                                |
| 37-139      | 114         | 114.0       | 0.3                        | 1.1                                |

#### 10. Tone burst response

| UUC Setting       | STD               | Anticipated | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------------|-------------|-------------|----------------------------|------------------------------------|
| A / 37-139        | Toneburst<br>(ms) | Ref<br>(dB) | UUC<br>(dB) | ERR<br>(dB)                |                                    |
| UUC Time Response |                   |             |             |                            |                                    |
| Fast              | 200               | 135.0       | 135.0       | 0.0                        | 1                                  |
|                   | 2                 | 118.0       | 117.7       | -0.3                       | +1.0, -2.5                         |
|                   | 0.25              | 109.0       | 108.8       | -0.2                       | +1.5, -5.0                         |
| Slow              | 200               | 128.6       | 128.3       | -0.1                       | 1                                  |
|                   | 2                 | 109.0       | 108.8       | -0.2                       | +1.0, -5.0                         |
|                   | 200               | 129.0       | 129.0       | 0.0                        | 1                                  |
| SEL               | 2                 | 109.0       | 108.9       | -0.1                       | +1.0, -2.5                         |
|                   | 0.25              | 100.0       | 100.0       | 0.0                        | +1.5, -5.0                         |

#### 11. Peak C Sound level

| UUC Setting         | Anticipated | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|---------------------|-------------|-------------|----------------------------|------------------------------------|
| FAST / C / 95-142   | REF<br>(dB) | UUC<br>(dB) | ERR<br>(dB)                |                                    |
| STD Setting         |             |             |                            |                                    |
| Complete cycle      | 137.4       | 136.7       | -0.70                      | 3.0                                |
| Positive half cycle | 136.4       | 136.2       | -0.20                      | 2.0                                |
| Negative half cycle | 136.4       | 136.2       | -0.20                      | 2.0                                |

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Certificate No : 23-SLM-226  
Request No : Req-2023-1415

1. Indication at the calibration check frequency

| UUC Setting        | Nominal Level (dB) | Before Adjust |          | After Adjust |          | UNCERTAINTY (± dB) | Acceptance Limit (± dB) |
|--------------------|--------------------|---------------|----------|--------------|----------|--------------------|-------------------------|
|                    |                    | UUC (dB)      | ERR (dB) | UUC (dB)     | ERR (dB) |                    |                         |
| FAST / A / 37-139  |                    |               |          |              |          |                    |                         |
| Calibrator Setting |                    |               |          |              |          |                    |                         |
| 1000 Hz 114 dB     | 113.77             | 114.8         | +1.03    | 113.8        | -0.03    | 0.2                | 0.3                     |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 73246

2. Self-generated noise, Microphone installed

| UUC Setting   | Measured (dB) | UNCERTAINTY (± dB) |
|---------------|---------------|--------------------|
| FAST / 37-139 |               |                    |
| UUC Weighting |               |                    |
| A             | 29.1          | 0.1                |

3. Self-generated noise, Microphone replaced by the electrical input signal device

| UUC Setting   | Measured (dB) | UNCERTAINTY (± dB) |
|---------------|---------------|--------------------|
| FAST / 37-139 |               |                    |
| UUC Weighting |               |                    |
| A             | 28.9          | 0.1                |
| C             | 28.4          | 0.1                |
| Z             | 32.9          | 0.1                |

4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting   | Deviation from various Frequency Weighting Response curve | UNCERTAINTY |     | Acceptance Limit<br>(± dB) |
|---------------|---|-------------|-----|----------------------------|
|               |   | (± dB)      |     |                            |
|               |   | A           | Z   |                            |
| FAST / 37-139 |   |             |     |                            |
| STD Setting   |   |             |     |                            |
| 125 Hz        | 0.0   | 0.1         | 0.1 | 0.6                        |
| 1000 Hz       | 0.0   | 0.0         | 0.0 | 0.6                        |
| 4000 Hz       | 0.4   | 0.4         | 0.4 | 0.6                        |
| 8000 Hz       | 0.1   | 0.1         | 0.2 | 0.7                        |
|               |   |             |     | 5.0                        |



Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 23-SLM-226  
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260 Request No : Req-2023-1415

Unit Under Calibration Details

Measurement Item : Sound Level Meter Microphone Class : 2  
Manufacturer : LARSON DAVIS Microphone Model : 375A04  
Model : LxT2 Microphone SN : 329362  
Serial Number : 0006616 Preamplifier Model : PRMLxT2C  
ID : UAE-EFM-0472564 Preamplifier SN : 071494  
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 26 June 2023  
Calibrated Date : 28 June 2023  
Calibration Procedure : In-house method (IP-SLM-01) based on IEC 61672-3 ; 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

Reference Standard

| Instrument              | Brand   | Model     | SN        | Due calibration | Traceability |
|-------------------------|---------|-----------|-----------|-----------------|--------------|
| Standard Microphone     | GRAS    | 40AN      | 188273    | 6 October 2023  | GRAS         |
| Midfrequency Calibrator | Quest   | Quest-cal | EFA000234 | 29 June 2023    | TSI          |
| Audio Generator         | Svanick | Scan401   | 131       | 12 October 2023 | WK Electric  |

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. Noppadol Luangrat  
Calibration Officer

Approved By :

Mr. Pait Maibavorn  
Calibration Engineer Supervisor  
Issue Date : 28 June 2023



Certificate No : 23-SLM-226

Request No : Req-2023-1415

### 7. Long Term Stability

| UUC Setting       | Measured | UNCERTAINTY | Acceptance Limit |
|-------------------|----------|-------------|------------------|
| FAST / A / 37-139 | UUC      | ( $\pm$ dB) | ( $\pm$ dB)      |
| STD Setting       | (dB)     |             |                  |
| Initial           | 114.0    |             |                  |
| Final             | 114.0    |             |                  |
| Deviated          | 0.0      | 0.1         | 0.3              |

### 8. Level linearity on the reference level range

| UUC Setting       | Anticipated | Deviation | UNCERTAINTY | Acceptance Limit |
|-------------------|-------------|-----------|-------------|------------------|
| FAST / A / 37-139 | REF         | UUC       | ( $\pm$ dB) | ( $\pm$ dB)      |
| STD dB            | (dB)        | (dB)      |             |                  |
| 141.00            | 141         | 141.0     | 0.0         | 0.8              |
| 140.00            | 140         | 140.0     | 0.0         | 0.8              |
| 139.00            | 139         | 139.0     | 0.0         | 1.1              |
| 134.00            | 134         | 134.0     | 0.0         | 1.1              |
| 129.00            | 129         | 129.0     | 0.0         | 1.1              |
| 124.00            | 124         | 124.0     | 0.0         | 1.1              |
| 119.00            | 119         | 119.0     | 0.0         | 1.1              |
| 114.00            | 114         | 114.0     | 0.0         | 1.1              |
| 109.00            | 109         | 109.0     | 0.0         | 1.1              |
| 104.00            | 104         | 104.0     | 0.0         | 1.1              |
| 99.00             | 99          | 98.9      | -0.1        | 1.1              |
| 94.00             | 94          | 93.9      | -0.1        | 1.1              |
| 89.00             | 89          | 88.9      | -0.1        | 1.1              |
| 84.00             | 84          | 83.9      | -0.1        | 1.1              |
| 79.00             | 79          | 78.9      | -0.1        | 1.1              |
| 74.00             | 74          | 73.9      | -0.1        | 1.1              |
| 69.00             | 69          | 68.9      | -0.1        | 1.1              |
| 64.00             | 64          | 63.9      | -0.1        | 1.1              |
| 59.00             | 59          | 58.9      | -0.1        | 1.1              |
| 54.00             | 54          | 54.0      | 0.0         | 1.1              |
| 49.00             | 49          | 49.0      | 0.0         | 1.1              |
| 44.00             | 44          | 44.1      | 0.1         | 1.1              |
| 39.00             | 39          | 39.4      | 0.4         | 1.1              |

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Certificate No : 23-SLM-226

Request No : Req-2023-1415

### 5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

| UUC Setting   | Deviation from various Frequency | UNCERTAINTY | Acceptance Limit |
|---------------|----------------------------------|-------------|------------------|
| FAST / 37-139 | Weighting Response curve         | ( $\pm$ dB) | ( $\pm$ dB)      |
| STD Setting   | A (dB)                           | C (dB)      | Z (dB)           |
| 63 Hz         | -0.2                             | -0.1        | -0.1             |
| 125 Hz        | -0.1                             | 0.0         | -0.1             |
| 250 Hz        | -0.1                             | -0.1        | 0.0              |
| 500 Hz        | -0.1                             | 0.0         | 0.0              |
| 1000 Hz       | 0.0                              | 0.0         | 0.0              |
| 2000 Hz       | 0.0                              | 0.0         | 0.0              |
| 4000 Hz       | 0.0                              | 0.0         | 0.0              |
| 8000 Hz       | -0.1                             | -0.1        | 0.0              |
| 16000 Hz      | -0.1                             | -0.1        | -0.1             |
|               |                                  | 0.2         | 1.0              |
|               |                                  |             | 2.0              |
|               |                                  |             | 3.0              |
|               |                                  |             | 5                |
|               |                                  |             | +5, -INF.        |

### 6. Frequency and time weightings at 1kHz

| UUC Setting   | STD    | Measured | UNCERTAINTY | Acceptance Limit |
|---------------|--------|----------|-------------|------------------|
| FAST / 37-139 | REF    | UUC      | ( $\pm$ dB) | ( $\pm$ dB)      |
| UUC Weighting | (dB)   | (dB)     |             |                  |
| A             | 114.00 | 114.0    | 0.0         | 0.2              |
| C             | 114.00 | 114.0    | 0.0         | 0.2              |
| Z             | 114.00 | 114.0    | 0.0         | 0.2              |

| UUC Setting       | STD    | Measured | UNCERTAINTY | Acceptance Limit |
|-------------------|--------|----------|-------------|------------------|
| 37-139 / A        | REF    | UUC      | ( $\pm$ dB) | ( $\pm$ dB)      |
| UUC Time Response | (dB)   | (dB)     |             |                  |
| Fast              | 114.00 | 114.0    | 0.0         | 0.1              |
| Slow              | 114.00 | 114.0    | 0.0         | 0.1              |
| Leq               | 114.00 | 114.0    | 0.0         | 0.1              |

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Certificate No : 23-SLM-226

Request No : Req-2023-1415

#### 12. Overload Indication

| UUC Setting             | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139       | UUC<br>(dB) |                            |                                    |
| STD Setting             | 143.2       |                            |                                    |
| Positive one-half cycle | 143.1       |                            |                                    |
| Negative one-half cycle |             |                            |                                    |
| Deviated                | 0.1         | 0.2                        | 1.5                                |

#### 13. High Level Stability

| UUC Setting       | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139 | UUC<br>(dB) |                            |                                    |
| STD Setting       | 138.0       |                            |                                    |
| Initial           | 138.0       |                            |                                    |
| Final             |             |                            |                                    |
| Deviated          | 0.0         | 0.1                        | 0.3                                |

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

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Certificate No : 23-SLM-226

Request No : Req-2023-1415

#### 9. Level linearity including the level range control

| UUC Setting | STD         | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------|-------------|-------------|----------------------------|------------------------------------|
| FAST / A    | REF<br>(dB) | UUC<br>(dB) |                            |                                    |
| UUC Range   | 44.3        | 44.5        | 0.2                        | 1.1                                |
| 37-139      | 114         | 114.0       | 0.3                        | 1.1                                |

#### 10. Tone burst response

| UUC Setting       | STD               | Anticipated             | Measured                | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------------|-------------------------|-------------------------|----------------------------|------------------------------------|
| A / 37-139        | Toneburst<br>(ms) | Ref<br>(dB)             | UUC<br>(dB)             | ERR<br>(dB)                |                                    |
| UUC Time Response |                   |                         |                         |                            |                                    |
| Fast              | 200<br>2<br>0.25  | 135.0<br>118.0<br>109.0 | 135.0<br>117.7<br>108.6 | 0.0<br>-0.3<br>-0.4        | 1<br>+1.0, -2.5<br>+1.5, -5.0      |
| Slow              | 200<br>2          | 128.6<br>109.0          | 128.5<br>108.9          | -0.1<br>-0.1               | 1<br>+1.0, -5.0                    |
| SEL               | 200<br>2<br>0.25  | 129.0<br>109.0<br>100.0 | 129.0<br>108.9<br>99.8  | 0.0<br>-0.1<br>-0.2        | 1<br>+1.0, -2.5<br>+1.5, -5.0      |

#### 11. Peak C Sound level

| UUC Setting         | Anticipated | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|---------------------|-------------|-------------|----------------------------|------------------------------------|
| FAST / C / 95-142   | REF<br>(dB) | UUC<br>(dB) | ERR<br>(dB)                |                                    |
| STD Setting         |             |             |                            |                                    |
| Complete cycle      | 137.4       | 136.7       | -0.70                      | 3.0                                |
| Positive half cycle | 136.4       | 136.2       | -0.20                      | 2.0                                |
| Negative half cycle | 136.4       | 136.2       | -0.20                      | 2.0                                |

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Certificate No : 22-ACT-248  
Request No : Req-2022-0628

1. Indication at the calibration check frequency

| UUC Setting  | Nominal Level (dB) | Before Adjust |          | Adjust   |          | Acceptance Limit (± dB) |
|--|--------------------|---------------|----------|----------|----------|-------------------------|
|  |                    | UUC (dB)      | ERR (dB) | UUC (dB) | ERR (dB) |                         |
| FAST / A / 37-139  |                    |               |          |          |          |                         |
| Calibrator Setting   |                    |               |          |          |          |                         |
| 1000 Hz 114.00 dB  | 113.85             | 113.7         | -0.15    | 113.9    | 0.05     | 0.20                    |
| Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN.58079 |                    |               |          |          |          |                         |

2. Self-generated noise, Microphone installed

| UUC Setting   | Measured (dB) | UNCERTAINTY (± dB) |
|---------------|---------------|--------------------|
| FAST / 37-139 |               |                    |
| UUC Weighting |               |                    |
| A             | 29.1          | 0.10               |

3. Self-generated noise, Microphone replaced by the electrical input signal device

| UUC Setting   | Measured (dB) | UNCERTAINTY (± dB) |
|---------------|---------------|--------------------|
| FAST / 37-139 |               |                    |
| UUC Weighting |               |                    |
| A             | 28.8          | 0.10               |
| C             | 28.4          | 0.10               |
| Z             | 32.6          | 0.10               |

4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting   | Deviation from various Frequency Weighting Response curve | UNCERTAINTY |        | Acceptance Limit (± dB) |
|---------------|---|-------------|--------|-------------------------|
|               |   | A (dB)      | Z (dB) |                         |
| FAST / 37-139 |   |             |        |                         |
| STD Setting   |   |             |        |                         |
| 125 Hz        | 0.0   | 0.1         | 0.1    | 2.0                     |
| 1000 Hz       | 0.0   | 0.0         | 0.0    | 1.0                     |
| 4000 Hz       | 0.2   | 0.2         | 0.2    | 3.0                     |
| 8000 Hz       | 0.0   | 0.0         | 0.1    | 5.0                     |

Certificate of Calibration


**Customer**  
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address : 81 Soi Udonsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260  
Certificate No : 22-ACT-248  
Request No : Req-2022-0628

Unit Under Calibration Details

Measurement item : Sound Level Meter  
Manufacturer : LARSON DAVIS  
Model : LxT2  
Serial Number : 0005344  
ID : UAE.EFM.0412563  
Resolution : 0.1 dB  
Calibration Environment and Details  
Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 23 March 2022  
Calibrated Date : 1 April 2022  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-1 : 2013 Electroacoustics - Sound level meters - Part 1: Periodic tests  
Location of Calibration : Lab Acoustic  
Reference Standard  
Instrument : Model : SN, Due calibration : Traceability  
Standard Microphone : GRAS : 40AN : 188273 : 15 September 2022 : GRAS  
Multifrequency Calibrator : Quest : Quest-cal : EFA000234 : 14 June 2022 : TSI  
Audio Generator : Svanhvi : Svan401 : 131 : 18 October 2022 : WK Electric

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 Luangrit  
Calibration Officer

Approved By : 

Mr. Paet Muthavorn  
Calibration Engineer Supervisor  
Issue Date : 1 April 2022

Certificate No : 22-ACT-248  
Request No : Req-2022-0628

7. Long Term Stability

| UUC Setting       | Measured    |                       | Acceptance Limit<br>(± dB) |
|-------------------|-------------|-----------------------|----------------------------|
|                   | UUC<br>(dB) | UNCERTAINTY<br>(± dB) |                            |
| FAST / A / 37-139 |             |                       |                            |
| STD Setting       |             |                       |                            |
| Initial           | 114.0       |                       |                            |
| Final             | 114.0       |                       |                            |
| Deviated          | 0.0         | 0.1                   | 0.3                        |

8. Level linearity on the reference level range

| UUC Setting       | Anticipated REF<br>(dB) | Deviation   |             | Acceptance Limit<br>(± dB) |
|-------------------|-------------------------|-------------|-------------|----------------------------|
|                   |                         | UUC<br>(dB) | ERR<br>(dB) |                            |
| FAST / A / 37-139 |                         |             |             |                            |
| STD dB            |                         |             |             |                            |
| 139.00            | 139                     | 139.0       | 0.0         | 1.1                        |
| 134.00            | 134                     | 134.0       | 0.0         | 1.1                        |
| 129.00            | 129                     | 129.0       | 0.0         | 1.1                        |
| 124.00            | 124                     | 124.0       | 0.0         | 1.1                        |
| 119.00            | 119                     | 119.0       | 0.0         | 1.1                        |
| 114.00            | 114                     | 114.0       | 0.0         | 1.1                        |
| 109.00            | 109                     | 109.0       | 0.0         | 1.1                        |
| 104.00            | 104                     | 104.0       | 0.0         | 1.1                        |
| 99.00             | 99                      | 98.9        | -0.1        | 1.1                        |
| 94.00             | 94                      | 94.0        | 0.0         | 1.1                        |
| 89.00             | 89                      | 89.0        | 0.0         | 1.1                        |
| 84.00             | 84                      | 84.0        | 0.0         | 1.1                        |
| 79.00             | 79                      | 79.0        | 0.0         | 1.1                        |
| 74.00             | 74                      | 74.0        | 0.0         | 1.1                        |
| 69.00             | 69                      | 69.0        | 0.0         | 1.1                        |
| 64.00             | 64                      | 64.0        | 0.0         | 1.1                        |
| 59.00             | 59                      | 59.0        | 0.0         | 1.1                        |
| 54.00             | 54                      | 54.0        | 0.0         | 1.1                        |
| 49.00             | 49                      | 49.0        | 0.0         | 1.1                        |
| 44.00             | 44                      | 44.1        | 0.1         | 1.1                        |
| 39.00             | 39                      | 39.4        | 0.4         | 1.1                        |
| 38.00             | 38                      | 38.5        | 0.5         | 1.1                        |

Certificate No : 22-ACT-248  
Request No : Req-2022-0628

5. Electrical signal test of frequency weightings. Weighting network response with relative to 1 kHz

| UUC Setting   | Deviation from various Frequency Weighting Response curve |        |        |  | UNCERTAINTY<br>(± dB) | Acceptance Limit<br>(± dB) |
|---------------|---|--------|--------|--|-----------------------|----------------------------|
|               | A (dB)  | C (dB) | Z (dB) |  |                       |                            |
| FAST / 37-139 |   |        |        |  |                       |                            |
| STD Setting   |   |        |        |  |                       |                            |
| 63 Hz         | -0.2  | -0.1   | -0.1   |  |                       | 2.0                        |
| 125 Hz        | -0.1  | 0.0    | 0.0    |  |                       | 1.5                        |
| 250 Hz        | -0.1  | 0.0    | 0.0    |  |                       | 1.5                        |
| 500 Hz        | -0.1  | 0.0    | 0.0    |  |                       | 1.5                        |
| 1000 Hz       | 0.0   | 0.0    | 0.0    |  | 0.2                   | 1.0                        |
| 2000 Hz       | 0.0   | 0.0    | 0.0    |  |                       | 2.0                        |
| 4000 Hz       | 0.0   | 0.0    | 0.0    |  |                       | 3.0                        |
| 8000 Hz       | -0.1  | -0.1   | 0.0    |  |                       | 5.0                        |
| 16000 Hz      | -0.1  | -0.1   | -0.1   |  |                       | +5, -INF.                  |

6. Frequency and time weightings at 1kHz

| UUC Setting   | STD REF<br>(dB) | Measured    |             | UNCERTAINTY<br>(± dB) | Acceptance Limit<br>(± dB) |
|---------------|-----------------|-------------|-------------|-----------------------|----------------------------|
|               |                 | UUC<br>(dB) | ERR<br>(dB) |                       |                            |
| FAST / 37-139 |                 |             |             |                       |                            |
| UUC Weighting |                 |             |             |                       |                            |
| A             | 114.00          | 114.0       | 0.0         |                       | 0.2                        |
| C             | 114.00          | 114.0       | 0.0         | 0.2                   | 0.2                        |
| Z             | 114.00          | 114.0       | 0.0         |                       | 0.2                        |

| UUC Setting       | STD REF<br>(dB) | Measured    |             | UNCERTAINTY<br>(± dB) | Acceptance Limit<br>(± dB) |
|-------------------|-----------------|-------------|-------------|-----------------------|----------------------------|
|                   |                 | UUC<br>(dB) | ERR<br>(dB) |                       |                            |
| 37-139 / A        |                 |             |             |                       |                            |
| UUC Time Response |                 |             |             |                       |                            |
| Fast              | 114.00          | 114.0       | 0.0         |                       | 0.1                        |
| Slow              | 114.00          | 114.0       | 0.0         | 0.2                   | 0.1                        |
| Leq               | 114.00          | 114.0       | 0.0         |                       | 0.1                        |

Certificate No : 22-ACT-248  
Request No : Req-2022-0628

12. Overload indication

| UUC Setting             | Measured | UNCERTAINTY | Acceptance Limit |
|-------------------------|----------|-------------|------------------|
| FAST / A / 37-139       | UUC (dB) | (± dB)      | (± dB)           |
| STD Setting             |          |             |                  |
| Positive one-half cycle | 143.2    |             |                  |
| Negative one-half cycle | 143.1    |             |                  |
| Deviated                | 0.1      | 0.2         | 1.5              |

13. High Level Stability

| UUC Setting       | Measured | UNCERTAINTY | Acceptance Limit |
|-------------------|----------|-------------|------------------|
| FAST / A / 37-139 | UUC (dB) | (± dB)      | (± dB)           |
| STD Setting       |          |             |                  |
| Initial           | 138.0    |             |                  |
| Final             | 138.0    |             |                  |
| Deviated          | 0.0      | 0.1         | 0.3              |

End of Certificate

Certificate No : 22-ACT-248  
Request No : Req-2022-0628

9. Level linearity including the level range control

| UUC Setting | STD      | Measured | UNCERTAINTY | Acceptance Limit |
|-------------|----------|----------|-------------|------------------|
| FAST / A    | REF (dB) | UUC (dB) | (± dB)      | (± dB)           |
| UUC Range   |          | ERR (dB) |             |                  |
|             | 44.2     | 44.4     | 0.2         | 1.1              |
| 37-139      | 114      | 114.0    | 0.3         | 1.1              |

10. Tone burst response

| UUC Setting       | STD            | Anticipated | Measured | UNCERTAINTY | Acceptance Limit |
|-------------------|----------------|-------------|----------|-------------|------------------|
| A / 37-139        | Toneburst (ms) | Ref (dB)    | UUC (dB) | ERR (dB)    | (± dB)           |
| UUC Time Response |                |             |          |             |                  |
| Fast              | 200            | 135.0       | 135.0    | 0.0         | 1.0              |
|                   | 2              | 118.0       | 117.7    | -0.3        | +1.0, -2.5       |
|                   | 0.25           | 109.0       | 108.8    | -0.2        | +1.5, -5.0       |
| Slow              | 200            | 128.6       | 128.5    | -0.1        | 1.0              |
|                   | 2              | 109.0       | 108.9    | -0.1        | +1.0, -5.0       |
|                   | 200            | 129.0       | 129.1    | +0.1        | 1.0              |
| SEL               | 2              | 109.0       | 109.1    | +0.1        | +1.0, -2.5       |
|                   | 0.25           | 100.0       | 100.0    | 0.0         | +1.5, -5.0       |

11. Peak C Sound level

| UUC Setting         | Anticipated | Measured | UNCERTAINTY | Acceptance Limit |
|---------------------|-------------|----------|-------------|------------------|
| FAST / C / 95-142   | REF (dB)    | UUC (dB) | ERR (dB)    | (± dB)           |
| STD Setting         |             |          |             |                  |
| Complete cycle      | 137.4       | 136.7    | -0.70       | 3.0              |
| Positive half cycle | 136.4       | 136.1    | -0.30       | 2.0              |
| Negative half cycle | 136.4       | 136.2    | -0.20       | 2.0              |



Certificate No : 22-ACT-247  
Request No : Req-2022-0627

1. Indication at the calibration check frequency

| UUC Setting        | Nominal Level (dB) | Before Adjust |          | Adjust   |          | Acceptance Limit (± dB) |
|--------------------|--------------------|---------------|----------|----------|----------|-------------------------|
|                    |                    | UUC (dB)      | ERR (dB) | UUC (dB) | ERR (dB) |                         |
| FAST / A / 37-139  |                    |               |          |          |          |                         |
| Calibrator Setting |                    |               |          |          |          |                         |
| 1000 Hz 114.00 dB  | 113.85             | 113.8         | -0.05    | 113.9    | 0.05     | 0.3                     |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN:58079

2. Self-generated noise, Microphone installed

| UUC Setting   | Measured (dB) | UNCERTAINTY (± dB) |
|---------------|---------------|--------------------|
| FAST / 37-139 |               |                    |
| UUC Weighting |               |                    |
| A             | 28.4          | 0.10               |

3. Self-generated noise, Microphone replaced by the electrical input signal device

| UUC Setting   | Measured (dB) | UNCERTAINTY (± dB) |
|---------------|---------------|--------------------|
| FAST / 37-139 |               |                    |
| UUC Weighting |               |                    |
| A             | 28.1          | 0.10               |
| C             | 27.7          | 0.10               |
| Z             | 32.0          | 0.10               |

4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting   | Deviation from various Frequency Weighting Response curve | UNCERTAINTY |     | Acceptance Limit (± dB) |
|---------------|---|-------------|-----|-------------------------|
|               |   | A           | Z   |                         |
| FAST / 37-139 |   |             |     |                         |
| STD Setting   |   |             |     |                         |
| 125 Hz        | 0.0   | 0.1         | 0.1 | 2.0                     |
| 1000 Hz       | 0.0   | 0.0         | 0.0 | 1.0                     |
| 4000 Hz       | 0.4   | 0.5         | 0.5 | 3.0                     |
| 8000 Hz       | 0.2   | 0.1         | 0.3 | 5.0                     |

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Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Name :  
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260  
Certificate No : 22-ACT-247  
Request No : Req-2022-0627

Unit Under Calibration Details

Measurement Item : Sound Level Meter  
Manufacturer : LARSON DAVIS  
Model : LX12  
Serial Number : 0005395  
ID : UAE.EFM.02/2564  
Resolution : 0.1 dB  
Instrument Status : Used  
Microphone Class : 2  
Microphone Model : 375A04  
Microphone SN : 329355  
Preamplifier Model : PRMLX12C  
Preamplifier SN : 93797

Calibration Environment and Details


Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 23 March 2022  
Calibrated Date : 1 April 2022  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-1 : 2013 Electroacoustics - Sound level meters - Part 1: Periodic tests  
Location of Calibration : Lab Acoustic  
Reference Standard : Lab Acoustic

Reference Standard


| Instrument                | Brand | Model     | SN        | Due calibration   | Traceability |
|---------------------------|-------|-----------|-----------|-------------------|--------------|
| Standard Microphone       | GRAS  | 40AN      | 188273    | 15 September 2022 | GRAS         |
| Multifrequency Calibrator | Quest | Quest-cal | EFA000234 | 14 June 2022      | TSI          |
| Audio Generator           | Swank | Swan401   | 131       | 18 October 2022   | WK Electric  |

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. Noppadol Luangrit  
Calibration Officer

Approved By : 

Mr. Pait Mahavorn  
Calibration Engineer Supervisor  
Issue Date : 1 April 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory. Date 01/07/19

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Certificate No : 22-ACT-247  
Request No : Req-2022-0627

7. Long Term Stability

| UUC Setting       | Measured | UUC<br>(dB) | UNCERTAINTY<br>(± dB) | Acceptance<br>Limit<br>(± dB) |
|-------------------|----------|-------------|-----------------------|-------------------------------|
|                   |          |             |                       |                               |
| FAST / A / 37-139 |          |             |                       |                               |
| STD Setting       |          |             |                       |                               |
| Initial           |          | 114.0       |                       |                               |
| Final             |          | 114.0       |                       |                               |
| Deviated          |          | 0.0         | 0.1                   | 0.3                           |

8. Level linearity on the reference level range

| UUC Setting       | Anticipated | REF<br>(dB) | Deviation   |             | UNCERTAINTY<br>(± dB) | Acceptance<br>Limit<br>(± dB) |
|-------------------|-------------|-------------|-------------|-------------|-----------------------|-------------------------------|
|                   |             |             | UUC<br>(dB) | ERR<br>(dB) |                       |                               |
| FAST / A / 37-139 |             |             |             |             |                       |                               |
| STD dB            |             |             |             |             |                       |                               |
| 139.00            | 139         | 139         | 139.0       | 0.0         |                       | 1.1                           |
| 134.00            | 134         | 134         | 134.0       | 0.0         |                       | 1.1                           |
| 129.00            | 129         | 129         | 129.0       | 0.0         |                       | 1.1                           |
| 124.00            | 124         | 124         | 124.0       | 0.0         |                       | 1.1                           |
| 119.00            | 119         | 119         | 119.0       | 0.0         |                       | 1.1                           |
| 114.00            | 114         | 114         | 114.0       | 0.0         |                       | 1.1                           |
| 109.00            | 109         | 109         | 109.0       | 0.0         |                       | 1.1                           |
| 104.00            | 104         | 104         | 104.0       | 0.0         |                       | 1.1                           |
| 99.00             | 99          | 99          | 99.0        | 0.0         |                       | 1.1                           |
| 94.00             | 94          | 94          | 94.0        | 0.0         |                       | 1.1                           |
| 89.00             | 89          | 89          | 89.0        | 0.0         |                       | 1.1                           |
| 84.00             | 84          | 84          | 84.0        | 0.0         |                       | 1.1                           |
| 79.00             | 79          | 79          | 79.0        | 0.0         |                       | 1.1                           |
| 74.00             | 74          | 74          | 74.0        | 0.0         |                       | 1.1                           |
| 69.00             | 69          | 69          | 69.0        | 0.0         |                       | 1.1                           |
| 64.00             | 64          | 64          | 64.0        | 0.0         |                       | 1.1                           |
| 59.00             | 59          | 59          | 59.0        | 0.0         |                       | 1.1                           |
| 54.00             | 54          | 54          | 54.0        | 0.0         |                       | 1.1                           |
| 49.00             | 49          | 49          | 49.0        | 0.0         |                       | 1.1                           |
| 44.00             | 44          | 44          | 44.1        | 0.1         |                       | 1.1                           |
| 39.00             | 39          | 39          | 39.3        | 0.3         |                       | 1.1                           |
| 38.00             | 38          | 38          | 38.4        | 0.4         |                       | 1.1                           |

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Certificate No : 22-ACT-247  
Request No : Req-2022-0627

5. Electrical signal test of frequency weightings. Weighting network response with relative to 1 kHz

| UUC Setting   | Deviation from various Frequency |        |        |     | UNCERTAINTY<br>( ± dB) | Acceptance<br>Limit<br>( ± dB) |
|---------------|----------------------------------|--------|--------|-----|------------------------|--------------------------------|
|               | Weighting Response curve         |        |        |     |                        |                                |
|               | A (dB)                           | C (dB) | Z (dB) |     |                        |                                |
| FAST / 37-139 |                                  |        |        |     |                        |                                |
| STD Setting   |                                  |        |        |     |                        |                                |
| 63 Hz         | -0.2                             | -0.1   | -0.1   |     |                        | 2.0                            |
| 125 Hz        | -0.1                             | 0.0    | 0.0    |     |                        | 1.5                            |
| 250 Hz        | -0.1                             | 0.0    | 0.0    |     |                        | 1.5                            |
| 500 Hz        | -0.1                             | 0.0    | 0.0    |     |                        | 1.5                            |
| 1000 Hz       | 0.0                              | 0.0    | 0.0    | 0.2 |                        | 1.0                            |
| 2000 Hz       | 0.0                              | 0.0    | 0.0    |     |                        | 2.0                            |
| 4000 Hz       | 0.0                              | 0.0    | 0.0    |     |                        | 3.0                            |
| 8000 Hz       | -0.1                             | -0.1   | 0.0    |     |                        | 5.0                            |
| 16000 Hz      | -0.1                             | -0.1   | -0.1   |     |                        | +5, -INF                       |

6. Frequency and time weightings at 1kHz

| UUC Setting   | STD    | REF<br>(dB) | Measured    |             | UNCERTAINTY<br>(± dB) | Acceptance<br>Limit<br>(± dB) |
|---------------|--------|-------------|-------------|-------------|-----------------------|-------------------------------|
|               |        |             | UUC<br>(dB) | ERR<br>(dB) |                       |                               |
| FAST / 37-139 |        |             |             |             |                       |                               |
| UUC Weighting |        |             |             |             |                       |                               |
| A             | 114.00 | 114.00      | 114.0       | 0.0         |                       | 0.2                           |
| C             | 114.00 | 114.00      | 114.0       | 0.0         | 0.2                   | 0.2                           |
| Z             | 114.00 | 114.00      | 114.0       | 0.0         |                       | 0.2                           |

| UUC Setting       | STD    | REF<br>(dB) | Measured    |             | UNCERTAINTY<br>(± dB) | Acceptance<br>Limit<br>(± dB) |
|-------------------|--------|-------------|-------------|-------------|-----------------------|-------------------------------|
|                   |        |             | UUC<br>(dB) | ERR<br>(dB) |                       |                               |
| 37-139 / A        |        |             |             |             |                       |                               |
| UUC Time Response |        |             |             |             |                       |                               |
| Fast              | 114.00 | 114.00      | 114.0       | 0.0         |                       | 0.1                           |
| Slow              | 114.00 | 114.00      | 114.0       | 0.0         | 0.2                   | 0.1                           |
| Leq               | 114.00 | 114.00      | 114.0       | 0.0         |                       | 0.1                           |

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Certificate No : 22-ACT-247  
Request No : Req-2022-0627

12. Overload indication

| UUC Setting             |  | Measured | UNCERTAINTY | Acceptance Limit |
|-------------------------|--|----------|-------------|------------------|
| FAST / A / 37-139       |  | UUC (dB) | ( ± dB)     | ( ± dB)          |
| STD Setting             |  |          |             |                  |
| Positive one-half cycle |  | 142.2    |             |                  |
| Negative one-half cycle |  | 142.2    |             |                  |
| Deviated                |  | 0.0      | 0.2         | 1.5              |

13. High Level Stability

| UUC Setting       |  | Measured | UNCERTAINTY | Acceptance Limit |
|-------------------|--|----------|-------------|------------------|
| FAST / A / 37-139 |  | UUC (dB) | ( ± dB)     | ( ± dB)          |
| STD Setting       |  |          |             |                  |
| Initial           |  | 138.0    |             |                  |
| Final             |  | 138.0    |             |                  |
| Deviated          |  | 0.0      | 0.1         | 0.3              |

End of Certificate

Certificate No : 22-ACT-247  
Request No : Req-2022-0627

9. Level linearity including the level range control

| UUC Setting |  | STD      | Measured | UNCERTAINTY | Acceptance Limit |
|-------------|--|----------|----------|-------------|------------------|
| FAST / A    |  | REF (dB) | UUC (dB) | ( ± dB)     | ( ± dB)          |
| UUC Range   |  |          |          |             |                  |
|             |  | 43.4     | 43.5     | 0.1         | 1.1              |
| 37-139      |  | 114      | 114.0    | 0.3         | 1.1              |

10. Tone burst response

| UUC Setting       |  | STD            | Anticipated | Measured | UNCERTAINTY | Acceptance Limit |
|-------------------|--|----------------|-------------|----------|-------------|------------------|
| A / 37-139        |  | Toneburst (ms) | Ref (dB)    | UUC (dB) | ERR (dB)    | ( ± dB)          |
| UUC Time Response |  |                |             |          |             |                  |
| Fast              |  | 200            | 135.0       | 134.9    | -0.1        | 1.0              |
|                   |  | 2              | 118.0       | 117.8    | -0.2        | +1.0, -2.5       |
|                   |  | 0.25           | 109.0       | 108.7    | -0.3        | +1.5, -5.0       |
| Slow              |  | 200            | 128.6       | 128.4    | -0.2        | 1.0              |
|                   |  | 2              | 109.0       | 108.8    | -0.2        | +1.0, -5.0       |
| SEL               |  | 200            | 129.0       | 129.0    | 0.0         | 1.0              |
|                   |  | 2              | 109.0       | 109.1    | +0.1        | +1.0, -2.5       |
|                   |  | 0.25           | 100.0       | 99.9     | -0.1        | +1.5, -5.0       |

11. Peak C Sound level

| UUC Setting         |  | Anticipated | Measured | UNCERTAINTY | Acceptance Limit |
|---------------------|--|-------------|----------|-------------|------------------|
| FAST / C / 95-142   |  | REF (dB)    | UUC (dB) | ERR (dB)    | ( ± dB)          |
| STD Setting         |  |             |          |             |                  |
| Complete cycle      |  | 137.4       | 136.8    | -0.60       | 3.0              |
| Positive half cycle |  | 136.4       | 136.2    | -0.20       | 2.0              |
| Negative half cycle |  | 136.4       | 136.2    | -0.20       | 2.0              |





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INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE  
7/139 MOO 13, SOI SUTINSAKORN 11 TAMBON BANG KAEO,  
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10140 THAILAND  
TEL: (66)0-2116-5869-1 FAX: (66)0-2116-7140



Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD. Certificate No : 23-SLM-027  
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok Request No : Req-2023-0155  
10260

Unit Under Calibration Details

Measurement Item : Sound Level Meter Microphone Class : 2  
Manufacturer : LARSON DAVIS Microphone Model : 375A04  
Model : LX72 Microphone SN : 328669  
Serial Number : 0006617 Preamplifier Model : PRMLX72C  
ID : UAE.EFM.048.2564 Preamplifier SN : 071532  
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 24 January 2023  
Calibrated Date : 30 January 2023  
Calibration Procedure : In-house method (CP-SLM-01) based on IEC 61673-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab-Acoustic

Reference Standard

| Instrument                | Brand   | Model     | SN        | Due calibration | Traceability |
|---------------------------|---------|-----------|-----------|-----------------|--------------|
| Standard Microphone       | GRAS    | 40AN      | 188273    | 6 October 2023  | GRAS         |
| Multifrequency Calibrator | Quest   | Quest-cal | EFA000234 | 29 June 2023    | TSI          |
| Audio Generator           | Svanick | Svan401   | 131       | 12 October 2023 | WK Electric  |

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. Noppadol Luangrat  
Calibration Officer

Approved By :

Mr. Paet Malhavorn  
Calibration Engineer Supervisor  
Issue Date : 30 January 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.  
เอกสารไม่ควบคุม

Certificate No : 23-SLM-027  
Request No : Req-2023-0155

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

| UUC Setting   | Deviation from various Frequency |        |        |  | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|---------------|----------------------------------|--------|--------|--|----------------------------|------------------------------------|
|               | Weighting Response curve         |        |        |  |                            |                                    |
| FAST / 37-139 | A (dB)                           | C (dB) | Z (dB) |  |                            |                                    |
| STD Setting   |                                  |        |        |  |                            |                                    |
| 63 Hz         | -0.1                             | 0.0    | 0.0    |  |                            | 2.0                                |
| 125 Hz        | -0.1                             | 0.1    | 0.0    |  |                            | 1.5                                |
| 250 Hz        | 0.0                              | 0.0    | 0.0    |  |                            | 1.5                                |
| 500 Hz        | 0.0                              | 0.1    | 0.0    |  |                            | 1.5                                |
| 1000 Hz       | 0.0                              | 0.0    | 0.0    |  | 0.2                        | 1.0                                |
| 2000 Hz       | 0.1                              | 0.1    | 0.0    |  |                            | 2.0                                |
| 4000 Hz       | 0.0                              | 0.1    | 0.1    |  |                            | 3.0                                |
| 8000 Hz       | 0.0                              | 0.0    | 0.1    |  |                            | 5                                  |
| 16000 Hz      | 0.0                              | 0.0    | -0.1   |  |                            | +5, -INF.                          |

6. Frequency and time weightings at 1kHz

| UUC Setting   | STD    | Measured |      | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|---------------|--------|----------|------|----------------------------|------------------------------------|
|               |        | UUC      | ERR  |                            |                                    |
|               |        | (dB)     | (dB) |                            |                                    |
| FAST / 37-139 |        |          |      |                            |                                    |
| UUC Weighting |        |          |      |                            |                                    |
| A             | 114.00 | 114.0    | 0.0  |                            | 0.2                                |
| C             | 114.00 | 114.0    | 0.0  | 0.2                        | 0.2                                |
| Z             | 114.00 | 114.0    | 0.0  |                            | 0.2                                |

| UUC Setting       | STD    | Measured |      | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|--------|----------|------|----------------------------|------------------------------------|
|                   |        | UUC      | ERR  |                            |                                    |
|                   |        | (dB)     | (dB) |                            |                                    |
| 37-139 / A        |        |          |      |                            |                                    |
| UUC Time Response |        |          |      |                            |                                    |
| Fast              | 114.00 | 114.0    | 0.0  |                            | 0.1                                |
| Slow              | 114.00 | 114.0    | 0.0  | 0.2                        | 0.1                                |
| Leq               | 114.00 | 114.0    | 0.0  |                            | 0.1                                |

Certificate No : 23-SLM-027  
Request No : Req-2023-0155

1. Indication at the calibration check frequency

| UUC Setting        | Nominal<br>Level<br>(dB) | Before Adjust |       | Adjust |      | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|--------------------|--------------------------|---------------|-------|--------|------|----------------------------|------------------------------------|
|                    |                          | UUC           | ERR   | UUC    | ERR  |                            |                                    |
|                    |                          | (dB)          | (dB)  | (dB)   | (dB) |                            |                                    |
| FAST / A / 37-139  |                          |               |       |        |      |                            |                                    |
| Calibrator Setting |                          |               |       |        |      |                            |                                    |
| 1000 Hz 114.36 dB  | 113.79                   | 112.9         | -0.89 | 113.8  | 0.01 | 0.20                       | 0.3                                |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

2. Self-generated noise, Microphone installed

| UUC Setting   | Measured |  | UNCERTAINTY<br>( $\pm$ dB) |
|---------------|----------|--|----------------------------|
|               |          |  |                            |
|               |          |  |                            |
|               |          |  |                            |
| FAST / 37-139 |          |  |                            |
| UUC Weighting |          |  |                            |
| A             | 31.5     |  | 0.10                       |

3. Self-generated noise, Microphone replaced by the electrical input signal device

| UUC Setting   | Measured |  | UNCERTAINTY<br>( $\pm$ dB) |
|---------------|----------|--|----------------------------|
|               |          |  |                            |
|               |          |  |                            |
| FAST / 37-139 |          |  |                            |
| UUC Weighting |          |  |                            |
| A             | 31.4     |  | 0.10                       |
| C             | 30.7     |  | 0.10                       |
| Z             | 35.1     |  | 0.10                       |

4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting   | Deviation from various Frequency<br>Weighting Response curve |      |      |  | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|---------------|--|------|------|--|----------------------------|------------------------------------|
|               | A  | C    | Z    |  |                            |                                    |
|               | (dB)   | (dB) | (dB) |  |                            |                                    |
| FAST / 37-139 |  |      |      |  |                            |                                    |
| STD Setting   |  |      |      |  |                            |                                    |
| 125 Hz        | 0.0  | 0.1  | 0.1  |  | 0.50                       | 2.0                                |
| 1000 Hz       | 0.0  | 0.0  | 0.0  |  | 0.60                       | 1.0                                |
| 4000 Hz       | 0.6  | 0.7  | 0.7  |  | 0.60                       | 3.0                                |
| 8000 Hz       | 0.5  | 0.6  | 0.7  |  | 0.70                       | 5.0                                |

Certificate No : 23-SLM-027  
Request No : Req-2023-0155

9. Level linearity including the level range control

| UUC Setting | STD<br>REF<br>(dB) | Measured    |             | UNCERTAINTY<br>(± dB) | Acceptance<br>Limit<br>(± dB) |
|-------------|--------------------|-------------|-------------|-----------------------|-------------------------------|
|             |                    | UUC<br>(dB) | ERR<br>(dB) |                       |                               |
| 37~139      | 46.70              | 46.8        | 0.1         | 0.3                   | 1.1                           |
|             | 114                | 114.0       | 0.0         |                       | 1.1                           |

10. Tone burst response

| UUC Setting | STD<br>Toneburst<br>(ms) | Anticipated<br>Ref<br>(dB) | Measured    |             | UNCERTAINTY<br>(± dB) | Acceptance<br>Limit<br>(± dB) |
|-------------|--------------------------|----------------------------|-------------|-------------|-----------------------|-------------------------------|
|             |                          |                            | UUC<br>(dB) | ERR<br>(dB) |                       |                               |
| Fast        | 200                      | 135.0                      | 135.0       | 0.0         | 0.3                   | 1                             |
|             | 2                        | 118.0                      | 117.8       | -0.2        |                       | +1.0, -2.5                    |
|             | 0.25                     | 109.0                      | 108.6       | -0.4        |                       | +1.5, -5.0                    |
| Slow        | 200                      | 128.6                      | 128.5       | -0.1        | 0.3                   | 1                             |
|             | 2                        | 109.0                      | 108.9       | -0.1        |                       | +1.0, -5.0                    |
|             | 200                      | 135.0                      | 135.0       | 0.0         |                       | 1                             |
| SEL         | 2                        | 118.0                      | 117.8       | -0.2        | 0.3                   | +1.0, -2.5                    |
|             | 0.25                     | 109.0                      | 108.6       | -0.4        |                       | +1.5, -5.0                    |

11. Peak C Sound level

| UUC Setting       | Anticipated<br>REF<br>(dB) | Measured    |             | UNCERTAINTY<br>(± dB) | Acceptance<br>Limit<br>(± dB) |
|-------------------|----------------------------|-------------|-------------|-----------------------|-------------------------------|
|                   |                            | UUC<br>(dB) | ERR<br>(dB) |                       |                               |
| FAST / C / 95-142 | 137.4                      | 136.6       | -0.80       | 0.2                   | 3.0                           |
|                   |                            | 136.2       | -0.20       |                       | 2.0                           |
|                   |                            | 136.4       | -0.20       |                       | 2.0                           |

Certificate No : 23-SLM-027  
Request No : Req-2023-0155

7. Long Term Stability

| UUC Setting       | Measured<br>UUC<br>(dB) | UNCERTAINTY<br>(± dB) | Acceptance<br>Limit<br>(± dB) |
|-------------------|-------------------------|-----------------------|-------------------------------|
|                   |                         |                       |                               |
| FAST / A / 37~139 | 114.0                   | 0.0                   | 0.3                           |
|                   |                         |                       |                               |
| STD Setting       | 114.0                   | 0.0                   | 0.3                           |
|                   |                         |                       |                               |
| Initial           | 114.0                   | 0.0                   | 0.3                           |
|                   |                         |                       |                               |
| Final             | 114.0                   | 0.0                   | 0.3                           |
|                   |                         |                       |                               |
| Deviated          | 0.0                     | 0.1                   | 0.3                           |
|                   |                         |                       |                               |

8. Level linearity on the reference level range

| UUC Setting       | Anticipated<br>REF<br>(dB) | Deviation   |             | UNCERTAINTY<br>(± dB) | Acceptance<br>Limit<br>(± dB) |
|-------------------|----------------------------|-------------|-------------|-----------------------|-------------------------------|
|                   |                            | UUC<br>(dB) | ERR<br>(dB) |                       |                               |
| FAST / A / 37~139 | 140                        | 140.0       | 0.0         | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| STD dB            | 139                        | 139.0       | 0.0         | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 140.00            | 134                        | 134.0       | 0.0         | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 139.00            | 129                        | 129.0       | 0.0         | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 134.00            | 124                        | 124.0       | 0.0         | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 129.00            | 119                        | 119.0       | 0.0         | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 124.00            | 114                        | 114.0       | 0.0         | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 119.00            | 109                        | 109.0       | 0.0         | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 114.00            | 104                        | 104.0       | 0.0         | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 109.00            | 99                         | 98.9        | -0.1        | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 104.00            | 94                         | 93.9        | -0.1        | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 99.00             | 89                         | 88.9        | -0.1        | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 94.00             | 84                         | 83.9        | -0.1        | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 89.00             | 79                         | 78.9        | -0.1        | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 84.00             | 74                         | 73.9        | -0.1        | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 79.00             | 69                         | 68.9        | -0.1        | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 74.00             | 64                         | 63.9        | -0.1        | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 69.00             | 59                         | 58.9        | -0.1        | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 64.00             | 54                         | 53.9        | -0.1        | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 59.00             | 49                         | 48.9        | 0.0         | 0.3                   | 0.8                           |
|                   |                            |             |             |                       | 1.1                           |
| 54.00             | 44                         | 44.2        | 0.2         | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 49.00             | 43                         | 43.2        | 0.2         | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 44.00             | 42                         | 42.3        | 0.3         | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 43.00             | 41                         | 41.4        | 0.4         | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 42.00             | 41                         | 41.4        | 0.4         | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |
| 41.00             | 41                         | 41.4        | 0.4         | 0.3                   | 1.1                           |
|                   |                            |             |             |                       | 1.1                           |



### Certificate of Calibration

#### Customer

Name UNITED ANALYST AND ENGINEERING CONSULTANT CO.LTD. Certificate No : 23-SLM-186  
Address 81 Soi Udomsuk 41, Sukhumvit Road, Bangteak, Prakong, Bangkok Request No : Req-2023-1165  
10260

#### Unit Under Calibration Details

Measurement Item : Sound Level Meter Microphone Class : 2  
Manufacturer : LARSON DAVIS Microphone Model : 375B02  
Model : LX12 Microphone S/N : 11794  
Serial Number : 0005342 Preamplifier Model : PRMLX12B  
ID : UAE EPM.039/2563 Preamplifier S/N : 056134  
Resolution : 0.1 dB Instrument Status : Used

#### Calibration Environment and Details

Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 26 May 2023  
Calibrated Date : 2 June 2023

Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

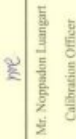
#### Reference Standard

| Instrument                 | Brand   | Model     | S/N       | Due calibration | Traceability |
|----------------------------|---------|-----------|-----------|-----------------|--------------|
| Standard Microphone        | GRAS    | 40AN      | 188273    | 6 October 2023  | GRAS         |
| Multi-frequency Calibrator | Quest   | Quest-cal | EFA000234 | 29 June 2023    | TSI          |
| Audio Generator            | Soundck | Sva401    | 131       | 12 October 2023 | WK Electric  |

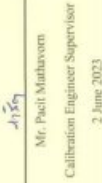
#### Note

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. Noppadol Luangrat  
Calibration Officer

Approved By :

  
Mr. Paet Mahavorn  
Calibration Engineer Supervisor

Issue Date :

2 June 2023

Certificate No : 23-SLM-027  
Request No : Req-2023-0155

#### 12. Overload Indication

| UUC Setting             | Measured | UNCERTAINTY | Acceptance Limit |
|-------------------------|----------|-------------|------------------|
| FAST / A / 37-139       | UUC (dB) | ( ± dB)     | ( ± dB)          |
| STD Setting             |          |             |                  |
| Positive one-half cycle | 142.5    |             |                  |
| Negative one-half cycle | 142.4    |             |                  |
| Deviated                | 0.1      | 0.2         | 1.5              |

#### 13. High Level Stability

| UUC Setting       | Measured | UNCERTAINTY | Acceptance Limit |
|-------------------|----------|-------------|------------------|
| FAST / A / 37-139 | UUC (dB) | ( ± dB)     | ( ± dB)          |
| STD Setting       |          |             |                  |
| Initial           | 138.0    |             |                  |
| Final             | 138.0    |             |                  |
| Deviated          | 0.0      | 0.1         | 0.3              |

End of Certificate



Certificate No : 23-SLM-186  
Request No : Req-2023-1165

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

| UUC Setting   |  | Deviation from various Frequency |        |        |  | UNCERTAINTY | Acceptance Limit<br>( $\pm$ dB) |
|---------------|--|----------------------------------|--------|--------|--|-------------|---------------------------------|
| FAST / 37-139 |  | Weighting Response curve         |        |        |  |             |                                 |
| STD Setting   |  | A (dB)                           | C (dB) | Z (dB) |  | ( $\pm$ dB) |                                 |
| 63 Hz         |  | -0.1                             | 0.0    | 0.0    |  |             | 2.0                             |
| 125 Hz        |  | -0.1                             | 0.0    | 0.0    |  |             | 1.5                             |
| 250 Hz        |  | -0.1                             | 0.0    | 0.0    |  |             | 1.5                             |
| 500 Hz        |  | 0.0                              | 0.0    | 0.0    |  |             | 1.5                             |
| 1000 Hz       |  | 0.0                              | 0.0    | 0.0    |  | 0.2         | 1.0                             |
| 2000 Hz       |  | 0.0                              | 0.1    | 0.0    |  |             | 2.0                             |
| 4000 Hz       |  | 0.0                              | 0.0    | 0.0    |  |             | 3.0                             |
| 8000 Hz       |  | 0.0                              | 0.0    | 0.0    |  |             | 5                               |
| 16000 Hz      |  | 0.0                              | -0.1   | -0.1   |  |             | +5, -INF.                       |

6. Frequency and time weightings at 1kHz

| UUC Setting   | STD REF (dB) | Measured |                            | Acceptance Limit<br>( $\pm$ dB) |
|---------------|--------------|----------|----------------------------|---------------------------------|
|               |              | UUC (dB) | ERR (dB)                   |                                 |
|               |              | ERR (dB) | UNCERTAINTY<br>( $\pm$ dB) |                                 |
| FAST / 37-139 |              |          |                            |                                 |
| UUC Weighting |              |          |                            |                                 |
| A             | 114.00       | 114.0    | 0.0                        | 0.2                             |
| C             | 114.00       | 114.0    | 0.0                        | 0.2                             |
| Z             | 114.00       | 114.0    | 0.0                        | 0.2                             |

| UUC Setting       | STD REF (dB) | Measured |                            | Acceptance Limit<br>( $\pm$ dB) |
|-------------------|--------------|----------|----------------------------|---------------------------------|
|                   |              | UUC (dB) | ERR (dB)                   |                                 |
|                   |              | ERR (dB) | UNCERTAINTY<br>( $\pm$ dB) |                                 |
| 37-139 / A        |              |          |                            |                                 |
| UUC Time Response |              |          |                            |                                 |
| Fast              | 114.00       | 114.0    | 0.0                        | 0.1                             |
| Slow              | 114.00       | 114.0    | 0.0                        | 0.1                             |
| Leq               | 114.00       | 114.0    | 0.0                        | 0.1                             |

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Certificate No : 23-SLM-186  
Request No : Req-2023-1165

1. Indication at the calibration check frequency

| UUC Setting        | Nominal Level (dB) | Before Adjust |                            | After Adjust |                            | UNCERTAINTY<br>( $\pm$ dB) | Acceptance Limit<br>( $\pm$ dB) |
|--------------------|--------------------|---------------|----------------------------|--------------|----------------------------|----------------------------|---------------------------------|
|                    |                    | UUC (dB)      | ERR (dB)                   | UUC (dB)     | ERR (dB)                   |                            |                                 |
|                    |                    | ERR (dB)      | UNCERTAINTY<br>( $\pm$ dB) | ERR (dB)     | UNCERTAINTY<br>( $\pm$ dB) |                            |                                 |
| FAST / A / 37-139  |                    |               |                            |              |                            |                            |                                 |
| Calibrator Setting |                    |               |                            |              |                            |                            |                                 |
| 1000 Hz 114 dB     | 114.54             | 114.4         | -0.14                      | 114.5        | -0.04                      | 0.2                        | 0.3                             |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand 3M, Model AC-300, SN. AC-300001087

2. Self-generated noise, Microphone installed

| UUC Setting | Measured      |                            | UNCERTAINTY<br>( $\pm$ dB) |
|-------------|---------------|----------------------------|----------------------------|
|             | FAST / 37-139 | ERR (dB)                   |                            |
|             | ERR (dB)      | UNCERTAINTY<br>( $\pm$ dB) |                            |
| A           | 28.2          | 0.1                        |                            |

3. Self-generated noise, Microphone replaced by the electrical input signal device

| UUC Setting | Measured      |                            | UNCERTAINTY<br>( $\pm$ dB) |
|-------------|---------------|----------------------------|----------------------------|
|             | FAST / 37-139 | ERR (dB)                   |                            |
|             | ERR (dB)      | UNCERTAINTY<br>( $\pm$ dB) |                            |
| A           | 27.7          | 0.1                        |                            |
| C           | 27.0          | 0.1                        |                            |
| Z           | 31.5          | 0.1                        |                            |

4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting   | Deviation from various Frequency Weighting Response curve |           |           |  | UNCERTAINTY<br>(± dB) | Acceptance Limit<br>(± dB) |
|---------------|---|-----------|-----------|--|-----------------------|----------------------------|
|               | Weighting Response curve                                  |           |           |  |                       |                            |
|               | A<br>(dB)   | C<br>(dB) | Z<br>(dB) |  |                       |                            |
| FAST / 37-139 |   |           |           |  |                       |                            |
| STD Setting   |   |           |           |  |                       |                            |
| 125 Hz        | 0.1   | 0.1       | 0.1       |  | 0.6                   | 2.0                        |
| 1000 Hz       | 0.0   | 0.0       | 0.0       |  | 0.6                   | 1.0                        |
| 4000 Hz       | 0.4   | 0.4       | 0.4       |  | 0.6                   | 3.0                        |
| 8000 Hz       | 0.4   | 0.3       | 0.4       |  | 0.7                   | 5.0                        |

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เอกสารไม่ควบคุม

Certificate No : 23-SLM-186  
Request No : Req-2023-1165

9. Level linearity including the level range control

| UUC Setting | STD<br>REF | Measured    |             | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------|------------|-------------|-------------|----------------------------|------------------------------------|
|             |            | UUC<br>(dB) | ERR<br>(dB) |                            |                                    |
| FAST / A    | 43.0       | 43.1        | 0.1         | 0.3                        | 1.1                                |
|             | 114        | 114.0       | 0.0         |                            | 1.1                                |

10. Tone burst response

| UUC Setting | STD<br>Toneburst<br>(ms) | Anticipated<br>Ref<br>(dB) | Measured    |             | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------|--------------------------|----------------------------|-------------|-------------|----------------------------|------------------------------------|
|             |                          |                            | UUC<br>(dB) | ERR<br>(dB) |                            |                                    |
| Fast        | 200                      | 135.0                      | 134.9       | -0.1        | 0.2                        | 1                                  |
|             | 2                        | 118.0                      | 117.8       | -0.2        |                            | +1.0, -2.5                         |
|             | 0.25                     | 109.0                      | 108.5       | -0.5        |                            | +1.5, -5.0                         |
| Slow        | 200                      | 128.6                      | 128.4       | -0.2        | 0.2                        | 1                                  |
|             | 2                        | 109.0                      | 108.8       | -0.2        |                            | +1.0, -5.0                         |
|             | 200                      | 129.0                      | 129.0       | 0.0         |                            | 1                                  |
| SEL         | 2                        | 109.0                      | 109.0       | 0.0         | +1.0, -2.5                 | +1.0, -2.5                         |
|             | 0.25                     | 106.0                      | 99.7        | -6.3        |                            | +1.5, -5.0                         |

11. Peak C Sound level

| UUC Setting | FAST / C / 95-142   | Anticipated<br>REF<br>(dB) | Measured    |             | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------|---------------------|----------------------------|-------------|-------------|----------------------------|------------------------------------|
|             |                     |                            | UUC<br>(dB) | ERR<br>(dB) |                            |                                    |
| STD Setting | Complete cycle      | 137.4                      | 136.7       | -0.70       | 0.2                        | 3.0                                |
|             | Positive half cycle | 136.4                      | 136.2       | -0.20       |                            | 2.0                                |
|             | Negative half cycle | 136.4                      | 136.2       | -0.20       |                            | 2.0                                |

Certificate No : 23-SLM-186  
Request No : Req-2023-1165

7. Long Term Stability

| UUC Setting       | Measured<br>UUC<br>(dB) | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------------------|----------------------------|------------------------------------|
|                   |                         |                            |                                    |
| FAST / A / 37-139 | 114.0                   |                            |                                    |
|                   | 114.0                   |                            |                                    |
| Deviated          | 0.0                     | 0.1                        | 0.3                                |

8. Level linearity on the reference level range

| UUC Setting | FAST / A / 37-139 | Anticipated<br>REF<br>(dB) | Deviation   |             | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------|-------------------|----------------------------|-------------|-------------|----------------------------|------------------------------------|
|             |                   |                            | UUC<br>(dB) | ERR<br>(dB) |                            |                                    |
| STD dB      | 139.00            | 139                        | 139.0       | 0.0         |                            | 1.1                                |
|             | 134.00            | 134                        | 134.0       | 0.0         |                            | 1.1                                |
|             | 129.00            | 129                        | 129.0       | 0.0         |                            | 1.1                                |
|             | 124.00            | 124                        | 124.0       | 0.0         |                            | 1.1                                |
|             | 119.00            | 119                        | 119.0       | 0.0         |                            | 1.1                                |
|             | 114.00            | 114                        | 114.0       | 0.0         |                            | 1.1                                |
|             | 109.00            | 109                        | 109.0       | 0.0         |                            | 1.1                                |
|             | 104.00            | 104                        | 104.0       | 0.0         |                            | 1.1                                |
|             | 99.00             | 99                         | 99.0        | 0.0         |                            | 1.1                                |
|             | 94.00             | 94                         | 94.0        | 0.0         |                            | 1.1                                |
|             | 89.00             | 89                         | 89.0        | 0.0         |                            | 1.1                                |
|             | 84.00             | 84                         | 84.0        | 0.0         |                            | 1.1                                |
|             | 79.00             | 79                         | 79.0        | 0.0         | 0.3                        | 1.1                                |
|             | 74.00             | 74                         | 74.0        | 0.0         |                            | 1.1                                |
|             | 69.00             | 69                         | 69.0        | 0.0         |                            | 1.1                                |
|             | 64.00             | 64                         | 64.0        | 0.0         |                            | 1.1                                |
|             | 59.00             | 59                         | 59.0        | 0.0         |                            | 1.1                                |
|             | 54.00             | 54                         | 54.0        | 0.0         |                            | 1.1                                |
|             | 49.00             | 49                         | 49.0        | 0.0         |                            | 1.1                                |
|             | 44.00             | 44                         | 44.1        | 0.1         |                            | 1.1                                |
|             | 39.00             | 39                         | 39.3        | 0.3         |                            | 1.1                                |
|             | 38.00             | 38                         | 38.4        | 0.4         |                            | 1.1                                |
|             | 37.00             | 37                         | 37.6        | 0.6         |                            | 0.8                                |





## Certificate of Calibration

### Customer

Name UNITED ANALYST AND ENGINEERING CONSULTANT CO.LTD. Certificate No : 23-SLM-224  
Address 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok Request No : Req-2023-1412  
10260

### Unit Under Calibration Details

Measurement Item : Sound Level Meter  
Manufacturer : LARSON DAVIS  
Model : LxT2  
Serial Number : 0005289  
ID : UAE.LPM.105.2562  
Resolution : 0.1 dB  
Pre-amplifier Model : PRMLxT2B  
Pre-amplifier SN : 056076  
Instrument Status : Used

### Calibration Environment and Details

Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 26 June 2023  
Calibrated Date : 28 June 2023  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

### Reference Standard

| Instrument              | Brand   | Model     | SN        | Due calibration | Traceability |
|-------------------------|---------|-----------|-----------|-----------------|--------------|
| Standard Microphone     | GRAS    | 40AN      | 188273    | 6 October 2023  | GRAS         |
| Midfrequency Calibrator | Quest   | Quest-cal | EFA000234 | 29 June 2023    | TSI          |
| Audio Generator         | Svanick | Svan401   | 131       | 13 October 2023 | WK Electric  |

### 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. Noppakorn Luangrat  
Calibration Officer

Approved By :

Mr. Pait Mahavorn  
Calibration Engineer Supervisor  
Issue Date : 28 June 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

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Certificate No : 23-SLM-186

Request No : Req-2023-1165

### 12. Overload indication

| UUC Setting             | Measured | UNCERTAINTY | Acceptance Limit |
|-------------------------|----------|-------------|------------------|
| FAST / A / 37.139       | UUC      | ( ± dB)     | ( ± dB)          |
| STD Setting             | (dB)     |             |                  |
| Positive one-half cycle | 141.8    |             |                  |
| Negative one-half cycle | 142.0    |             |                  |
| Deviated                | -0.2     | 0.2         | 1.5              |

### 13. High Level Stability

| UUC Setting       | Measured | UNCERTAINTY | Acceptance Limit |
|-------------------|----------|-------------|------------------|
| FAST / A / 37.139 | UUC      | ( ± dB)     | ( ± dB)          |
| STD Setting       | (dB)     |             |                  |
| Initial           | 138.0    |             |                  |
| Final             | 138.0    |             |                  |
| Deviated          | 0.0      | 0.1         | 0.3              |

End of Certificate

เอกสารไม่ควบคุม



Certificate No : 23-SLM-224  
Request No : Req-2023-1412

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

| UUC Setting<br>FAST / 37-139 | Deviation from various Frequency<br>Weighting Response curve |        |        | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|------------------------------|--|--------|--------|----------------------------|------------------------------------|
|                              | A (dB)   | C (dB) | Z (dB) |                            |                                    |
| STD Setting                  |  |        |        |                            |                                    |
| 63 Hz                        | -0.1   | 0.0    | 0.0    |                            | 2.0                                |
| 125 Hz                       | -0.1   | 0.1    | 0.0    |                            | 1.5                                |
| 250 Hz                       | 0.0  | 0.0    | 0.0    |                            | 1.5                                |
| 500 Hz                       | 0.0  | 0.1    | 0.0    |                            | 1.5                                |
| 1000 Hz                      | 0.0  | 0.0    | 0.0    | 0.2                        | 1.0                                |
| 2000 Hz                      | 0.1  | 0.1    | 0.0    |                            | 2.0                                |
| 4000 Hz                      | 0.0  | 0.1    | 0.1    |                            | 3.0                                |
| 8000 Hz                      | 0.0  | 0.0    | 0.1    |                            | 5                                  |
| 16000 Hz                     | 0.0  | 0.0    | -0.1   |                            | +5, -INF.                          |

6. Frequency and time weightings at 1kHz

| UUC Setting   | STD REF (dB) | Measured |          | Acceptance Limit<br>( $\pm$ dB) |
|---------------|--------------|----------|----------|---------------------------------|
|               |              | UUC (dB) | ERR (dB) |                                 |
|               |              | 114.0    | 0.0      |                                 |
| FAST / 37-139 |              |          |          |                                 |
| UUC Weighting |              |          |          |                                 |
| A             | 114.00       | 114.0    | 0.0      | 0.2                             |
| C             | 114.00       | 114.0    | 0.0      | 0.2                             |
| Z             | 114.00       | 114.0    | 0.0      | 0.2                             |

| UUC Setting       | STD REF (dB) | Measured |          | UNCERTAINTY ( ± dB) | Acceptance Limit ( ± dB) |
|-------------------|--------------|----------|----------|---------------------|--------------------------|
|                   |              | UUC (dB) | ERR (dB) |                     |                          |
| 37-139 / A        |              |          |          |                     |                          |
| UUC Time Response |              |          |          |                     |                          |
| Fast              | 114.00       | 114.0    | 0.0      |                     | 0.1                      |
| Slow              | 114.00       | 114.0    | 0.0      | 0.2                 | 0.1                      |
| Leq               | 114.00       | 114.0    | 0.0      |                     | 0.1                      |



Certificate No : 23-SLM-224  
Request No : Req-2023-1412

1. Indication at the calibration check frequency

| UUC Setting        | Nominal Level (dB) | Before Adjust |          | After Adjust |          | UNCERTAINTY<br>( $\pm$ dB) | Acceptance Limit<br>( $\pm$ dB) |
|--------------------|--------------------|---------------|----------|--------------|----------|----------------------------|---------------------------------|
|                    |                    | UUC (dB)      | ERR (dB) | UUC (dB)     | ERR (dB) |                            |                                 |
| FAST / A / 37-139  |                    |               |          |              |          |                            |                                 |
| Calibrator Setting |                    |               |          |              |          |                            |                                 |
| 1000 Hz 114 dB     | 113.77             | 114.1         | +0.33    | 113.8        | +0.03    | 0.2                        | 0.3                             |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN: 73246

2. Self-generated noise, Microphone installed

| UUC Setting   | Measured |  | UNCERTAINTY<br>( $\pm$ dB) |
|---------------|----------|--|----------------------------|
|               |          |  |                            |
|               |          |  |                            |
| FAST / 37-139 |          |  |                            |
| UUC Weighting |          |  |                            |
| A             | 30.0     |  | 0.1                        |

3. Self-generated noise, Microphone replaced by the electrical input signal device

|  | UUC Setting   | Measured<br>(dB) | UNCERTAINTY<br>( $\pm$ dB) |
|--|---------------|------------------|----------------------------|
|  | FAST / 37-139 |                  |                            |
|  | UUC Weighting |                  |                            |
|  | A             | 29.7             | 0.1                        |
|  | C             | 29.1             | 0.1                        |
|  | Z             | 33.7             | 0.1                        |

4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting   | Deviation from various Frequency Weighting Response curve |           |           |  | UNCERTAINTY<br>( $\pm$ dB) | Acceptance Limit<br>( $\pm$ dB) |
|---------------|---|-----------|-----------|--|----------------------------|---------------------------------|
|               |   |           |           |  |                            |                                 |
|               | A<br>(dB)   | C<br>(dB) | Z<br>(dB) |  |                            |                                 |
| FAST / 37-139 |   |           |           |  |                            |                                 |
| STD Setting   |   |           |           |  |                            |                                 |
| 125 Hz        | 0.0   | 0.2       | 0.0       |  | 0.6                        | 2.0                             |
| 1000 Hz       | 0.0   | 0.0       | 0.0       |  | 0.6                        | 1.0                             |
| 4000 Hz       | 1.1   | 1.1       | 1.1       |  | 0.6                        | 3.0                             |
| 8000 Hz       | 2.4   | 2.4       | 2.4       |  | 0.7                        | 5.0                             |

Certificate No : 23-SLM-224  
Request No : Req-2023-1412

9. Level linearity including the level range control

| UUC Setting | STD<br>REF<br>(dB) | Measured    |             | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------|--------------------|-------------|-------------|----------------------------|------------------------------------|
|             |                    | UUC<br>(dB) | ERR<br>(dB) |                            |                                    |
| FAST / A    | 44.8               | 44.9        | 0.1         | 0.3                        | 1.1                                |
|             | 114                | 114.0       | 0.0         |                            |                                    |

10. Tone burst response

| UUC Setting | STD<br>Toneburst<br>(ms) | Anticipated<br>Ref<br>(dB) | Measured    |             | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------|--------------------------|----------------------------|-------------|-------------|----------------------------|------------------------------------|
|             |                          |                            | UUC<br>(dB) | ERR<br>(dB) |                            |                                    |
| Fast        | 200                      | 135.0                      | 134.9       | -0.1        | 0.2                        | 1                                  |
|             | 2                        | 118.0                      | 117.8       | -0.2        |                            | +1.0, -2.5                         |
|             | 0.25                     | 109.0                      | 108.6       | -0.4        |                            | +1.5, -5.0                         |
| Slow        | 200                      | 128.6                      | 128.5       | -0.1        | 0.2                        | 1                                  |
|             | 2                        | 109.0                      | 108.8       | -0.2        |                            | +1.0, -5.0                         |
|             | 200                      | 129.0                      | 129.0       | 0.0         |                            | 1                                  |
| SEL         | 2                        | 109.0                      | 109.0       | 0.0         | 0.2                        | +1.0, -2.5                         |
|             | 0.25                     | 100.0                      | 99.8        | -0.2        |                            | +1.5, -5.0                         |

11. Peak C Sound level

| UUC Setting | FAST / C / 95-142   | Anticipated<br>REF<br>(dB) | Measured    |             | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------|---------------------|----------------------------|-------------|-------------|----------------------------|------------------------------------|
|             |                     |                            | UUC<br>(dB) | ERR<br>(dB) |                            |                                    |
| STD Setting | Complete cycle      | 137.4                      | 136.7       | -0.70       | 0.2                        | 3.0                                |
|             | Positive half cycle | 136.4                      | 136.2       | -0.20       |                            | 2.0                                |
|             | Negative half cycle | 136.4                      | 136.2       | -0.20       |                            | 2.0                                |

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Certificate No : 23-SLM-224  
Request No : Req-2023-1412

7. Long Term Stability

| UUC Setting<br>FAST / A / 37-139 | Measured<br>UUC<br>(dB) | UNCERTAINTY<br>( ± dB) | Acceptance<br>Limit<br>( ± dB) |
|----------------------------------|-------------------------|------------------------|--------------------------------|
|                                  |                         |                        |                                |
| STD Setting                      | Initial                 | 114.0                  |                                |
|                                  | Final                   | 114.0                  |                                |
| Deviated                         |                         | 0.0                    | 0.1                            |
|                                  |                         |                        | 0.3                            |

8. Level linearity on the reference level range

| UUC Setting       |        | Anticipated<br>REF<br>(dB) | Deviation   |             | UNCERTAINTY<br>(± dB) | Acceptance<br>Limit<br>(± dB) |
|-------------------|--------|----------------------------|-------------|-------------|-----------------------|-------------------------------|
| FAST / A / 37-139 | STD dB |                            | UUC<br>(dB) | ERR<br>(dB) |                       |                               |
| 142.00            | 139.00 | 142                        | 142.0       | 0.0         | 0.3                   | 0.8                           |
|                   |        | 139                        | 139.0       | 0.0         |                       | 1.1                           |
|                   |        | 134                        | 134.0       | 0.0         |                       | 1.1                           |
| 134.00            | 129.00 | 129                        | 129.0       | 0.0         |                       | 1.1                           |
|                   |        | 124                        | 124.0       | 0.0         |                       | 1.1                           |
|                   |        | 119                        | 119.0       | 0.0         |                       | 1.1                           |
| 114.00            | 109.00 | 114                        | 114.0       | 0.0         |                       | 1.1                           |
|                   |        | 109                        | 109.0       | 0.0         |                       | 1.1                           |
|                   |        | 104                        | 104.0       | 0.0         |                       | 1.1                           |
| 99.00             | 94.00  | 99                         | 98.9        | -0.1        |                       | 1.1                           |
|                   |        | 94                         | 93.9        | -0.1        |                       | 1.1                           |
|                   |        | 89                         | 88.9        | -0.1        |                       | 1.1                           |
| 84.00             | 79.00  | 84                         | 83.9        | -0.1        | 1.1                   |                               |
|                   |        | 79                         | 78.9        | -0.1        | 1.1                   |                               |
|                   |        | 74                         | 73.9        | -0.1        | 1.1                   |                               |
| 74.00             | 69.00  | 69                         | 68.9        | -0.1        | 1.1                   |                               |
|                   |        | 64                         | 63.9        | -0.1        | 1.1                   |                               |
|                   |        | 59                         | 58.9        | -0.1        | 1.1                   |                               |
| 59.00             | 54.00  | 54                         | 53.9        | -0.1        | 1.1                   |                               |
|                   |        | 49                         | 49.0        | 0.0         | 1.1                   |                               |
|                   |        | 44                         | 44.1        | 0.1         | 1.1                   |                               |
| 44.00             | 39.00  | 39                         | 39.4        | 0.4         | 1.1                   |                               |

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Certificate No : 23-SLM-224  
Request No : Req-2023-1412

12. Overload indication

| UUC Setting             | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139       | UUC<br>(dB) |                            |                                    |
| STD Setting             |             |                            |                                    |
| Positive one-half cycle | 143.9       |                            |                                    |
| Negative one-half cycle | 144.0       |                            |                                    |
| Deviated                | -0.1        | 0.2                        | 1.5                                |

13. High Level Stability

| UUC Setting       | Measured    | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139 | UUC<br>(dB) |                            |                                    |
| STD Setting       |             |                            |                                    |
| Initial           | 138.0       |                            |                                    |
| Final             | 138.0       |                            |                                    |
| Deviated          | 0.0         | 0.1                        | 0.3                                |

End of Certificate



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 284/23

15 August, 2023

Page : 2 of 2

| Standard<br>Ultrasonic Anemometer<br>m/sec | HOOK GAGE NO. 1425 |                  |                 | TESTED ANEMOMETER |                     |
|--|--------------------|------------------|-----------------|-------------------|---------------------|
|  | Pressure<br>inches | Vacuum<br>inches | Pressure<br>hPa | Velocity<br>m/sec | Correction<br>m/sec |
| 1.00                                       | -                  | -                | -               | 1.0               | 0.00                |
| 3.02                                       | -                  | -                | -               | 2.9               | 0.12                |
| 5.00                                       | -                  | -                | -               | 4.5               | 0.50                |
| 7.04                                       | -                  | -                | -               | 6.9               | 0.14                |
| 9.02                                       | -                  | -                | -               | 8.6               | 0.42                |
| 11.01                                      | -                  | -                | -               | 11.0              | 0.01                |
| 13.01                                      | -                  | -                | -               | 12.6              | 0.41                |
| 15.01                                      | -                  | -                | -               | 15.0              | 0.01                |
| 17.02                                      | -                  | -                | -               | 16.6              | 0.42                |
| 20.02                                      | -                  | -                | -               | 19.9              | 0.12                |

| Wind Aloft Plotting Board                |                       |
|--|-----------------------|
| US DEPARTMENT OF COMMERCE WEATHER BUREAU |                       |
| WIND DIRECTION                           | TESTED WIND DIRECTION |
| 0  | 0                     |
| 90                                       | 90                    |
| 180                                      | 180                   |
| 270                                      | 270                   |

Calibrated by : *Wacharapol*

Mr. Wacharapol Subwat  
Mechanical Engineer



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                                    | ความเป็นกรด-ด่าง (pH)<br>อุณหภูมิ (Temperature)                      | Mettler-Toledo          | Seven Easy S20 /<br>1231155210  | National Food Institute,<br>Ministry of Industry, Thailand | 2401718-001-01    | 11 Mar 24           | 10 Mar 25               | -      |
| 2     | Ion Selective Electrode Meter<br>(ISE)      |  | Orion                   | Star A214 /<br>X36836           | Science Tech Co.,Ltd.                                      | FT004/24          | 27 May 24           | 26 May 25               | -      |
| 3     | BOD Incubator                               | บีโอดี (BOD)   | Arco                    | UR-1320 /<br>(UAE:WAO.018/2551) | Technology Promotion Association<br>(Thailand-Japan)       | 24TJM587          | 1 Apr 24            | 31 Mar 25               | -      |
| 4     | BOD Incubator                               | บีโอดี (BOD)   | Arco                    | UR-1320 /<br>(UAE:WAO.006/2553) | Technology Promotion Association<br>(Thailand-Japan)       | 24TJM588          | 1 Apr 24            | 31 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     | COD Reactor<br>(Heating Block)              | ซีโอดี (COD)   | Hanna                   | HI839800-02 /<br>6480019101     | Hanna Instruments (Thailand) Ltd.                          | HIT-2413-0434     | 25 Mar 24           | 24 Mar 25               | -      |
| 7     | Analytical Balance<br>(Readability 0.01 mg) | ของแข็งแขวนลอย (TSS)<br>ของแข็งละลายทั้งหมด (TDS)                    | Mettler-Toledo          | XSR205DU /<br>C009071872        | National Food Institute,<br>Ministry of Industry, Thailand | 2402283-001-01    | 2 Apr 24            | 1 Apr 25                | -      |
| 8     | Hot Air Oven                                | ของแข็งแขวนลอย (TSS)   | Memmert                 | UF55 /<br>B216.1666             | National Food Institute,<br>Ministry of Industry, Thailand | 2400141-001-01    | 11 Oct 23           | 10 Oct 24               | -      |
| 9     | Digestor Unit                               | ทีเคเอ็น (TKN)   | FOSS<br>TECATOR         | DT2520 /<br>91794469            | FOSS South East Asia                                       | 9809              | 8 Feb 24            | 7 Feb 25                | -      |
| 10    | Distillation Unit<br>(Kjeldahl Method)      | ทีเคเอ็น (TKN)   | FOSS<br>TECATOR         | KT8100 /<br>91889052            | FOSS South East Asia                                       | 8411              | 29 May 23           | 28 May 24               | -      |
| 11    | Conductivity Meter                          | ความเค็ม (Salinity)  | SI Analytics            | Lab955 /<br>16300356            | DKSH Technology Limited                                    | C24240057         | 11 Mar 24           | 10 Mar 25               | -      |
| 12    | UV-VIS Spectrophotometer                    | ฟอสฟอรัสทั้งหมด (Total P), สี (Color),<br>ไนโตรเจนทั้งหมด (Total N), | Agilent<br>Technologies | Cary60 G6860A /<br>MY15410009   | DQE Services Co.,Ltd.                                      | SP24-018          | 7 May 24            | 6 May 25                | -      |
| 13    | UV-VIS Spectrophotometer                    | ซัลเฟต (Sulfate)   | Hitachi                 | U-1900 /<br>2021-064            | DQE Services Co.,Ltd.                                      | SP24-008          | 16 Jan 24           | 15 Jan 25               | -      |



# 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 |
|--------------|--|---|----------------------|--|---|----------------------------------|---------------------|-------------------------|--------|
| <b>Water</b> |  |   |                      |  |   |                                  |                     |                         |        |
| 14           | Turbidity Meter  | Turbidity                                     | Oakton               | T100IR / 1120501017  | Technology Promotion Association (Thailand-Japan) | 23CH1148                         | 14 Sep 23           | 13 Sep 24               | -      |
| 15           | Gas Chromatography - Mass Spectrometer (GC-MS)         | สารประกอบอินทรีย์ระเหยง่าย (VOCs)             | Agilent Technologies | System ID: CN17100005<br>Intoxu 9000 (G3950A) /<br>CN17100005 5977B MSD<br>(G7077B) / US1715M030 | Agilent Technologies (Thailand)<br>Co.,Ltd.       | Preventive Maintenance Checklist | 1 Mar 24            | 1 Mar 25                | -      |
| 16           | Inductively Coupled Plasma (ICP)                       | เหล็ก (Fe)                                    | Agilent Technologies | System ID:G8015A<br>G8015AA /<br>MY18030001  | Agilent Technologies (Thailand)<br>Co.,Ltd.       | Preventive Maintenance Checklist | 13 Nov 23           | 12 Nov 24               | -      |
| 17           | Cold Vapor Atomic Absorption Spectrophotometer (CVAAS) | ปรอท (Mercury)                                | Milestone            | DMA-80 / 11030982  | Sithiporn Associates Co.,Ltd.                     | Service Protocol Report          | 17 Nov 23           | 16 Nov 24               | -      |
| 18           | Cold Vapor Atomic Fluorescence Spectrometer (CVAFS)    | ปรอท (Mercury)                                | Analytik Jena        | mercur DUO plus / K170A0153  | Analytik Jena FarEast Thailand Ltd.               | Maintenance Protocol             | 12 Feb 24           | 10 Feb 25               | -      |
| 19           | Incubator  | โคลิฟอร์มแบคทีเรียทั้งหมด (Coliform Bacteria) | Memmert              | IPP 260 / V615.0187  | Technology Promotion Association (Thailand-Japan) | 24TM648                          | 1 Apr 24            | 31 Mar 25               | -      |
| 20           | Incubator  | โคลิฟอร์มแบคทีเรีย (Fecal Coliform Bacteria)  | Memmert              | IPP 260 / V618.0033  | Technology Promotion Association (Thailand-Japan) | 24TM651                          | 2 Apr 24            | 1 Apr 25                | -      |
| 21           | Water Bath   |   | Memmert              | VNB 14 / L407.0756   | Technology Promotion Association (Thailand-Japan) | 23TM1079                         | 10 Jul 23           | 9 Jul 24                | -      |
| 22           | Analytical Balance                                     |   | OHAUS                | PX623 / C236754745   | DKSH (Thailand) Ltd.                              | C01234158                        | 7 Dec 23            | 6 Dec 24                | -      |

List of Instruments Certification for Air Quality Analysis

| No. | Instrument/Equipment                       | Parameter   | Manufacturer            | Model/Serial No.                           | Calibrator  | Certification No.                       | Date of Calibration | Due date of Calibration | Remark |
|-----|--|---|-------------------------|--|---|---|---------------------|-------------------------|--------|
| Air |  |   |                         |  |   |   |                     |                         |        |
| 1   | Analytical Balance<br>(Readability 0.1 mg) | ฝุ่นละอองรวม (TSP)<br>ฝุ่นละอองขนาดเล็กไม่เกิน 10 ไมครอน (PM-10 ) | Mettler-Toledo          | AB204-S /<br>1128312528                    | Mettler-Toledo (Thailand) Ltd.  | 23MM331                                 | 7 Apr 23            | 5 Apr 24                | -      |
| 2   | Analytical Balance<br>(Readability 0.1 mg) |   | Mettler-Toledo          | AB204-S/FACT /<br>B108115858               | Mettler-Toledo (Thailand) Ltd.  | 23MM332                                 | 7 Apr 23            | 5 Apr 24                | -      |
| 3   | UV-VIS Spectrophotometer                   | NOx as NO <sub>2</sub> , SO <sub>2</sub> , CO                     | Hitachi                 | U-1900 /<br>2021-064                       | DQE Services Co.Ltd.  | SP24-008                                | 16 Jan 24           | 14 Jan 25               | -      |
| 4   | Ion Chromatography Anion<br>(IC)           | HCL   | Dionex                  | DionexAqionRfIC /<br>220380031             | Archemica Lab Co.Ltd.   | Qualification Report<br>Anion (ID#1047) | 23 Apr 24           | 22 Apr 25               | -      |
| 5   | Atomic Absorption<br>Spectrometer (AAS)    | Cadmium, Lead, Mercury  | Agilent<br>Technologies | System IDG8432A<br>AA240FS /<br>MY13160001 | Thailand Institute of Scientific and<br>Technological Research(TISTR) | MTC. ACL. No.<br>358/67                 | 11 Mar 24           | 10 Mar 25               | -      |





## 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.010/2563  
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             | 24.996                    | 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

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**SCIENCE TECH CO., LTD.**

Head Office : 321/43 Nanglinchee Rd. Chongnondsee Yamaawa Bangkok 10120  
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Science Tech Laboratory : 279/27-29 Soi Watpiman Sathupradit 19 Rd.  
Chongnondsee Yamaawa Bangkok 10120 Tel. 0-2285-4101 Fax. 0-2285-4856

Job No. : JF004/24

Certificate No. : FT004/24

Page : 1 of 2

## Certificate of Calibration

Equipment : pH/ISE Meter  
Manufacturer : Orion  
Made in : USA.  
Model : STAR A214  
Serial No. : X36836  
ID No. : UAE.WAT.025/2560  
Ion Selective Model : 9409BN  
Serial No. : ZW1-18420  
Reference Electrode Model : 900100  
Serial No. : ZW1-16834  
Range : 0 to 14 pH  
Resolution : 0.001 pH 0.1 mV  
Submitted by : บริษัท ยูนิคัส แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด  
3 ซอยอุดมสุข 41 ถนนสุขุมวิท แขวงบางจาก  
เขตพระโขนง กรุงเทพฯ 10260  
Ambient Temperature : (25 ± 3) °C  
Relative Humidity : (50 ± 15)%  
Issue date : Monday, May 27, 2024  
Calibrated by : Khannika Sangkham  
Approved by :   
(Khannika Sangkham)  
Laboratory manager

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## Certificate of Calibration

Job No. : JF004/24 Certificate No. : FT004/24  
Received date : Thursday, May 23, 2024 Page : 2 of 2  
Calibration date : Thursday, May 23, 2024

### Condition of this calibration result

- Reference standard materials : Certified Fluoride standard reference solution (Directly measured by differential potentiometry with the aid of potassium fluoride "quasi without transference" against solutions prepared from primary reference materials from NIST)
- 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

### Result of Calibration

Function : pH/ISE Meter with Probe

#### Direct Measurement

First Standard concentrated = 0.1 ppm  
Secondary Standard concentrated = 1 ppm  
Tertiary Standard concentrated = 10 ppm  
Fourthly Standard concentrated = 100 ppm  
Slope = -55.1 mV/Dec.

Channel : I

| Unit Under Calibration | Standard Concentrated (ppm) | UUC Reading (ppm) | Correction (ppm) | Stdev (ppm) |
|------------------------|-----------------------------|-------------------|------------------|-------------|
| Model :                | 0.1                         | 0.104             | -0.004           | 0.00        |
| 9409BN S/N. ZW1-18420  | 1                           | 1.03              | -0.03            | 0.01        |
| 900100 S/N. ZW1-16834  | 10                          | 10.2              | -0.2             | -0.16       |
|                        | 100                         | 100               | 0                | 0.48        |

-0000-

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
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TEL. 0-2717-3000-29 FAX. 0-2719-9444



Cert. No.: 24TM587  
Page : 1 of 3

## Certificate of Calibration

Equipment : BOD Incubator  
Manufacturer : ARCO  
Model : UR-1320  
Serial No. : -  
ID No. : UAE.WAO.018/2551  
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 : 01 April 2024  
Calibration Date : 01 April 2024  
Ambient Temperature : (26 ± 10) °C  
Relative Humidity : (50 ± 30) %  
Calibrated by : Krisda Maloo  
Approved by :   
( ) Porpan Paipim  
(x) Suwit Imjai  
( ) Kunchit Promprat

Issue Date : 5 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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A 0065063



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2404-0004OC-1

Cert. No.: 24TM567  
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:-

| Instrument           | Serial No. | Cert. No. | Traceable | Due Date    |
|----------------------|------------|-----------|-----------|-------------|
| 1 ) Data Acquisition | MY57013711 | 23LM115   | TPA       | 11 Jul 2024 |

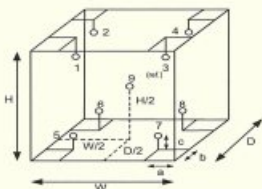
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available



#### Probe Installation Details :

#### Dimension of Chamber :

|     |    |    |            |      |                |
|-----|----|----|------------|------|----------------|
| a = | 10 | cm | D =        | 0.62 | m              |
| b = | 10 | cm | W =        | 1.2  | m              |
| c = | 10 | cm | H =        | 1.2  | m              |
|     |    |    | Capacity = | 0.89 | m <sup>3</sup> |

| Environment during calibration |           |          |
|--------------------------------|-----------|----------|
|                                | Beginning | Finished |
| Temp. ( °C )                   | 27        | 26       |
| REL.Humid. ( % )               | 48        | 49       |
| AC Supply ( Volt )             | 221       | 220      |

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1          | 18-18RTD-01       |
| 2          | 18-18RTD-02       |
| 3          | 18-18RTD-03       |
| 4          | 18-18RTD-04       |
| 5          | 18-18RTD-05       |
| 6          | 23-18RTD-06       |
| 7          | 18-18RTD-07       |
| 8          | 22-18RTD-08       |
| 9 (ref.)   | 18-18RTD-09       |

เอกสารไม่ควบคุม  
a 1209743



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2404-0004OC-1

Cert. No.: 24TM567  
Page : 3 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

| Instrument           | Serial No. | Cert. No. | Traceable | Due Date    |
|----------------------|------------|-----------|-----------|-------------|
| 1 ) Data Acquisition | MY57013711 | 23LM115   | TPA       | 11 Jul 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

| Measured Temperature ( °C ) |        |        |        |        |        |        |        |        |          | Uncertainty ( ± °C ) |
|-----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------------------|
| Point ( °C )                | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9 (ref.) |                      |
| 20.0                        | 19.954 | 20.183 | 20.235 | 19.707 | 19.706 | 19.739 | 19.785 | 19.821 | 19.826   | 0.66                 |

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 %.

-ofo-

เอกสารไม่ควบคุม  
a 1209742



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
554/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 24TM568  
Page : 1 of 3

## Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : ARCO

Model : UR-1320

Serial No. : -

ID No. : UAE.WAO.006/2553

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 : 01 April 2024

Calibration Date : 01 April 2024

Ambient Temperature : ( 26 ± 10 ) °C

Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Krida Malee

Approved by :

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

Issue Date : 5 April 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

A 0065064



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2404-0004OC-2

Cert. No.: 24TM568  
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:-

| Instrument           | Serial No. | Cert. No. | Traceable | Due Date    |
|----------------------|------------|-----------|-----------|-------------|
| 1 ) Data Acquisition | MY57013711 | 23LM115   | TPA       | 11 Jul 2024 |

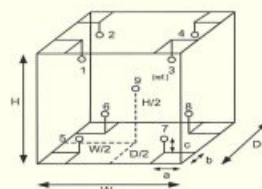
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available



#### Probe Installation Details :

#### Dimension of Chamber :

|     |    |    |            |      |                |
|-----|----|----|------------|------|----------------|
| a = | 10 | cm | D =        | 0.62 | m              |
| b = | 10 | cm | W =        | 1.2  | m              |
| c = | 10 | cm | H =        | 1.2  | m              |
|     |    |    | Capacity = | 0.89 | m <sup>3</sup> |

| Environment during calibration |           |          |
|--------------------------------|-----------|----------|
|                                | Beginning | Finished |
| Temp. ( °C )                   | 26        | 27       |
| REL.Humid. ( % )               | 45        | 47       |
| AC Supply ( Volt )             | 220       | 221      |

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1          | 22-18RTD-2/1      |
| 2          | 18RTD-2/2         |
| 3          | 18RTD-2/3         |
| 4          | 18RTD-2/4         |
| 5          | 18RTD-2/5         |
| 6          | 18RTD-2/6         |
| 7          | 18RTD-2/7         |
| 8          | 18RTD-2/8         |
| 9 (ref.)   | 18RTD-2/9         |

เอกสารไม่ควบคุม

a 1209741





Equipment : BOD Incubator  
 Condition As-Received : Used Item  
 Reference : 2404-0004OC-2  
 Result of Calibration : ( \* ) Without Adjustment  
 Function of UUC\* : Temperature Source  
 Fresh air setting : Not Available

Cert. No.: 24TM588  
 Page : 3 of 3

| Calibration Point (°C) | UUC* Setting (°C) | UUC* Reading (°C) | Temperature stability (± °C) | Temperature uniformity (°C) | Overall Variation (°C) | Coverage Factor k |
|------------------------|-------------------|-------------------|------------------------------|-----------------------------|------------------------|-------------------|
| 20.0                   | 20.0              | 19.8              | 0.47                         | 0.69                        | 1.4                    | 2                 |

| Calibration Point<br>( °C ) | Measured Temperature ( °C ) |        |        |        |        |        |        |        | Uncertainty<br>( ± °C ) |          |
|-----------------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|-------------------------|----------|
|                             | Position                    |        |        |        |        |        |        |        |                         |          |
|                             | 1                           | 2      | 3      | 4      | 5      | 6      | 7      | 8      |                         | 9 (ref.) |
| 20.0                        | 20.289                      | 19.835 | 20.129 | 19.985 | 20.190 | 20.180 | 20.300 | 20.457 | 20.248                  | 0.67     |

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม

a 1209740

## กำหนดจุดห้ามใช้งาน

References Certificate Number. : 234TM588

Equipment : BOD Incubator

Model : UR-1320

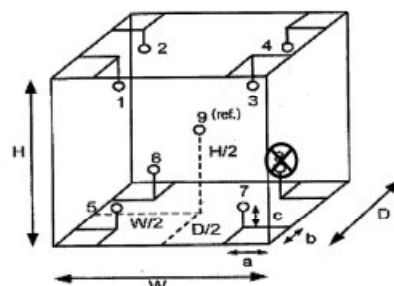
Serial No. : -

ID No. : UAE.WAO.006/2553

Manufacturer : ARCO

Calibration Point : 20.0 °C

Unit Under Calibration Setting : 20.0 °C



รูปภาพเครื่องมือ แสดงจุดที่ได้รับการสอบเทียบ และสัญลักษณ์ ⊗ แสดงจุดห้ามใช้งาน

กำหนดจุดห้ามใช้งานตำแหน่งที่...8.....

หมายเหตุ เก็บใบแนบ

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เอกสารไม่ควบคุม



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 Ruttanaprapachal  
 Approved by :   
 Approved Signatory  
 ( ) Porpan 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.

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Equipment : Electronic Balance  
 Condition As-Received : Used Item  
 Reference : 2405-0168OC-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:-

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

- This certificate is valid only to the item calibrated on date and place of calibration.
- This result of calibration was made on requested at the point specified by customer.
- This certificate is not certified for any commercial transaction.
- 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 :

| Applied Weight (g) | Balance Reading (g) | Correction (g) | Measurement Uncertainty (± mg) | Coverage Factor (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)

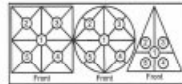
| Applied Weight (g) | Standard Deviation of Reading (g) |
|--------------------|-----------------------------------|
| 100                | 0.00007                           |
| 200                | 0.00007                           |

เอกสารไม่ควบคุม



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

Cert.No.: 24MM293  
Page: 3 of 3



Maximum difference between  
off-center and central loading  
(g)  
0.0003

## 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

| Position 1 | Position 2 | Position 3 | Position 4 | Position 5 |
|------------|------------|------------|------------|------------|
| (g)        | (g)        | (g)        | (g)        | (g)        |
| +0.0002    | -0.0001    | 0.0000     | +0.0002    | 0.0000     |

## 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 %.

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เอกสารไม่ควบคุม



Hanna Instruments (Thailand) Ltd.

410/67-68 Soi Ratchadapisek 24, Ratchadapisek Rd., Samsen-nok,  
Huaykwang, Bangkok 10310 Tel: 0-2541-4199 Fax: 0-2541-4198



Certificate No.: HIT-2413-0434

Page: 1 of 2

## CERTIFICATE OF CALIBRATION

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

Calibrated by : ☒ Mr. Pichit Petthong

☐ Mr. Chuanarong 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.

\*\* This certificate may not be reproduced other than in full, except with the prior written \*\*

approval of the head of Hanna Instrument (Thailand).

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Certificate No.: HIT-2413-0434

Page: 2 of 2

## 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 | AL07155    | 24H41           | Technology Promotion<br>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)    |
| 149.293 | 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



มูลนิธิศูนย์ส่งเสริมมาตรฐานอาหาร  
ศูนย์บริการข้อมูลอาหาร  
Foundation for Industrial Development National Food Institute  
Food Industrial Laboratory Service Center



## Calibration Certificate

Certificate No.: 2402283-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
Address: 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Phrakhanong, 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  
Responsible for the Technical Management Team

Date of Issue: 9 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

2008 ถนนสุขุมวิท 35 ถนนสุขุมวิท แขวงคลองตัน เขตคลองเตย กรุงเทพมหานคร เอกสารไม่ควบคุม  
2008 Soi 35, Anin Areein Road, Bang Wi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand  
Tel: +66(0) 2142 8589 Fax: +66(0) 2142 8545





## Calibration Report

**Certificate No.:** 2402283-001-01  
**Equipment:** Electronic Balance  
**Model:** XSR205DU  
**Serial No.:** C009071872  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.00001 g / 0.0001 g  
**ID No.:** UAE.WAO.012/2563

**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 3rd-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 8095567572 TCS M23040335 8 April 2024

**Instrument Model Serial No. Calibrated By Certificate No. Due Date**  
Thermo-Hygro Meter 608-H1 NFI.BTH 016/23 Quality Return 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               | 0.0000048                         |
| 200               | 0.0000053                         |

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

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

2008 35/35, Anuram Road, Bang Yai Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand  
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545

## Calibration Report

**Certificate No.:** 2402283-001-01  
**Equipment:** Electronic Balance  
**Model:** XSR205DU  
**Serial No.:** C009071872  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.00001 g / 0.0001 g  
**ID No.:** UAE.WAO.012/2563

**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 (g) | Standard Value (g) | Average Reading (g) | Correction (g) | Uncertainty (± g) | Coverage Factor |
|-------------------|--------------------|---------------------|----------------|-------------------|-----------------|
| Unloaded          | 0.000000           | 0.000000            | 0.000000       | 0.0000088         | 2.00            |
| 0.001             | 0.001003           | 0.001011            | -0.000008      | 0.0000091         | 2.00            |
| 0.005             | 0.005003           | 0.004999            | 0.000004       | 0.0000094         | 2.00            |
| 0.01              | 0.010003           | 0.010002            | 0.000001       | 0.0000091         | 2.00            |
| 0.05              | 0.049996           | 0.050000            | 0.000004       | 0.0000098         | 2.00            |
| 0.1               | 0.100011           | 0.100000            | 0.000011       | 0.000011          | 2.00            |
| 0.5               | 0.500016           | 0.500001            | 0.000015       | 0.000014          | 2.00            |
| 1                 | 1.000023           | 1.000002            | -0.000021      | 0.000016          | 2.00            |
| 2                 | 2.000027           | 2.000001            | -0.000026      | 0.000017          | 2.00            |
| 5                 | 5.000017           | 5.000002            | -0.000015      | 0.000020          | 2.00            |
| 10                | 10.000009          | 10.000000           | -0.000009      | 0.000026          | 2.00            |
| 20                | 20.000031          | 20.000002           | -0.000029      | 0.000037          | 2.00            |
| 30                | 30.000040          | 30.000003           | -0.000037      | 0.000052          | 2.00            |
| 50                | 50.000028          | 50.000004           | -0.000024      | 0.000068          | 2.00            |
| 80                | 80.000068          | 80.000005           | -0.000063      | 0.00011           | 2.00            |

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

2008 35/35, Anuram Road, Bang Yai Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand  
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545

## Calibration Report

**Certificate No.:** 2402283-001-01  
**Equipment:** Electronic Balance  
**Model:** XSR205DU  
**Serial No.:** C009071872  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.00001 g / 0.0001 g  
**ID No.:** UAE.WAO.012/2563

**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 (g) | Standard Value (g) | Average Reading (g) | Correction (g) | Uncertainty (± g) | Coverage Factor |
|-------------------|--------------------|---------------------|----------------|-------------------|-----------------|
| 90                | 90.00010           | 90.00000            | -0.00010       | 0.00015           | 2.00            |
| 100               | 100.00006          | 100.00000           | -0.00006       | 0.00015           | 2.00            |
| 110               | 110.00007          | 110.00001           | -0.00006       | 0.00017           | 2.00            |
| 120               | 120.00009          | 120.00000           | -0.00009       | 0.00018           | 2.00            |
| 130               | 130.00010          | 130.00000           | -0.00010       | 0.00019           | 2.00            |
| 140               | 140.00014          | 140.00000           | -0.00014       | 0.00020           | 2.00            |
| 150               | 150.00009          | 150.00001           | -0.00008       | 0.00020           | 2.00            |
| 160               | 160.00010          | 160.00001           | -0.00009       | 0.00022           | 2.00            |
| 170               | 170.00012          | 170.00001           | -0.00011       | 0.00023           | 2.00            |
| 200               | 200.00018          | 200.00000           | -0.00018       | 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

2008 35/35, Anuram Road, Bang Yai Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand  
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545

## Calibration Certificate

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

**Date of Calibration:** 11 October 2023 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 Sooktang  
Scientist

**Approved by:** (Mr.Pheraphat Tuanjit)  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team

**Date of Issue:** 16 October 2023

**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

2008 35/35, Anuram Road, Bang Yai Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand  
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545







# Certificate of Calibration

Certificate No.: C24240057

Page: 2 of 2

**Equipment:** CONDUCTIVITY METER  
**Model:** Lab 955  
**Serial No. (or ID.):** 16300356  
**Manufacturer:** SI Analytic  
**Electrode Serial No.** 16070087  
**Condition:** In Condition

**Certificate No.:** C24240057  
**Issued Date:** 11 March 2024  
**Job No.:** WO-00020309  
**Page:** 1 of 2  
**Model :** LF413T **Brand :** SI Analytic

**Customer:** United Analyst and Engineering Consultant Company Limited  
 3 Soi Udomsuk 41 Sukhumvit Road,  
 Bangkok, Prakanong, Bangkok 10260 Thailand

**Environment Condition:** Temperature 23 °C ± 2 °C  
 Humidity 50 %RH ± 15 %RH

**Calibration Place:** Environment Laboratory, DKSH Technology Limited,  
 2533 Sukhumvit Road, Bangkok,  
 Phrakhanong, Bangkok 10260 Thailand

**Calibration By:** Mr. Pongpisut Suebchantha  
**Calibration Date:** 11 March 2024  
**The Method used:** In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14  
**Traceability:** This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 960753, 890591, 890593

## Calibration Results:

### Before Adjustment

| Standard Conductivity Solution | Unit Under Calibration Reading | Correction   | Coverage Factor (k) | Uncertainty (±) |
|--------------------------------|--------------------------------|--------------|---------------------|-----------------|
| 25.000 µS/cm                   | 26.7 µS/cm                     | -1.700 µS/cm | 2.00                | 0.21 µS/cm      |
| 1413.0 µS/cm                   | 1428 µS/cm                     | -15.0 µS/cm  | 2.00                | 9.0 µS/cm       |
| 111.3 mS/cm                    | 108.4 mS/cm                    | 2.9 mS/cm    | 2.00                | 0.67 mS/cm      |

### After Adjustment : at 1413 µS/cm

| Standard Conductivity Solution | Unit Under Calibration Reading | Correction   | Coverage Factor (k) | Uncertainty (±) |
|--------------------------------|--------------------------------|--------------|---------------------|-----------------|
| 25.000 µS/cm                   | 25.9 µS/cm                     | -0.900 µS/cm | 2.00                | 0.21 µS/cm      |
| 1413.0 µS/cm                   | 1413 µS/cm                     | 0.0 µS/cm    | 2.00                | 9.0 µS/cm       |
| 111.3 mS/cm                    | 107.5 mS/cm                    | 3.8 mS/cm    | 2.00                | 0.67 mS/cm      |

The End of Certificate

(Mr. Pongpisut Suebchantha)

Person in charge

(Mr. Nitinun Srihawan)

Authorized signatory

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

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

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

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 DKSH Technology Limited  
 2533 ซอยสุขุมวิท 41 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
 2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260  
 Phone: +66 2639 7050 Email: info.calibration@dksh.com Website: www.dksh.com/certificatio-thailand

Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม

CAL-FM-CA-09: 12 Sep 2022

บริษัท ดีเคเอส อีเซีย จำกัด  
 DKSH Technology Limited  
 2533 ซอยสุขุมวิท 41 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
 2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260  
 Phone: +66 2639 7050 Email: info.calibration@dksh.com Website: www.dksh.com/certificatio-thailand

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CAL-FM-CA-09: 12 Sep 2022

DQE Services Co., Ltd.

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



## 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, Bangkok, 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. Tanawat Ritidach)  
 Technical Manager

**Approved by :**   
 (Ms. Chonhicha Sangsorn)  
 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.

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DQE Services Co., Ltd.

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Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



## REPORT OF CALIBRATION

**Certificate No. :** SP24-018 **Page** 2 of 5

**Environment Condition :** Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 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 Starna 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.


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DQE

Services

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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>k |
|---------------------|----------------------|----------------------|---------------------|----------------------|----------------------|
| 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                 |

เอกสารไม่ควบคุม

DQE

Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230  
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

# 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>k |
|---------------------|----------------------|----------------------|---------------------|----------------------|----------------------|
| 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                 |

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Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

ISO-9001:2015  
CALIBRATION DATA

# 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>k |
|----------------------|----------------------|---------------------|----------------------|----------------------|
| 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                 |


เอกสารไม่ควบคุม

DQE Services Co.,Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

  
ISO-15187-1:2015  
CALIBRATION DATA

**CERTIFICATE OF CALIBRATION**

**Certificate No. :** SP24-008

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 :** Hitachi

**Model :** U-1900

**Serial No. :** 2021-064

**ID No. :** UAE.WAS.006/2552


**Received Date :** 16 January 2024

**Calibration Date :** 16 January 2024

**Issue Date :** 19 January 2024


**Condition Instrument :** Good

**Calibrated by :**

  
( Mr. Tanawut Rittidach )

Technical Manager

**Approved by :**

  
( Ms. Chonthicha Sangnern )

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 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 DQE Services Co., Ltd.

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## REPORT OF CALIBRATION

Certificate No. : SP24-008

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 Starna Scientific Limited

Spectral Band Width of UUC : 4.0 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

FM-706-02 R01 1/11/2021



## REPORT OF CALIBRATION

Certificate No. : SP24-008

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>k |
|---------------------|----------------------|----------------------|---------------------|----------------------|----------------------|
| 420                 | 0.0000               | 0.000                | 0.0000              | 0.0028               | 2.00                 |
|                     | 0.5780               | 0.575                | 0.0030              | 0.0031               | 2.00                 |
|                     | 1.0484               | 1.046                | 0.0024              | 0.0029               | 2.00                 |
|                     | 2.1876               | 2.186                | 0.0016              | 0.0080               | 2.00                 |
| 440                 | 0.0000               | 0.000                | 0.0000              | 0.0028               | 2.00                 |
|                     | 0.5595               | 0.558                | 0.0015              | 0.0034               | 2.00                 |
|                     | 1.0239               | 1.024                | -0.0001             | 0.0035               | 2.00                 |
|                     | 2.1230               | 2.121                | 0.0020              | 0.0079               | 2.00                 |
| 465                 | 0.0000               | 0.000                | 0.0000              | 0.0028               | 2.00                 |
|                     | 0.5230               | 0.520                | 0.0030              | 0.0030               | 2.00                 |
|                     | 0.9633               | 0.961                | 0.0023              | 0.0029               | 2.00                 |
|                     | 1.9753               | 1.975                | 0.0003              | 0.0070               | 2.00                 |
| 546.1               | 0.0000               | 0.000                | 0.0000              | 0.0028               | 2.00                 |
|                     | 0.5181               | 0.516                | 0.0021              | 0.0031               | 2.00                 |
|                     | 1.0002               | 0.999                | 0.0012              | 0.0033               | 2.00                 |
|                     | 1.9973               | 1.994                | 0.0033              | 0.0084               | 2.00                 |
| 590                 | 0.0000               | 0.000                | 0.0000              | 0.0028               | 2.00                 |
|                     | 0.5517               | 0.550                | 0.0017              | 0.0030               | 2.00                 |
|                     | 1.0803               | 1.080                | 0.0003              | 0.0030               | 2.00                 |
|                     | 2.0373               | 2.032                | 0.0053              | 0.0080               | 2.00                 |
| 635                 | 0.0000               | 0.000                | 0.0000              | 0.0028               | 2.00                 |
|                     | 0.5591               | 0.558                | 0.0011              | 0.0031               | 2.00                 |
|                     | 1.0518               | 1.051                | 0.0008              | 0.0030               | 2.00                 |
|                     | 1.9274               | 1.923                | 0.0044              | 0.0079               | 2.00                 |

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FM-706-02 R01 1/11/2021



## REPORT OF CALIBRATION

Certificate No. : SP24-008

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>k |
|---------------------|----------------------|----------------------|---------------------|----------------------|----------------------|
| 235                 | 0.0000               | 0.000                | 0.0000              | 0.0050               | 2.00                 |
|                     | 0.7469               | 0.748                | -0.0011             | 0.0057               | 2.00                 |
| 257                 | 0.0000               | 0.000                | 0.0000              | 0.0050               | 2.00                 |
|                     | 0.8674               | 0.865                | 0.0024              | 0.0059               | 2.00                 |
| 313                 | 0.0000               | 0.000                | 0.0000              | 0.0050               | 2.00                 |
|                     | 0.2919               | 0.293                | -0.0011             | 0.0051               | 2.00                 |
| 350                 | 0.0000               | 0.000                | 0.0000              | 0.0050               | 2.00                 |
|                     | 0.6430               | 0.641                | 0.0020              | 0.0055               | 2.00                 |

เอกสารไม่ควบคุม

FM-706-02 R01 1/11/2021



## REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 5 of 5

## Wavelength Accuracy :

| CRMs Values<br>(nm.) | UUC Reading<br>(nm.) | Correction<br>(nm.) | Uncertainty<br>(nm.) | Coverage factor<br>k |
|----------------------|----------------------|---------------------|----------------------|----------------------|
| 241.54               | 241.1                | 0.44                | 0.18                 | 2.00                 |
| 279.40               | 278.9                | 0.50                | 0.18                 | 2.00                 |
| 288.70               | 288.0                | 0.70                | 0.18                 | 2.00                 |
| 334.22               | 333.8                | 0.42                | 0.18                 | 2.00                 |
| 361.26               | 360.8                | 0.46                | 0.18                 | 2.00                 |
| 418.48               | 418.2                | 0.28                | 0.18                 | 2.00                 |
| 446.70               | 446.0                | 0.70                | 0.18                 | 2.00                 |
| 453.20               | 453.1                | 0.10                | 0.18                 | 2.00                 |
| 460.06               | 459.6                | 0.46                | 0.18                 | 2.00                 |
| 536.90               | 536.4                | 0.50                | 0.18                 | 2.00                 |
| 637.94               | 637.6                | 0.34                | 0.18                 | 2.00                 |
| 440.74               | 440.1                | 0.64                | 0.18                 | 2.00                 |
| 472.22               | 472.0                | 0.22                | 0.18                 | 2.00                 |
| 513.70               | 513.5                | 0.20                | 0.18                 | 2.00                 |
| 528.72               | 528.2                | 0.52                | 0.18                 | 2.00                 |
| 574.60               | 574.3                | 0.30                | 0.18                 | 2.00                 |
| 585.48               | 585.0                | 0.48                | 0.20                 | 2.00                 |
| 684.63               | 684.2                | 0.43                | 0.18                 | 2.00                 |
| 740.27               | 740.0                | 0.27                | 0.20                 | 2.00                 |
| 748.28               | 747.8                | 0.48                | 0.18                 | 2.00                 |
| 807.16               | 806.8                | 0.36                | 0.18                 | 2.00                 |
| 879.70               | 879.2                | 0.50                | 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 -

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FM-706-02 R01 1/11/2021





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: 0-2718-9484

Cert.No.: 23CH1148  
Page.: 1 of 2

## Certificate of Calibration

Equipment : Turbidity Meter  
Manufacturer : Oakton  
Model : T100IR  
Serial No. : 1120501017  
ID. No. : UAE.WAT.056/2563  
Condition As-Received: Used Item  
Received Date : 13 September 2023  
Calibration Date : 14 September 2023  
Reference : 2309-0458DSC-1  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Sol Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 20) %  
Calibration Procedure : In - house method : CP-CH11  
based on direct measurement by  
using Formazin standard solution  
Calibrated by : Walalak Sirthean  
Approved by :   
( ) Sathip Meangmai  
( ✓ ) Warakorn Lermagatrakul  
( ) Ponpan Paipim  
Issue Date : 15 September 2023

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

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

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A 0011853



## Agilent CrossLab Start Up Services Agilent Intuvo 9000 Gas Chromatograph Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results.

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.



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Cert.No.: 23CH1148  
Page.: 2 of 2

### Condition of this calibration result

#### 1. Reference Standard Instruments :

This certification is traceable to the International System of unit (SI unit) through:-  
- Technology Promotion Association (Thailand-Japan).

| Instruments           | Serial No. | ID No.   | Certificate No. | Due date     |
|-----------------------|------------|----------|-----------------|--------------|
| 1) Thermo-Hygraph     | 1103328    | 130EC010 | 23C1361         | 13 June 2024 |
| 2) Electronic Balance | 1124013382 | 140RC006 | 23MM18          | 20 Feb 2024  |

#### 2. Standard Material : The Formazin suspension has been prepared gravimetric from

| Material                  | Manufacturer | Lot No.    | Assay  |
|---------------------------|--------------|------------|--------|
| 1) Hexamethylenetetramine | HIMEDIA      | 0000493947 | 99.65% |
| 2) Hydrazinium Sulfate    | HIMEDIA      | 0000522014 | 99.40% |

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

### Calibration result

Performing five - Formazin suspension standard curve by using 0,20,100,400,800 NTU  
Turbidity Meter Serial Number : 1120501017

| Standard<br>Formazine suspension<br>( NTU ) | UUC* Reading<br>( NTU ) | Uncertainty of<br>Measurement<br>( ± NTU ) | Coverage<br>Factor<br>k |
|---|-------------------------|--|-------------------------|
| 0   | 0.00                    | 0.0067                                     | 2.00                    |
| 20  | 20.3                    | 0.39                                       | 2.00                    |
| 100   | 101                     | 0.76                                       | 2.00                    |
| 400   | 401                     | 1.5  | 2.05                    |
| 800   | 800                     | 2.1  | 2.23                    |

Remark - UUC\* = Unit Under Calibration  
- NTU = Nephelometric Turbidity Units

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-

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a 117917

Agilent Intuvo 9000 GC Preventive Maintenance Checklist



## Introduction

### Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

### Important Customer Web Links

- For more information about **Agilent Technologies services**, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>.
- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>.
- Need technical support, FAQs, supplies? - visit our **Support Home page** <http://www.agilent.com/search/support>.
- Videos** about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube channel** at <https://www.youtube.com/user/agilent>.

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## Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Section not applicable" checkboxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Complete the total number of pages field in the Service Completion section
- Ask the customer to sign the Service Completion section including the customer's and your signature.

## Additional Instruction Notes

- Check for any active service notes for this unit. If there are any applicable "Safety" or "Modification Recommended" Service notes, plan to implement the changes on this unit before doing any qualification service.
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with the instrument control software.

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## Preventive Maintenance Procedure

## Clean and inspect GC

- ✓ Unplug power cord from the power source.
- ✓ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ✓ Inspect internal connectors for proper contact and placement.
- ✓ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- ✓ Verify operation of all instrument fans.

## Inlet and detector consumable replacement

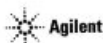
- ✓ For the inlet installed, perform inlet maintenance using the built-in procedures accessed from Agilent 9000 touch screen display or web interface.
- ✓ Replace column Compression Bolts.
- ✓ Replace the split vent trap for the Split/Splitless Capillary (SSL) or Multi-Mode Inlet (MMI) using the built-in procedure accessed from Agilent 9000 touch screen display or web interface.
- ✓ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castle assemblies for contamination – clean as necessary. Use the built-in procedures accessed from Agilent 9000 touch screen display or web interface.
- ✓ Replace the Guard Chip or Jumper Chip for the Split/Splitless Capillary (SSL) or Multi-Mode Inlet (MMI) using the built-in procedure accessed from Agilent 9000 touch screen display or web interface.

## Inlet and Detector Tests

- ✓ Zero all pressure sensors.
- ✓ Perform the inlet pressure leak test.
- ✓ Perform the inlet restriction test.
- ✓ Perform the FID jet restriction test if FID installed.
- ✓ Perform the FID leakage test if FID installed.
- ✓ Record if test passed or failed in the results table.

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## System Information

- ☐ Check this box if an instrument configuration report is attached instead of completing the table below.

|                                     |            |
|-------------------------------------|------------|
| Instrument System Name and ID       | CN17100005 |
| Instrument System Site and Location | UAE        |

| List System Component Product Numbers | List the Serial Numbers of each Component |
|---------------------------------------|---|
| 1. G3950A                             | CN17100005                                |
| 2.                                    |   |
| 3.                                    |   |
| 4.                                    |   |
| 5.                                    |   |
| 6.                                    |   |
| 7.                                    |   |
| 8.                                    |   |
| 9.                                    |   |
| 10.                                   |   |

## Preparation

- ✓ Discuss any specific issues with the customer before starting.
- ✓ Review the instrument logbook for recorded problems and comments.
- ✓ Save instrument control settings before starting the procedure.
- ✓ Perform a general inspection of the system for cleanliness.
- ✓ Check for proper installation of parts, assemblies, sensors etc.
- ✓ Check system for required installation of components, settings as defined by current Service Notes.
- ✓ Check for required firmware updates and verify with customers if they would like them installed.
- ✓ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.

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## ALS Maintenance

- ✓ Check all cabling and configuration settings between GC, tray, and injectors.
- ✓ Vacuum or remove any dust, especially around fans.
- ✓ Check operation of all fans.
- ✓ Check syringe for smooth plunger operation.
- ✓ Check for smooth operation of the needle support rod – clean if necessary
- ✓ Check for correct operation of syringe volume stops

## Restore Instrument

- ✓ Restore the normal operating conditions using the Keyboard or Data System.
- ✓ Check and record the post PM detector signal output values. Results should be similar or lower than the detector outputs recorded prior to PM.
- ✓ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

## Guidance:

If the PM Service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

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## Signature Page

## Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review with the customer this service, parts replaced, and test results obtained.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

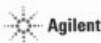
## PM Test Results Table

| Detector Signal Outputs | Before PM Service | After PM Service |
|-------------------------|-------------------|------------------|
| Detector output [D1]    | 25                | 18               |
| Detector output [D2]    | N/A               |                  |

| Tests                                     | Expected Result | Actual Result or N/A |
|---|-----------------|----------------------|
| Inlet Leak Test                           | Pass            | Pass                 |
| Inlet Restriction Test                    | Pass            | Pass                 |
| FID jet restriction test if FID installed | Pass            | Pass                 |
| FID leakage test if FID installed         | Pass            | Pass                 |

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## Intuvo Parts List Table

Note: The following kits are recommended for capillary and MultiMode inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

| Part Description             | Part Number | Product/Model # where used | Quantity Consumed |
|------------------------------|-------------|----------------------------|-------------------|
| FID Jet 0.11 inch ID         | 5200-0176   | G3950A                     |                   |
| Inlet PM Kit                 | 5188-6497   | G3950A                     |                   |
| FID Ignitor Glow Plug        | 19231-60680 | G3950A                     |                   |
| Bus Bolt with Washer         | G4581-60260 | G3950A                     |                   |
| Guard Chip for SS inlet      | G4587-60565 | G3950A                     |                   |
| Guard Chip for MMI           | G4587-60665 | G3950A                     |                   |
| Jumper Chip for SS inlet     | G4587-60575 | G3950A                     |                   |
| Jumper Chip for MMI          | G4587-60675 | G3950A                     |                   |
| Column Compression Bolts     | G4581-60260 | G3950A                     |                   |
| Split Vent Trap Filter (2pk) | 5188-6497   | G3950A                     |                   |

## Service Engineer Comments

If there are any specific points you wish to note as part of performing the service or other items of interest for the customer, please write include them in this box.

## Service Completion

Service request number 6906726359 Date service completed 1 Mar 2024

Agilent signature [Signature] Customer signature \_\_\_\_\_

Total number of pages in this document \_\_\_\_\_

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### 7697A Headspace Sampler Preventive Maintenance Checklist - Enhanced

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results. Delivered by highly-trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. For more information about Agilent Technologies services please visit our web site using the following URL <http://www.chem.agilent.com/en-us/products/services/pages/default.aspx>

## Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of additional or special procedures and/or parts for the instrument service, then these must be ordered separately and charged as a repair, which may incur additional costs.

## Service Engineer's Responsibilities

- Only complete/printout pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "✓" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- It is important to consult with the customer prior to a PM to determine which parts are installed in the instrument to decide if individual components need to be purchased rather than the 7697A Standard PM Kit. The 7697A Standard PM Kit contents are based off of the contents of the original shipment. Different types of deactivated treatment for the sample probe and sample loop, different sample loop sizes, and transfer line sizes may require for individual parts to be ordered to perform the PM procedure. If different parts are required, reference the Agilent supplies catalog for part numbers.

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### 7697A Headspace Sampler Preventive Maintenance Checklist - Enhanced

## System Information

## Guidance

- ☐ Check this box if an instrument configuration report is attached instead of completing the table.

|                                       |   |
|---------------------------------------|---|
| Instrument system name and ID         | CN1710005                                 |
| Instrument system site and location   | UAE                                       |
| List system component product numbers | List the serial numbers of each component |
| 1. G4557-64000                        | 1. CN17110041                             |
| 2.                                    | 2.  |
| 3.                                    | 3.  |
| 4.                                    | 4.  |
| 5.                                    | 5.  |
| 6.                                    | 6.  |
| 7.                                    | 7.  |
| 8.                                    | 8.  |
| 9.                                    | 9.  |
| 10.                                   | 10.                                       |

## Preparation

- ☒ Discuss any specific issues with the customer prior to starting.
- ☒ Review the instrument logbook.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform general inspection of system for cleanliness
- ☒ Check for proper installation of safety-related parts, assemblies, sensors etc
- ☐ Check for required firmware updates and verify with customers if they would like it installed.

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## 7697A Headspace Sampler Preventive Maintenance Checklist - Enhanced



### Inspect and Clean Sampler

- ☐ If a tray is part of the system, remove the tray and pneumatics to allow for access to the oven.
- ☐ If a tray is part of the system, check that the shutter sensor is not dusty. If it is, use air duster to remove the dust.
- ☐ Check for any debris in the carousel and clean if necessary.
- ☐ If a tray is part of the system, reinstall the tray and pneumatics unit.
- ☐ Remove the front panel of the instrument.
- ☐ Check the carousel belt for wear. If it is worn, consult with the customer to determine if it should be replaced.
- ☐ Use a dry, clean cloth to wipe the lifter rod(s) clean. Do not apply any lubricant.
- ☐ Vacuum the inside of the unit.
- ☐ Reinstall the front panel of the instrument.
- ☐ Using the Manual Operations function under the Service Mode Key on the instrument keypad, confirm that the following components work:
  - ☐ Tray Lifter - if present
  - ☐ Sample Lifter
  - ☐ Carousel Motor
  - ☐ Shutter Motor - if present

### Pneumatic Components

- ☐ Remove the sample probe and the sample loop.
- ☐ Replace the six port valve rotor. Do not begin until the valve is cool enough to handle. For complete instructions, refer to your service procedures.
- ☐ Unscrew the valve assembly. Do not move the preset socket adjustment screw.
- ☐ Carefully loosen and remove the rotor from the valve assembly noting the orientation of the rotor tab.
- ☐ Clean and inspect the valve body. Note any scratches. Recommend repairs in the engineer notes.
- ☐ Install the new rotor in the valve assembly with the same orientation.
- ☐ Screw in the valve assembly into the valve body one turn beyond the point where it first touches the rotor.
- ☐ To seat the valve, cycle it 10 times.
- ☐ With the valve in the full clockwise or counterclockwise position, tighten the preload.
- ☐ Cycle the valve 3 times.
- ☐ Install the new sample loop and the new sample probe.
- ☐ Remove the fused silica transfer line.
- Special Note: If OQ will be performed after the PM, remove the fused silica transfer line and do not reinstall it until the transfer line measurement is taken for the OQ procedure.**
- ☐ Reinstall the fused silica transfer line.
- ☐ Use Service Reminders under the Service Mode Key to reset the counter (press the OFF key) of the

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## 7697A Headspace Sampler Preventive Maintenance Checklist - Enhanced



sample probe, sample loop and transfer line.

- ☒ Use the Leak Test under the Service Mode Key on the instrument keypad to run the instrument restriction and leak test. Verify that it passes (make a note below in the tests results table). If it fails, consult the customer for repair options.

### Tray Components

- ☐ Section NOT applicable.
- ☐ Check for any debris in the sample trays and clean if necessary.
- ☐ Check that the tray gantry rod is clean. If it is dirty or dusty, wipe it clean with a dry cloth. Do not apply any kind of lubrication.
- ☐ Check that the sensors are not dusty. If they are, use air duster to remove the dust.
- ☐ Check the tray belts for any wear. If they are worn, consult with the customer to determine if they should be replaced.
- ☐ Verify that the three LED's for the tray racks light up when the trays are installed.
- ☐ Run the tray calibration.
- ☐ Reset the counter (pressing the OFF key) of the tray calibration.

### Restore Instrument

- ☒ Reconnect the headspace transfer line if it has not been already reconnected.
- ☒ Return instrument to initial conditions.
- ☒ Perform system checkout procedure or test.

### Guidance

If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

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## 7697A Headspace Sampler Preventive Maintenance Checklist - Enhanced



### Service Review

- ☐ Attach available reports/printouts of all tests to this documentation.
- ☐ Record the PM service activity in the customer's instrument records/logbook
- ☐ Update/reset instrument maintenance counters as appropriate
- ☐ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☐ Complete the Service Review Comments section below if there are additional comments
- ☐ Review the service and any test results with the customer.
- ☐ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

### 7697A Headspace Sampler Test Results Table

| Test Description       | Expected Test Result | Actual Test Result |
|------------------------|----------------------|--------------------|
| Tray Calibration       | Pass                 | Pass               |
| Leak Test              | Pass                 | Pass               |
| Chemical Checkout Test |                      |                    |

### 7697A Headspace Sampler Parts List Table

| Part Description                         | Part Number | Product or Module where used       | Quantity Consumed                    |
|--|-------------|------------------------------------|--------------------------------------|
| 7697A Enhanced PM Kit                    | G4556-67012 | 7697A HS Sampler                   | 1                                    |
| Ferrule Flexi Inert 0.53mm Col 10/PK NFS | G3188-27503 | 7697A HS Sampler AND G3520A module | 1 (Optional, not included in PM kit) |

### Part numbers and descriptions for the kit contents.

| Part Description   | Part Number | Quantity |
|--|-------------|----------|
| Sample Probe   | G4556-60125 | 1        |
| Sample Loop (1mL)  | G4556-80106 | 1        |
| Six Port Valve Rotor   | 1535-4862   | 1        |
| 7697A Fused Silica and ProSteel Kit                              | G3903-61001 | 1        |
| Polyimide, Valcon Ferrule, 5 pack                                | 0100-2595   | 1        |
| Nut and reducing union for 6 port valve transfer line connection | 0100-2594   | 1        |
| Thermal Gap Insulation Foam                                      | G3530-00610 | 1        |
| Liner, direct, 2mm ID, deactivated                               | 5181-8818   | 1        |

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## 7697A Headspace Sampler Preventive Maintenance Checklist - Enhanced



### Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the service or other items of interest for the customer, please write in this box.

### Other Important Customer Web Links

- ☐ How to get information on your product: Literature Library - <http://www.agilent.com/chem/library>
- ☐ Need to know more? - [www.agilent.com/chem/education](http://www.agilent.com/chem/education)
- ☐ Need technical support, FAQs? - [www.agilent.com/chem/techsupp](http://www.agilent.com/chem/techsupp)
- ☐ Need supplies? - [www.agilent.com/chem/supplies](http://www.agilent.com/chem/supplies)

### Service Completion

Service request number 6906726358 Date service completed 1 Mar 2017

Agilent signature C. J. J. J. Customer signature \_\_\_\_\_

Document part number: G4556-90023

Issued: 10-Feb-2017, Revision: 6

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## Agilent Preventive Maintenance Services

### Agilent GCMS Preventive Maintenance

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results.

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides what you need to reduce unplanned downtime and keep your systems operating at their peak performance.

This checklist is used as a guide for completing the preventive maintenance tasks. A signed copy of this checklist is provided for your records.



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### Introduction

This checklist covers the following model(s):

| Type | Model             |
|------|-------------------|
| SQ   | 5973 Series MSD   |
| SQ   | 5975 Series MSD   |
| SQ   | 5977 Series MSD   |
| TQ   | 7000 Series MS/MS |
| TQ   | 7010 Series MS/MS |
| QTOF | 7200 Series QTOF  |
| QTOF | 7250 Series QTOF  |

### Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures. Customers are responsible for regular maintenance and are encouraged to observe the service representative.
- Any parts not included in the Parts Lists section of this document are not part of the recommended Preventive Maintenance service nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

### Customer Responsibilities

Customers should ensure that all necessary operating supplies, consumables, and usage-dependent items such as gases, vials, syringes, calibrant solution and solvents required for successful preventive maintenance are available. A customer representative should be available while the preventive maintenance is being performed.



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### Important notice for customers

The customer should complete the following before the Support Provider arrives on site:

- Perform an autotune and retain the printed tune report just prior to the start of the PM to verify performance of the equipment.

**Note:** it is recommended to have the customer run the autotune and tune evaluation prior to the PM and then start the vent cycle so that the instrument will be ready for the service representative.

### Important Customer Web Links

- To access Agilent training and education, visit <http://www.agilent.com/chem/training> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- To access the **Agilent Resource Center** web page, visit <https://www.agilent.com/en-us/agilentresources>. The following information topics are available:
  - Sample Prep and Containment
  - Chemical Standards
  - Analysis
  - Service and Support
  - Application Workflows

The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>

Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>

**Need to place a service call?** Flexible Repair Options | Agilent

### Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.



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- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Service not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in order by sections: Review, System Checks, Pump maintenance, Cleaning System and Filters, then System Post Check.
  - The tasks in each section may be completed in the most logical order relevant to the system. Complete the **Service Review** section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Add relevant page numbers to selected pages and complete the total number of pages field in the Service Verification section
- Complete Signature Page and attach Signature Page to Service Order.

### Additional Instruction Notes

- Preventive maintenance is a factory recommended procedure designed to reduce the likelihood of electromechanical failures. Failure to perform preventive maintenance may reduce the long-term reliability of certain instruments and systems. **Two preventative maintenances (PMs) per year are recommended, the Major PM Service will be performed annually with an Interim PM performed 6 months after the Major PM.**

### Definition of the Task/Recommended items within the document

| Task |    | Recommended |       |  |
|------|----|-------------|-------|--|
| Yes  | No | Interim     | Major | As Needed  |
| ✓    |    |             |       | Yes selected means that the task was done or the part was required   |
|      | ✓  |             |       | No selected means that the task was not done or the part was not required.   |
|      |    | ✓           |       | Interim selected means that this task is recommended to be done at 6-month intervals   |
|      |    |             | ✓     | Major selected means that this task is recommended to be done yearly; if the customer would like a service to be done at the 6-month interval then the service could be purchased    |
|      |    |             |       | As needed selected means that the task was done, or the part was used as needed. For example, there could be two types of filters that could be used, and this was the one selected. |



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## Instrument Maintenance

Select the appropriate service to be performed.

- ☐ Interim Preventive Maintenance (when available, is typically 6 months or at the request of the customer)
- ☐ Major Preventive Maintenance (Yearly)
- ☐ Enhanced Preventive Maintenance (when available, is provided "As needed")

## System Information

- ☐ Check this box if an instrument configuration report is attached instead of completing the table.

|                                     |            |
|-------------------------------------|------------|
| Instrument System Name and ID       | CN17100005 |
| Instrument System Site and Location | UAE        |

| List System Component Product Numbers | List the Serial Numbers of each Component |
|---------------------------------------|---|
| 1. 67077B                             | U517154030                                |
| 2.                                    |   |
| 3.                                    |   |
| 4.                                    |   |
| 5.                                    |   |
| 6.                                    |   |

## Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components and implementation of Service Notes
- ☐ Check firmware version(s). Updating to the most current versions is strongly recommended. Verify with the customer before updating.

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## Preventive Maintenance Procedures

☐ Service Not Applicable

## Interim / Major Preventive Maintenance – GC/MS

| Yes/No                              | Interim/Major            | Description   |
|-------------------------------------|--------------------------|---|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Perform general inspection of system for cleanliness.   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Discuss any problems the customer is having with the instrument.  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Review customer maintenance records and exclude maintenance on recently serviced items.   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Review the most recent autotune report. This will give a starting point for evaluating spectral peaks, baseline noise, peak shape, mass assignments and resolution. |

## Interim / Major Preventive Maintenance – System Checks

☐ Service Not Applicable

| Yes/No                              | Interim/Major            | System Checks   |
|-------------------------------------|--------------------------|---|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Verify that calibration peaks were seen prior to starting the PM.   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Vent the instrument.  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Inspect vacuum hoses, pump, exhaust tubing, and power cords for excessive wear.   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Visually inspect calibrant levels – PFTBA/PFTD (if appl.), IRM (if appl.). Refill if available.                                 |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Look for any obvious external damage or problems.   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Clean air intake(s). Cosmetic cover(s) may need to be removed.  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Verify system line voltage meets instrument specifications: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | For HydroInert systems, verify customer is running hydrogen: Yes <input type="checkbox"/> No <input type="checkbox"/>           |

## Interim / Major Preventive Maintenance – Wet Mechanical vacuum pumps

☐ Service Not Applicable

| Yes/No                              | Interim/Major            | Wet Mechanical vacuum pumps   |
|-------------------------------------|--------------------------|---|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check for evidence of oil leakage. Check pump gasket for leakage.   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | GC/MS SQ with diffusion pump; drain and replace diffusion pump oil. |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Drain and replace mechanical pump oil.                              |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Replace Oil Mist Filter if applicable.                              |

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| Yes/No                              | Interim/Major            | Wet Mechanical vacuum pumps  |
|-------------------------------------|--------------------------|--|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Discuss with customer the need for more frequent oil changes if the oil is dirty.  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Don't use mist filters with Chemical Ionization.   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed. Visually confirm that no oil returns up vacuum hose. |

## Interim / Major Preventive Maintenance – Dry Mechanical vacuum pumps - Diaphragm

☒ Service Not Applicable

| Yes/No                   | Interim/Major            | Dry Mechanical vacuum pumps - Diaphragm   |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Check for evidence of poor vacuum – Turbo power demand, poor manifold vacuum, etc.  |
| <input type="checkbox"/> | <input type="checkbox"/> | Clear air flow paths of dust.   |
| <input type="checkbox"/> | <input type="checkbox"/> | If vacuum is poor, then replace the diaphragm pump.   |
| <input type="checkbox"/> | <input type="checkbox"/> | Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed. |

## Interim / Major Preventive Maintenance – Dry Mechanical vacuum pumps - Scroll

☒ Service Not Applicable

| Yes/No                   | Interim/Major            | Dry Mechanical vacuum pumps - Scroll  |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Replace the tip seal on the IOP pump.   |
| <input type="checkbox"/> | <input type="checkbox"/> | Check for evidence of poor vacuum – Rough vac pressure, turbo power demand, poor manifold vacuum, etc.                        |
| <input type="checkbox"/> | <input type="checkbox"/> | Replace the Exhaust Filter if required.   |
| <input type="checkbox"/> | <input type="checkbox"/> | Discuss with customer the need for more frequent changes, if needed.  |
| <input type="checkbox"/> | <input type="checkbox"/> | Inform customer that pump gas ballast should be installed all the time.   |
| <input type="checkbox"/> | <input type="checkbox"/> | Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed. |

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## Interim / Major Preventive Maintenance – Cleaning System and Filters

☐ Service Not Applicable

| Yes/No                              | Interim/Major            | Cleaning System and Filters  |
|-------------------------------------|--------------------------|--|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Fans   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Remove dust from fans and vent covers.   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Verify fans are functional and that there is enough space around the instrument for proper cooling.  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Source cleaning (all sources except HydroInert)  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Open analyzer and remove the source.   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Disassemble, Clean, Re-assemble source. (7200, also, remove and clean entrance lens)   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Re-install source and close analyzer.  |
| <input type="checkbox"/>            | <input type="checkbox"/> | HydroInert Source  |
| <input type="checkbox"/>            | <input type="checkbox"/> | Source NOT to be abrasively cleaned. No cleaning required at PM. If a decrease in performance is observed, recommend to the customer that filaments (repeller and extractor), extractor lens, and repeller lens may need to be replaced to restore performance. HydroInert source should not be run with helium carrier. |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Filters  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Replace RSMH-2 Helium gas filter (collision cell gas) – if applicable.   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Replace RSMH-2 Nitrogen gas filter (collision cell gas) – if applicable.   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Replace RSMHY-2 Hydrogen gas filter (HydroInert and JetClean) – if applicable.   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | CP17973 – Gas Clean GS/MS Filter (for He, N2 or H2 carrier) – if required  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 5190-9071 – Methane Gas Filter (CI systems) – if applicable  |

Guidance: Gas filters need to be changed only if required (ie indicating traps show color change, or if Big Universal Trap are approaching saturation based on time installed or number of gas cylinders changed for that trap)

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## Interim / Major Preventive Maintenance – System Post Check

☐ Service Not Applicable

| System post-check  |   |
|--|---|
| Yes/No Interim/Major   | Description   |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Pump system back down. Wait until system stability has been achieved.                             |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Verify system vacuum reading(s) via the gauge controller.   |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Leak Check  |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Verify system in manual tune  |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Compare against previous tune file report(s)  |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Change to Tune and verify that all temperatures, pressures, and gas flows reach method set points |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Check manually that you have calibration peaks.   |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | EI Autotune Performed   |

Guidance: If the PM Service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument setup and checkout.

## Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Record the PM event in the Smart Alerts logbook, if applicable.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review this service, parts replaced, and test results obtained with the customer.
- ☐ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box. Systems in a compliant environment may need additional documentation.
- ☐ Complete Signature Page and attach Signature Page to Service Order.

## Test Results

| Test Description | Expected Test Result | Actual Test Result |
|------------------|----------------------|--------------------|
| MTUNE            | Pass                 | Pass               |

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## Signature Page

## Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the service review or other items of interest for the customer, please write in this box.

## Service Verification

Service Request Number:

6006726358

Date of Service Completion:

1 May 2024

Service Engineer Name:

Samant Chinnavong

Customer Name:

Richardson J.

Service Engineer Signature:

C. Tan

Total number of pages in this document:

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## Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES  
Preventive Maintenance

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides what you need to reduce unplanned downtime and keep your systems operating at their peak performance.

This checklist is used as a guide for completing the preventive maintenance tasks. A signed copy of this checklist is provided for your records.



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## Introduction

## Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures. Customers are responsible for regular maintenance and are encouraged to observe the service representative.
- Any parts not included in the Parts Lists section of this document are not part of the recommended Preventive Maintenance service nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.
- For customers using HF applications, the instrument should be returned to its standard sample introduction system.



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### Important Customer Web Links

- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- To access the **Agilent Resource Center** web page, visit <https://www.agilent.com/en-us/agilentresources>. The following information topics are available:
  - Sample Prep and Containment
  - Chemical Standards
  - Analysis
  - Service and Support
  - Application Workflows
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>
- Need to place a service call?** [Flexible Repair Options | Agilent](#)

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### Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Service not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in the most logical order relevant to the individual system service in the order of the tasks listed.
- Complete the **Service Review** section together with the customer.
- Complete the fields for page numbers at the foot of each selected page.
- Add relevant page numbers to selected pages and complete the total number of pages field in the Service Completion section.
- Ask the customer to sign the Service Verification section including the customer's and your signature.

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### Instrument Maintenance

#### System Information

- ☐ Check this box if an instrument configuration report is attached instead of completing the table.

|                                     |                  |
|-------------------------------------|------------------|
| Instrument System Name and ID       | 3110 VDV ICP-OES |
| Instrument System Site and Location | URE              |

| List System Component Product Numbers | List the Serial Numbers of each Component |
|---------------------------------------|---|
| 1. G 3013A                            | 11 15030001                               |
| 2.                                    |   |
| 3.                                    |   |
| 4.                                    |   |
| 5.                                    |   |
| 6.                                    |   |
| 7.                                    |   |
| 8.                                    |   |
| 9.                                    |   |

| ICP-OES Configuration Table | Circle the type or write in the type if other              |
|-----------------------------|--|
| Nebulizer Type              | SeaSpray (OneNeb) Conical   Other                          |
| Spray Chamber               | Cyclonic Single Pass   Cyclonic Double Pass   Other        |
| Torch                       | Radial (Dual View)   Other                                 |
| Torch Type                  | One Piece   Semi Dismountable   Fully Dismountable   Other |
| Injector Diameter           | 2.4mm   1.8mm   1.4mm   0.8mm   Other                      |
| Injector Material           | Quartz   Ceramic   Other                                   |

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### Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components and implementation of Service Notes
- ☒ Check for required firmware/software updates and verify with customers if they would like them installed.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. *NA*
- ☒ Ask the customer to remove any samples from the ICP-OES sample introduction area, auto sampler or around the ICP-OES.

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## Preventive Maintenance Procedures

### Record Pre-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table – Pre-PM.

### Clean and inspect ICP-OES system

- ☒ Look for any obvious external damage or problems.
- ☒ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☒ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☒ Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- ☒ Record the instrument operating conditions in the ICP-OES Status Results Table.
- ☒ Replace the polychromator purge filter.
- ☒ Replace the radial pre-optics window
- ☒ Replace the axial pre-optics window for SVDV and VDV instruments.
- ☒ Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- ☒ Replace air inlet dust filter.
- ☐ Replace high capacity air inlet dust filter element if installed. *with*
- ☒ Remove and clean instrument water inlet filter.

### Agilent Water Recirculator

- ☐ Service not applicable
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir
- ☒ Remove, clean and reinstall water inlet metal mesh filter if present.
- ☒ Re fill with Agilent Cool Clear cooling fluid.
- ☒ Clean the cooling system Air filter and the condenser.

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### SPS 3 Auto Sampler

- ☒ Service not applicable
- ☐ Power cycle the autosampler and verify successful initialization.
- ☐ Inspect X and Z axis belts for wear. Replace is necessary.
- ☐ Clean X and Z axis slide shafts.
- ☐ Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and rinse port, ensure that the probe is approximately centered in the vial.

### SPS 4 Auto sampler

- ☒ Service not applicable
- ☐ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☐ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner.
- ☐ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☐ Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☐ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles
- ☐ Test using customer's tray and move the sample probe to the sample vial 1, wash vial and rinse port and ensure that the probe is centered in the vial. If not use calibration wizard and calibrate the position.

### AVS 4, 6, 7 Advanced Valve System

- ☒ Service not applicable
- ☐ Replace valve rotor seal
- ☐ Check fittings for signs of leaks
- ☐ Check tubing including autosampler tubing for kinks or excessive wear
- ☐ Check high flow pump for signs of leaks

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### ICP-OES adjustment

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.

### Record Post-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above, run the following Instrument tests
  - ☒ Subsystem Communications Test
  - ☒ Air Flow
  - ☒ Water Flow
  - ☒ Gas Flows
  - ☒ RF Generator
  - ☒ Camera Test
  - ☒ Optics Test
  - ☒ Nebulizer Test
- ☒ Record the result in the Instrument Test Results Table

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### Restore Instrument

- ☐ For HF applications, ask the customer to reinstall their sample introduction system. *with*
- ☒ Leave system in an idle state: on and purging.
- ☒ Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

### Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Record the PM event in the Smart Alerts logbook, if applicable.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review this service, parts replaced, and test results obtained with the customer.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box. Systems in a compliant environment may need additional documentation.
- ☒ Complete the Signature Page with both Service Engineer and Customer signatures.

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## Test Results

## Instrument Performance Test Results Table

Note: These measurements do not form part of any specification and are for reference only.

|                    | Pre PM Sensitivity Check |         | Post PM Sensitivity Check |         |
|--------------------|--------------------------|---------|---------------------------|---------|
|                    | Radial                   | Axial * | Radial                    | Axial*  |
| Zn 213.857 nm SRBR | 4190.5                   | 6449.9  | 4700.8                    | 7564.2  |
| Mn 257.610 nm SRBR | 15681.0                  | 27295.3 | 14569.1                   | 29992.5 |
| Al 396.152 nm SBR  | 12.1                     | 14.6    | 11.5                      | 15.6    |
| K 766.491 nm SBR   | 8.0                      | 31.2    | 7.4                       | 39.7    |

\* Axial result is not applicable for G8016AA, G8012AA Radial View instruments.

## Instrument Test Results Table

Note: The Instrument Test results are for systems using ICP Expert version 7.3 and above only.

| Instrument Test               | Result |
|-------------------------------|--------|
| Subsystem Communications Test | Pass   |
| Air Flow                      | Pass   |
| Water Flow                    | Pass   |
| Gas Flows                     | Pass   |
| RF Generator                  | Pass   |
| Camera Test                   | Pass   |
| Optics Test                   | Pass   |
| Nebulizer test                | Pass   |

เอกสารไม่ควบคุม

## ICP-OES Status Results Table

Note: These measurements do not form part of any specification and are for reference only.

| Measurement                  | Standby Mode   |       | Plasma On |       |
|------------------------------|----------------|-------|-----------|-------|
| Mains Voltage                | 225.153        | VAC   | 226.613   | VAC   |
| Mains Current                | 0.090          | A     | 0.219     | A     |
| Instrument Temperature       | 24.0           | °C    | 25.1      | °C    |
| RF Air Flow (sensor speed)   | 15.0           | Hz    | 19.0      | Hz    |
| Plasma Exhaust Temperature   | No measurement |       | 39.2      | °C    |
| Water Flow Oscillator        | No measurement |       | 1.52      | L/min |
| Water Flow Detector          | 0.44           | L/min | 0.81      | L/min |
| Water Inlet Temperature      | 17.3           | °C    | 17.8      | °C    |
| Polychromator Temperature    | 35.0           | °C    | 35.0      | °C    |
| CCD Temperature              | -39.8          | °C    | -39.8     | °C    |
| Thermal Stabilizer           | 35.0           | °C    | 35.0      | °C    |
| Argon Supply Pressure        | 659.52         | kPa   | 608.63    | kPa   |
| Purge Gas Supply Pressure*1  | 656.41         | kPa   | 627.71    | kPa   |
| Option Gas Supply Pressure*1 | -              | kPa   | -         | kPa   |
| Nebulizer Flow               | No measurement |       | 0.70      | L/min |
| Nebulizer Back Pressure      | No measurement |       | 166.30    | kPa   |
| Plasma Gas Flow              | No measurement |       | 11.98     | L/min |
| Auxiliary Gas Flow           | No measurement |       | 1.00      | L/min |
| RF Power                     | No measurement |       | 1199.5    | W     |
| RF Supply Current            | No measurement |       | 9.223     | A     |
| RF Supply Voltage            | No measurement |       | 194.481   | V     |

\*1 If option installed

เอกสารไม่ควบคุม

## Consumed PM Parts

| Part Description  | Part Number | Product or Model# where used  | Quantity consumed |
|---|-------------|-------------------------------|-------------------|
| Axial Pre-Optic Window                                  | G8010-68014 | G8010A, G8011A, G8014A/G8015A | 1                 |
| Radial Pre-Optic Window                                 | G8010-68015 | All                           | 1                 |
| Agilent Cool Clear Coolant Fluid                        | 5799-0037   | Agilent Water Recirculator    | -                 |
| Purge Gas Filter  | G8010-60136 | All                           | 1                 |
| Air Inlet Filter  | G8000-68002 | All                           | 1                 |
| High Capacity Air Filter                                | G8010-60189 | Optional                      | -                 |
| Rotor seal for 6-7 port valve for AVS6/7                | G8494-60002 | G8494A/G8495                  | -                 |
| Rotor seal for 4 port valve for AVS4                    | G8493-60002 | G8493A                        | -                 |
| Rinse solution to rinse station 2.5mm id x 1m           | G8410-80123 | SPS 4                         | -                 |
| Barb connector 2.5mm-1.5mm ID                           | G8410-80124 | SPS 4                         | -                 |
| PVC waste tubing, 8mm od x 5mm id, 2m                   | G8410-80122 | SPS 4                         | -                 |
| Additional Parts may be required from engineer's stock: |             |                               |                   |
| X axis drive belt                                       | 5410047500  | SPS 3                         | -                 |
| Z axis drive belt                                       | 5410047400  | SPS 3                         | -                 |
| Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,      | 3710049000  | SPS 4                         | -                 |

## Consumed Parts Reference

(Purchased by customer, not included as part of PM)

☐ Section Not Applicable

| Part Description | Part Number | Product or Model# where used | Quantity consumed |
|------------------|-------------|------------------------------|-------------------|
|                  |             |                              |                   |
|                  |             |                              |                   |
|                  |             |                              |                   |

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## Signature Page

## Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the installation or other items of interest for the customer, please write in this box.

## Service Verification

Service Request Number:

6006371120

Service Engineer Name:

Kangphorn S.

Service Engineer Signature:

Kangphorn S.

Total number of pages in this document:

14

Date Service Completed:

15 Nov 2023

Customer Name:

Aphorn Onkong

Customer Signature:

Aphorn Onkong

เอกสารไม่ควบคุม



| Report Summary                |                               |
|-------------------------------|-------------------------------|
| Instrument Model              | Agilent 5100/5110 VDV ICP-OES |
| Instrument ID                 | G8011A/G8015A                 |
| Instrument Serial Number      | MY18030001                    |
| Software Version              | 7.3.1.9507                    |
| Firmware Version              | 3442                          |
| Tested By                     | Kanyakorn S.                  |
| Test Completed On             | 11/13/2023 9:18:24 AM         |
| Result Summary                |                               |
| Subsystem Communications Test | Skipped                       |
| Air Flow Test                 | Skipped                       |
| Water Flow Test               | Skipped                       |
| Gas Flows Test                | Skipped                       |
| RF Generator Test             | Skipped                       |
| Camera Test                   | Skipped                       |
| Optics Test                   | Skipped                       |
| Advanced Valve System Test    | Skipped                       |
| Resolution Test               | Pass                          |
| Sensitivity Test              | Fail                          |
| Precision Test                | Pass                          |

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| Resolution Test    |               |       | Pass |
|--------------------|---------------|-------|------|
| Element Wavelength | Specification | Width |      |
| N (174.213 nm)     | ≤ 9.40        | 6.92  |      |
| As (188.980 nm)    | ≤ 8.20        | 6.12  |      |
| C (193.027 nm)     | ≤ 11.50       | 8.31  |      |
| Mo (202.032 nm)    | ≤ 8.20        | 6.35  |      |
| Cr (206.158 nm)    | ≤ 13.40       | 8.99  |      |
| Zn (213.857 nm)    | ≤ 8.70        | 6.64  |      |
| Pb (220.353 nm)    | ≤ 9.50        | 7.06  |      |
| Co (228.615 nm)    | ≤ 17.20       | 11.68 |      |
| Ba (230.424 nm)    | ≤ 9.40        | 7.27  |      |
| Mn (257.610 nm)    | ≤ 13.30       | 9.46  |      |
| Mn (260.568 nm)    | ≤ 20.30       | 14.18 |      |
| Cr (267.716 nm)    | ≤ 11.00       | 8.01  |      |
| Cu (324.754 nm)    | ≤ 25.00       | 18.89 |      |
| Cu (327.395 nm)    | ≤ 14.20       | 11.29 |      |
| Sr (338.071 nm)    | ≤ 33.50       | 24.48 |      |
| Ba (455.403 nm)    | ≤ 44.00       | 33.62 |      |
| Sr (460.733 nm)    | ≤ 36.00       | 17.37 |      |
| Ba (493.408 nm)    | ≤ 36.00       | 25.47 |      |
| Ba (614.171 nm)    | ≤ 42.00       | 25.43 |      |
| Ar (675.283 nm)    | ≤ 74.00       | 60.50 |      |
| K (766.491 nm)     | ≤ 80.00       | 65.33 |      |

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เอกสารไม่ควบคุม

| Sensitivity Test   |               |        | Fail    |           |         |
|--------------------|---------------|--------|---------|-----------|---------|
| Radial             |               |        |         |           |         |
| Element Wavelength | Specification | Method | Ratio   | Standard  | Blank   |
| As (188.980 nm)    | ≥ 46.0        | SRBR   | 142.0   | 958.5     | 41.7    |
| Se (196.026 nm)    | ≥ 41.0        | SRBR   | 105.9   | 937.4     | 67.5    |
| Zn (213.857 nm)    | ≥ 1421.0      | SRBR   | 4190.3  | 44372.5   | 111.6   |
| Pb (220.353 nm)    | ≥ 46.0        | SRBR   | 213.9   | 2521.3    | 125.4   |
| Mn (257.610 nm)    | ≥ 3518.0      | SRBR   | 13681.0 | 279651.7  | 416.6   |
| Al (396.152 nm)    | ≥ 3.4         | SBR    | 12.1    | 52269.7   | 3994.3  |
| Ba (493.408 nm)    | ≥ 34.0        | SBR    | 185.8   | 2294372.8 | 12280.0 |
| K (766.491 nm)     | ≥ 1.8         | SBR    | 8.0     | 107401.4  | 11876.7 |
| Axial              |               |        |         |           |         |
| Element Wavelength | Specification | Method | Ratio   | Standard  | Blank   |
| As (188.980 nm)    | ≥ 208.0       | SRBR   | 189.4   | 2285.0    | 129.5   |
| Se (196.026 nm)    | ≥ 159.0       | SRBR   | 168.7   | 2813.7    | 233.8   |
| Zn (206.200 nm)    | ≥ 234.0       | SRBR   | 905.0   | 10168.4   | 123.0   |
| Zn (213.857 nm)    | ≥ 1743.0      | SRBR   | 6849.9  | 135760.6  | 390.5   |
| Cd (214.439 nm)    | ≥ 4227.0      | SRBR   | 5597.6  | 92921.3   | 273.9   |
| Pb (220.353 nm)    | ≥ 320.0       | SRBR   | 454.8   | 10111.2   | 451.1   |
| Mn (257.610 nm)    | ≥ 10625.0     | SRBR   | 27295.3 | 1126118.1 | 1697.0  |
| Cr (267.716 nm)    | ≥ 1048.0      | SRBR   | 3948.2  | 144875.3  | 1322.0  |
| Cu (324.754 nm)    | ≥ 19.0        | SBR    | 49.2    | 341489.7  | 6798.2  |
| Al (396.152 nm)    | ≥ 6.0         | SBR    | 14.6    | 235321.6  | 15043.9 |
| Ba (493.408 nm)    | ≥ 60.0        | SBR    | 183.3   | 8393101.3 | 45538.3 |
| K (766.491 nm)     | ≥ 24.0        | SBR    | 31.2    | 1447045.2 | 44917.1 |

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เอกสารไม่ควบคุม

| Precision Test     |               | Pass                 |
|--------------------|---------------|----------------------|
| Radial             |               |                      |
| Element Wavelength | Specification | Measured Value % RSD |
| As (188.980 nm)    | ≤ 2.60        | 1.22                 |
| Se (196.026 nm)    | ≤ 2.60        | 0.76                 |
| Zn (213.857 nm)    | ≤ 1.50        | 0.33                 |
| Pb (220.353 nm)    | ≤ 2.60        | 0.86                 |
| Mn (257.610 nm)    | ≤ 1.50        | 0.45                 |
| Al (396.152 nm)    | ≤ 1.50        | 0.37                 |
| Ba (493.408 nm)    | ≤ 1.50        | 0.68                 |
| K (766.491 nm)     | ≤ 1.50        | 0.33                 |
| Axial              |               |                      |
| Element Wavelength | Specification | Measured Value % RSD |
| As (188.980 nm)    | ≤ 1.50        | 0.63                 |
| Se (196.026 nm)    | ≤ 1.50        | 0.87                 |
| Zn (206.200 nm)    | ≤ 1.50        | 0.59                 |
| Zn (213.857 nm)    | ≤ 1.50        | 0.46                 |
| Cd (214.439 nm)    | ≤ 1.50        | 0.70                 |
| Pb (220.353 nm)    | ≤ 1.50        | 0.36                 |
| Mn (257.610 nm)    | ≤ 1.50        | 0.95                 |
| Cr (267.716 nm)    | ≤ 1.50        | 0.56                 |
| Cu (324.754 nm)    | ≤ 1.50        | 0.69                 |
| Al (396.152 nm)    | ≤ 1.50        | 0.63                 |
| Ba (493.408 nm)    | ≤ 1.50        | 0.86                 |
| K (766.491 nm)     | ≤ 1.50        | 1.13                 |

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| Report Summary                |                               |         |
|-------------------------------|-------------------------------|---------|
| Instrument Model              | Agilent 5100/5110 VDV ICP-OES |         |
| Instrument ID                 | G8011A/G8015A                 |         |
| Instrument Serial Number      | MY18030001                    |         |
| Software Version              | 7.3.1.9507                    |         |
| Firmware Version              | 3442                          |         |
| Tested By                     | Kanyakorn S.                  |         |
| Test Completed On             | 11/13/2023 11:10:02 AM        |         |
| Result Summary                |                               |         |
| Subsystem Communications Test | Pass                          |         |
| Air Flow Test                 | Skipped                       |         |
| Water Flow Test               | Skipped                       |         |
| Gas Flows Test                | Skipped                       |         |
| RF Generator Test             | Skipped                       |         |
| Camera Test                   | Skipped                       |         |
| Optics Test                   | Pass                          |         |
| Advanced Valve System Test    | Skipped                       |         |
| Resolution Test               | Pass                          |         |
| Sensitivity Test              | Pass                          |         |
| Precision Test                | Pass                          |         |
| Subsystem Communications Test | Pass                          |         |
| Optics Test                   |                               |         |
|                               | Radial                        | Axial   |
| Intensity                     | 3522064                       | 4003312 |
| Wavelength                    | 737.212                       | 737.212 |

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| Resolution Test    |               |       | Pass |
|--------------------|---------------|-------|------|
| Element Wavelength | Specification | Width |      |
| N (174.213 nm)     | ≤ 9.40        | 6.92  |      |
| As (188.980 nm)    | ≤ 8.20        | 6.08  |      |
| C (193.027 nm)     | ≤ 11.50       | 8.33  |      |
| Mo (202.032 nm)    | ≤ 8.20        | 6.31  |      |
| Cr (206.158 nm)    | ≤ 13.40       | 8.98  |      |
| Zn (213.857 nm)    | ≤ 8.70        | 6.73  |      |
| Pb (220.353 nm)    | ≤ 9.50        | 7.02  |      |
| Co (228.615 nm)    | ≤ 17.20       | 11.65 |      |
| Ba (230.424 nm)    | ≤ 9.40        | 7.38  |      |
| Mn (257.610 nm)    | ≤ 13.30       | 9.46  |      |
| Mn (260.568 nm)    | ≤ 20.30       | 14.05 |      |
| Cr (267.716 nm)    | ≤ 11.00       | 7.92  |      |
| Cu (324.754 nm)    | ≤ 25.00       | 18.84 |      |
| Cu (327.395 nm)    | ≤ 14.20       | 11.31 |      |
| Sr (338.071 nm)    | ≤ 33.50       | 24.18 |      |
| Ba (455.403 nm)    | ≤ 44.00       | 33.28 |      |
| Sr (460.733 nm)    | ≤ 36.00       | 17.41 |      |
| Ba (493.408 nm)    | ≤ 36.00       | 25.43 |      |
| Ba (614.171 nm)    | ≤ 42.00       | 25.27 |      |
| Ar (675.283 nm)    | ≤ 74.00       | 56.87 |      |
| K (766.491 nm)     | ≤ 80.00       | 65.88 |      |

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| Sensitivity Test   |               |        |         |           |         | Pass |
|--------------------|---------------|--------|---------|-----------|---------|------|
| Radial             |               |        |         |           |         |      |
| Element Wavelength | Specification | Method | Ratio   | Standard  | Blank   |      |
| As (188.980 nm)    | ≥ 45.0        | SRBR   | 168.6   | 1284.6    | 53.3    |      |
| Se (196.026 nm)    | ≥ 41.0        | SRBR   | 122.4   | 1256.0    | 90.7    |      |
| Zn (213.857 nm)    | ≥ 1421.0      | SRBR   | 4700.8  | 53870.1   | 130.7   |      |
| Pb (220.353 nm)    | ≥ 46.0        | SRBR   | 236.0   | 3100.6    | 155.7   |      |
| Mn (257.610 nm)    | ≥ 3518.0      | SRBR   | 14569.1 | 318396.1  | 476.2   |      |
| Al (396.152 nm)    | ≥ 3.4         | SBR    | 11.5    | 59510.5   | 4761.6  |      |
| Ba (493.408 nm)    | ≥ 34.0        | SBR    | 170.6   | 2490835.6 | 14514.2 |      |
| K (766.491 nm)     | ≥ 1.8         | SBR    | 7.4     | 117698.7  | 14024.1 |      |
| Axial              |               |        |         |           |         |      |
| Element Wavelength | Specification | Method | Ratio   | Standard  | Blank   |      |
| As (188.980 nm)    | ≥ 208.0       | SRBR   | 214.5   | 2706.2    | 142.8   |      |
| Se (196.026 nm)    | ≥ 159.0       | SRBR   | 188.0   | 3262.8    | 255.9   |      |
| Zn (206.200 nm)    | ≥ 234.0       | SRBR   | 1088.2  | 12794.8   | 135.3   |      |
| Zn (213.857 nm)    | ≥ 1743.0      | SRBR   | 7564.2  | 156883.9  | 427.8   |      |
| Cd (214.439 nm)    | ≥ 4227.0      | SRBR   | 6647.3  | 116281.7  | 304.4   |      |
| Pb (220.353 nm)    | ≥ 320.0       | SRBR   | 519.3   | 12490.2   | 530.3   |      |
| Mn (257.610 nm)    | ≥ 10625.0     | SRBR   | 29992.5 | 1305862.5 | 1890.2  |      |
| Cr (267.716 nm)    | ≥ 1048.0      | SRBR   | 4366.6  | 173343.4  | 1547.9  |      |
| Cu (324.754 nm)    | ≥ 19.0        | SBR    | 46.8    | 361093.0  | 7560.5  |      |
| Al (396.152 nm)    | ≥ 6.0         | SBR    | 15.6    | 274029.5  | 16498.6 |      |
| Ba (493.408 nm)    | ≥ 60.0        | SBR    | 203.6   | 9028914.5 | 44122.1 |      |
| K (766.491 nm)     | ≥ 24.0        | SBR    | 39.7    | 1701521.4 | 41771.8 |      |

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| Precision Test     |               |                      | Pass |
|--------------------|---------------|----------------------|------|
| Radial             |               |                      |      |
| Element Wavelength | Specification | Measured Value % RSD |      |
| As (188.980 nm)    | ≤ 2.60        | 0.85                 |      |
| Se (196.026 nm)    | ≤ 2.60        | 1.26                 |      |
| Zn (213.857 nm)    | ≤ 1.50        | 0.42                 |      |
| Pb (220.353 nm)    | ≤ 2.60        | 0.54                 |      |
| Mn (257.610 nm)    | ≤ 1.50        | 0.60                 |      |
| Al (396.152 nm)    | ≤ 1.50        | 0.47                 |      |
| Ba (493.408 nm)    | ≤ 1.50        | 0.68                 |      |
| K (766.491 nm)     | ≤ 1.50        | 0.50                 |      |
| Axial              |               |                      |      |
| Element Wavelength | Specification | Measured Value % RSD |      |
| As (188.980 nm)    | ≤ 1.50        | 0.42                 |      |
| Se (196.026 nm)    | ≤ 1.50        | 0.66                 |      |
| Zn (206.200 nm)    | ≤ 1.50        | 0.42                 |      |
| Zn (213.857 nm)    | ≤ 1.50        | 0.54                 |      |
| Cd (214.439 nm)    | ≤ 1.50        | 0.42                 |      |
| Pb (220.353 nm)    | ≤ 1.50        | 0.22                 |      |
| Mn (257.610 nm)    | ≤ 1.50        | 0.54                 |      |
| Cr (267.716 nm)    | ≤ 1.50        | 0.49                 |      |
| Cu (324.754 nm)    | ≤ 1.50        | 0.85                 |      |
| Al (396.152 nm)    | ≤ 1.50        | 0.61                 |      |
| Ba (493.408 nm)    | ≤ 1.50        | 0.78                 |      |
| K (766.491 nm)     | ≤ 1.50        | 1.00                 |      |

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|                               |                               |                              |
|-------------------------------|-------------------------------|------------------------------|
| Report Summary                |                               |                              |
| Instrument Model              | Agilent 5100/5110 VDV ICP-OES |                              |
| Instrument ID                 | GB011A/G8015A                 |                              |
| Instrument Serial Number      | MY18030001                    |                              |
| Software Version              | 7.3.1.9507                    |                              |
| Firmware Version              | 3442                          |                              |
| Tested By                     | Kanyakorn S.                  |                              |
| Test Completed On             | 11/13/2023 11:15:43 AM        |                              |
| Result Summary                |                               |                              |
| Subsystem Communications Test | Pass                          |                              |
| Air Flow Test                 | Pass                          |                              |
| Water Flow Test               | Pass                          |                              |
| Gas Flows Test                | Pass                          |                              |
| RF Generator Test             | Pass                          |                              |
| Camera Test                   | Pass                          |                              |
| Optics Test                   | Skipped                       |                              |
| Advanced Valve System Test    | Skipped                       |                              |
| Resolution Test               | Skipped                       |                              |
| Sensitivity Test              | Skipped                       |                              |
| Precision Test                | Skipped                       |                              |
| Subsystem Communications Test | Pass                          |                              |
| Air Flow Test                 | Pass                          |                              |
| 30% Air Flow (relative speed) | 75% Air Flow (relative speed) |                              |
| 14.00                         | 20.00                         |                              |
| Water Flow Test               | Pass                          |                              |
| RF Water Flow(L/min)          | Camera Water Flow (L/min)     | Water Inlet Temperature (°C) |
| 1.27                          | 0.81                          | 20.37                        |

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เอกสารไม่ควบคุม

| Gas Flows Test                   |                          |                    | Pass                     |             |                  |
|----------------------------------|--------------------------|--------------------|--------------------------|-------------|------------------|
| Nebulizer<br>Target Flow         | Actual Flow              | Back<br>Pressure   | Auxiliary<br>Target Flow | Actual Flow | Back<br>Pressure |
| 0.70                             | 0.70                     | 271.62             | 2.00                     | 2.00        | 111.13           |
| Makeup<br>Target Flow            | Actual Flow              | Back<br>Pressure   | Plasma<br>Target Flow    | Actual Flow | Back<br>Pressure |
| 2.00                             | 2.00                     | 116.00             | 18.00                    | 17.94       | 23.11            |
| RF Generator Test                |                          |                    | Pass                     |             |                  |
| RF Power Supply Test             | Passed                   |                    |                          |             |                  |
| RF Power Supply (V)              | 147.380                  |                    |                          |             |                  |
| RF Oscillator Test               | Passed                   |                    |                          |             |                  |
| RF Oscillator Frequency<br>(MHz) | 25.843                   |                    |                          |             |                  |
| Work Coil Current (A)            | 44.410                   |                    |                          |             |                  |
| RF Power Supply Current (A)      | 1.999                    |                    |                          |             |                  |
| Camera Test                      |                          |                    | Pass                     |             |                  |
|                                  | Integration Time<br>(ms) | Standard Deviation | Status                   |             |                  |
| Electronic Offset Test           | 1000                     | 5.361              | Passed                   |             |                  |
| Dark Current Test                | 6000                     | 0.779              | Passed                   |             |                  |
| Array Test                       | 5                        | 0.025              | Passed                   |             |                  |
| Linearity Test                   |                          | 0.118              | Passed                   |             |                  |

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Milestone DMA-80 Service Protocol

SITHIPORN  
associates

## DMA-80 DIRECT MERCURY ANALYZER System



Milestone DMA-80 Service Protocol

## DMA-80 Direct Mercury Analyzer SERVICE PROTOCOL REPORT

To be filled in before service visit (1<sup>st</sup> page)

### Customer information:

|                   |   |
|-------------------|---|
| Company:          | บริษัท เอนเนอจีสตี จำกัด. (สง.ใหญ่)           |
| Department:       | LAB   |
| Person in charge: | คุณ ภูษงค์ พาณิชกุลศิริไพ                     |
| Address:          | ซอยอุดมสุข 41 ถนนสุขุมวิท กรุงเทพมหานคร 10260 |
| Tel.:             | +66 (86) 3191292                              |
| E-mail:           | bhuchonk@uaconsultant.co.th                   |

### Technical data:

|  |              |            |            |
|--|--------------|------------|------------|
| Unit Serial Number:                      | 11030982     |            |            |
| Terminal type or USB-640 Gateway:        | Termian-640  | SN         | 1012000091 |
| Software, type and revision:             | Easy Control | Rev.       |            |
| Air Compressor (if present)              | -            | SN         | -          |
| Gas system pump (if present)             | -            | SN         | -          |
| Installation and last maintenance dates: | Inst. on: -  | Maint. on: | 17-11-66   |

**NOTE:** after achievement of the following protocol a filled and signed copy of this report has to be sent to Milestone srl at: [service@milestonesrl.com](mailto:service@milestonesrl.com)

For the best result of the test below we recommended to use the Milestone DMA-80 Service Kit (PN DMA-SKIT).

SITHIPORN ASSOCIATES CO.,LTD.

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok 10700 Thailand  
Tel, (662) 433-8331, 434-9191 fax: (662) 433-1679, 434-9510



## 1. VISUAL INSPECTION

|                  | Good | Damaged | Corroded/Dirty |
|------------------|------|---------|----------------|
| External chassis | ✓    |         |                |
| Inside           | ✓    |         |                |
| Electric parts   | ✓    |         |                |
| Screws           | ✓    |         |                |

## 2. ELECTRICAL SAFETY TEST

Using a suitable testing device check the below reported parameters and take note of the results.

| Parameter                | Result                 | OK | Not OK |
|--------------------------|------------------------|----|--------|
| Voltage : 230 VAC (±10%) | Actual value : 224 VAC | ✓  |        |
| Ground : ≤ 2             | Actual value: 0.9 VAC  | ✓  |        |

## 3. PRESSURE CHECK

|             | Oxygen (purity O <sub>2</sub> >99,95%) | Milestone air compressor |
|-------------|--|--------------------------|
| Gas carrier | Purity:                                | ✓                        |

The pressure at the supply source manometer should be approx. 4.0bar  
The flow rate depends by type of cuvette installed on the DMA-80 unit.



|                | Correct value | Actual value | Final value | Correct value | Actual value | Final value | Correct value | Actual value | Final value |
|----------------|---------------|--------------|-------------|---------------|--------------|-------------|---------------|--------------|-------------|
| Inlet pressure | 3.1 bar       | -            | -           | 3.1 bar       | -            | -           | 3.1 bar       | 3.1 bar      | Pass        |
| Flow rate      | 10-12 l/h     | -            | -           | 8-10 l/h      | -            | -           | 6-8 l/h       | 6 l/h        | Pass        |

Check all possible leakage points and their conditions:

|                         | Good | Damaged | Corroded |
|-------------------------|------|---------|----------|
| Tubing                  | ✓    |         |          |
| Silicon joints          | ✓    |         |          |
| O-rings                 | ✓    |         |          |
| Cuvette sealing O-rings | ✓    |         |          |
| Gas connections         | ✓    |         |          |
| Valves                  | ✓    |         |          |
| Sample boat carrier     | ✓    |         |          |
| Catalyst flange         | ✓    |         |          |




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|                                  |   |              |       |      |
|----------------------------------|---|--------------|-------|------|
|                                  |  |              |       |      |
| Amalgamator stand by temperature | If controlled by Infrared sensor  | 170°C ± 10°C | 170°C | Pass |
|                                  | If IR sensor is not present   | 145°C ± 25°C | -     | -    |
| Amalgamator heating temperature  | 850°C ± 10°C  | 850°C        | Pass  |      |
| Cuvette                          | 125°C ± 5°C   | 125°C        | Pass  |      |

## 7. SPECTROMETER

The spectrometer can be equipped with a single beam system (ducon lamp) or with a dual beam system (tricon lamp)

|                                    | Old cuvette type  |              |             |   |              |             | Actual cuvette type   |              |             |                     |              |             |
|------------------------------------|---|--------------|-------------|---|--------------|-------------|---|--------------|-------------|---------------------|--------------|-------------|
| Dualcell system<br>Tricell system* |  |              |             |  |              |             |  |              |             |                     |              |             |
|                                    | Gain  |              |             | Offset  |              |             | Gain  |              |             | Offset              |              |             |
|                                    | Correct value   | Actual value | Final value | Correct value   | Actual value | Final value | Correct value   | Actual value | Final value | Correct value       | Actual value | Final value |
|                                    | 3.6VDC  | -            | -           | 0.015VDC ± 0.005VDC   | -            | -           | 3.93VDC   | 3.9V         | Pass        | 0.015VDC ± 0.005VDC | 0.015V       | Pass        |

(\*)The recommended Hg lamp operating signal should be around 3,96VDC (for detector 2) and 3,93VDC (for detector 1).

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## 4. AUTOSAMPLER SYSTEM

|                                  | OK | Not OK | Re-Adjusted |
|----------------------------------|----|--------|-------------|
| Calibration of autosampler motor | ✓  |        |             |
| Cylinders alignment              | ✓  |        |             |

|                              | Fast | Slow | Normal |
|------------------------------|------|------|--------|
| Speed of pneumatic cylinders |      |      | ✓      |

Using the maintenance grease, periodically lightly lubricate all exposed steel rods of the horizontal and vertical cylinders.

## 5. COMPONENTS CHECK

Conditions of the different parts used/installed on DMA unit:

|                     | OK | Not OK | Replaced | Cleaned |
|---------------------|----|--------|----------|---------|
| Catalyst tube       | ✓  |        |          |         |
| Amalgamator         | ✓  |        |          |         |
| Quartz boats        | ✓  |        |          |         |
| Nickel boats        | -  |        |          |         |
| Autosampler plate   | ✓  |        |          |         |
| Gas kit accessories | -  |        |          |         |

## 6. TEMPERATURES

|                               |                                  | Correct value | Actual value | Final value (Pass) |
|-------------------------------|----------------------------------|---------------|--------------|--------------------|
| Drying/ Decomposition furnace | If controlled by Infrared sensor | 850°C ± 10°C  | -            | -                  |
|                               | If controlled by thermocouple    | 650°C ± 10°C  | 650          | Pass               |
| Catalyst furnace              | Type 1                           | 515°C ± 5°C   | -            | -                  |
|                               | Type 2,3                         | 565°C ± 10°C  | 565°C        | Pass               |

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|  | OK | Not OK |
|--|----|--------|
| Conditions of the spectrometer system                | ✓  |        |
| Alignment between lamp, cuvette and detector         | ✓  |        |
| Cuvette cleaning (glass windows, sealing O-rings...) | ✓  |        |
| Lamp intensity                                       | ✓  |        |
| Operation of the mechanical shutter (if present)     | ✓  |        |

## 8. MILESTONE AIR COMPRESSOR (N.A.)

| Maintenance                                     | OK | Date last service |
|---|----|-------------------|
| Drain (compressor)                              |    |                   |
| Replacing air filters (air purification module) |    |                   |
| Check sealing connections                       |    |                   |

## 9. PARTS TO BE REPLACED

| PN        | DESCRIPTION   | Replaced | Not Replaced |
|-----------|---|----------|--------------|
| DMA8133   | Catalyst tube:<br>6 months if the unit runs daily,<br>1 year if the unit is used rarely.<br><i>In case of analyse of sample with high organic concentration the lifetime of the catalyst can be less than 6 months.</i> | ✓        |              |
| DMA8134   | Amalgamator:<br>6 months if the unit runs daily<br>1 year if the unit is used rarely  | ✓        |              |
| DMA8195A  | Hg lamp tri-cell (model 2011):<br>5 years   |          | ✓            |
| DMA8137   | Hg lamp dual-cell:<br>5 years   | -        | -            |
| 70200     | Hg trap<br>1 year   |          | ✓            |
| DMA8058/B | Amalgamator coil<br>6 months/1 year or as soon as the heating is not more homogeneous   |          | ✓            |
| DMA8142   | Nickel sample boats (set of 40pcs)<br>2 years<br>if strongly used, replace after 1 year   | -        | -            |
| DMA8347   | Quartz sample boats (set of 10pcs)<br>2/3 years   |          | ✓            |
| DMA8335   | Metal sample boat carrier<br>2 years  |          | ✓            |
| SL0108    | P/U-tube diam. 6/4 mm for internal O <sub>2</sub> /air supply<br>2 years  |          | ✓            |
| SO0376D   | Heating coil for drying/decomposition<br>2 years  |          | ✓            |

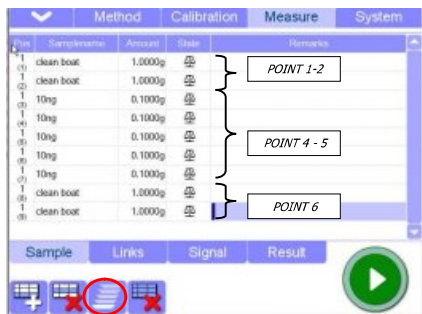
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## 10. TESTING PROCEDURE

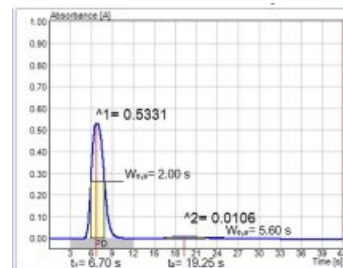
It consists to run some measurements for the evaluation of the analytical performance of the unit, like: absorbance, peaks shape, temperatures, lamp signal and verify the proper working of whole system.

- 1) Run minimum 2 blanks on the same sample boat (quartz if possible) in manner to clean it
- 2) Run blanks until absorbance value (Height) decrease under 0.0030 in cell 1
- 3) Set a fresh and stabilized 100µg/L Hg standard according to the prescriptions reported on the DMA80 User Manual. The quality of the used standard is fundamental for the success of the entire procedure
- 4) Weight approximately 100µg of the fresh 100µg/L – Standard (10ng) and start the analysis as a single measurement mode
- 5) Repeat five times the test
- 6) Run again two blanks measurements



Now, it is possible to evaluate:

### - Peaks



- The shape of the peak must be regular.
- The distance between Peak Cell 1 and Peak Cell 2 must be between 11 to 15 seconds.

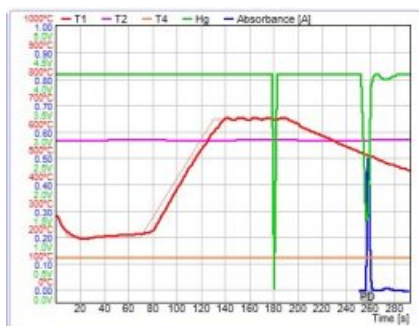
### - Results

| Pos | Sample name    | Amount  | State | Height | Hg [ng] | Hg [µg/kg] | Cal. Factory | Σ |
|-----|----------------|---------|-------|--------|---------|------------|--------------|---|
| 1   | Stability 10ng |         | M     |        |         | 100.290    | 0.92%        |   |
| 2   | Stability 10ng | 0.1000g | ✓     | 0.4931 | 9.9095  | 99.0951    | 1.0000       | Σ |
| 3   | Stability 10ng | 0.1000g | ✓     | 0.4965 | 9.9934  | 99.9335    | 1.0000       | Σ |
| 4   | Stability 10ng | 0.1000g | ✓     | 0.4991 | 10.059  | 100.597    | 1.0000       | Σ |
| 5   | Stability 10ng | 0.1000g | ✓     | 0.4976 | 10.022  | 100.221    | 1.0000       | Σ |
| 6   | Stability 10ng | 0.1000g | ✓     | 0.5031 | 10.160  | 101.602    | 1.0000       | Σ |

- The obtained absorbance (height) must be > 0.42 in cell 1 for each 100ppb analysis (0.22 with cuvette installed until December 2005, DMA s/n 05120292.)
- The relative standard deviation (rsd) is < 3 %.
- After two blanks (after 10ng measurements), the absorbance is < 0.0030 in cell 1(\*).

(\*) This condition is valid only in case the unit has: catalyst and amalgamator new, conditioned and never use before, sample boat carrier new and/or perfectly cleaned, catalyst flange new and/or perfectly cleaned, cuvette new and/or perfectly cleaned, tubes, silicon joints and o-rings replaced. Otherwise other blanks (more than 2) might be necessary.

### - Temperatures & signal profiles



- The Hg lamp signal must be between 3.8 and 4.5V and stable. A few minutes after the start of the analysis the lamp does switch off because of the zero detection but then it instantly returns to the original condition. In case of Tricell configuration two green colour graphics are reported. After the zero shuttering the time necessary to return to full signal is longer on Tricell compare to Ducon lamp.
- During the run the catalyst oven temperature must be stable around to 565°C or 515°C.
- The drying and ashing furnace must be follow the set temperature method.
- During the run the Amalgamator furnace temperature must be stable at the stand by temperature (170°C or 145°C). Then at the release step it must raise up to 850/900°C.
- The Cuvette temperature must be stable at approximately 125°C.
- The Hg absorbance peaks must be correctly detected and reported.

## 11. FINAL REPORT

|   |   |
|---|---|
| All screws inserted and tightened   | ✓ |
| All tubing sealing connections checked, cleaned or replaced and tightened | ✓ |
| All heating elements are working  | ✓ |
| Sensors installed, checked and tightened                                  | ✓ |
| Safety devices (thermo switch) fully checked                              | ✓ |
| All cooling fans are functioning  | ✓ |
| Testing procedure successfully passed                                     | ✓ |
| Necessary tools available at customer's site                              | ✓ |
| Last revision of User Manual available at customer's site                 | ✓ |
| Advised customer about care and maintenance instructions                  | ✓ |

|          |
|----------|
| Remarks: |
|          |
|          |
|          |
|          |
|          |
|          |
|          |
|          |
|          |

|                                   |  |
|-----------------------------------|--|
| Working hours of Service Engineer |  |
|-----------------------------------|--|

| Service Engineer Name | Signature          | Date       |
|-----------------------|--------------------|------------|
| ชานมเฉลิม วัลย์ศรี    | ชานมเฉลิม วัลย์ศรี | 17-11-2023 |

|   |  |
|---|--|
| Laboratory Manager / Operator acceptance signature: |  |
|---|--|

Serial-No.: K170A0153 Customer-No.: C04-006  
Date: 12 February 2024 Carried out by: Mr. Srichai Fak-On

Maintenance with following Operational Qualification (OQ)  
(requires a separate OQ protocol)



## Maintenance Protocol

### Atomic Fluorescence Spectrometer mercur DUO / mercur DUO plus

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|                |  |
|----------------|--|
| Company        | บริษัท ยูนิടെค แอนนาไลซิส แอนด์ เอ็นจิเนียริงคอนซัลแตนท์ จำกัด |
| User           | คุณกรวิทย์   |
| Department     | ห้องปฏิบัติการ (Mercur Analysis)                               |
| Street         | 3 ซอยอุดมสุข 41 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง              |
| Zip Code, City | กรุงเทพมหานคร 10260  |
| Country        | ประเทศไทย  |
| Phone          |  |
| Fax            |  |
| E-mail         |  |

Maintenance Protocol mercur DUO / mercur DUO plus | update 27.06.2018 Version 2.1 R01  
Analytik Jena AG | Jena-Case-St. 1 | 07745 Jena, Germany

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#### Maintenance works basic unit

|   |                                     |
|---|-------------------------------------|
| tightness visual check inside the Mercur          | <input checked="" type="checkbox"/> |
| visual check if gold-traps are broken             | <input checked="" type="checkbox"/> |
| visual check if spectrometer is contaminated      | <input checked="" type="checkbox"/> |
| visual check of the fluorescence cell             | <input checked="" type="checkbox"/> |
| visual check of the absorption cell, incl. window | <input checked="" type="checkbox"/> |
| reactor cleaning                                  | <input checked="" type="checkbox"/> |
| check pump-hose, if necessary change it           | <input checked="" type="checkbox"/> |
| check swivel drive (SEV)                          | <input checked="" type="checkbox"/> |
| check drying-hose, output gas-liquid-separator    | <input checked="" type="checkbox"/> |
| test Bubble-Sensor                                | <input checked="" type="checkbox"/> |
| check gas flows                                   | <input checked="" type="checkbox"/> |
| check volume flows, reagents                      | <input checked="" type="checkbox"/> |
| recording stray light values                      | <input checked="" type="checkbox"/> |
| measurement with 30 ng/l                          | <input checked="" type="checkbox"/> |

#### Maintenance works Autosampler

Serial No.: N/A

|  |                          |
|--|--------------------------|
| lubricate the dosing-winding (Teflon-grease-spray)                         | <input type="checkbox"/> |
| clean the dosing cylinder, if necessary exchange it                        | <input type="checkbox"/> |
| lubricate the winding system of the height drive with some drops of oil    | <input type="checkbox"/> |
| check the toothed belt   | <input type="checkbox"/> |
| check the position of the mechanical stopper (height: 13mm )               | <input type="checkbox"/> |
| check the pump rate of mixing pump (<14s AS52, typ.7s/<20s AS52S, typ.10s) | <input type="checkbox"/> |
| check the pump rate of washing cup   | <input type="checkbox"/> |
| check the electrical hose connections for good contact                     | <input type="checkbox"/> |
| check the connectors of the magnetic valves                                | <input type="checkbox"/> |
| check the dosing hose for buckling, if necessary exchange it               | <input type="checkbox"/> |

เอกสารไม่ควบคุม

| Device parameter                                 | nominal value                             | actual value                       |
|--|---|------------------------------------|
| visual check general tightness inside the Mercur | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| visual check Goldtraps                           | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| visual check spectrometer                        |   |                                    |
| Fluorescence cell                                | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| Absorption cell, incl. window                    | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| lens   | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| Swivel drive (SEV)                               | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| check pump hoses                                 | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| check hoses and hose connectors                  | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| check and clean reactor                          | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| check drying hose output Gas-liquid-separator    | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/>  |
| check bubble-sensor                              | o.k.: <input checked="" type="checkbox"/> | not o.k.: <input type="checkbox"/> |
| Check gasflow                                    |   |                                    |
| Argon pressure valve 4                           | 1.2 – 1.5 bar                             | 1.5 bar                            |
| Valve 1  | 10 Nl/h or 0.166 NL/min                   | 0.166 NL/min                       |
| Valve 2  | 50 Nl/h or 0.833 NL/min                   | 0.833 NL/min                       |
| Valve 3  | 5 Nl/h or 0.083 NL/min                    | 0.083 NL/min                       |
| Valve 4  | 10 Nl/h or 0.166 NL/min                   | 0.166 NL/min                       |
| Check liquidflow                                 |   |                                    |
| Acid   | 2.5ml/min<br>± 1 ml                       | 2.5 ml/min                         |
| Red.-agent                                       | 2.5ml/min<br>± 1 ml                       | 2.5 ml/min                         |
| Sample   | 10ml/min<br>± 2 ml                        | 10 ml/min                          |
| Adventitious light - values (V)                  | from file                                 |                                    |
| 100  | 0   | 0                                  |
| 200  | 0   | 0                                  |
| 300  | 0   | 0                                  |
| 350  | 0   | 0                                  |
| 400  | 1   | 1                                  |
| 450  | 3   | 3                                  |
| 500  | 8   | 8                                  |
| 550  | 18  | 17                                 |
| 575  | 26  | 25                                 |
| 600  | 36  | 35                                 |

เอกสารไม่ควบคุม



| Device parameter   | nominal value              | actual value                                |
|--|----------------------------|---|
| <b>Analytical parameters Fluorescence cell</b>               |                            |   |
| Conditions.: max conc.: 10 µg/L PMT-voltage: .....451.....V  |                            |   |
| Blank-solution   |                            | Int .....0.0005.....                        |
| without enrichment / FBR 30 ng/L                             | Int > 0.0015<br>RSD < 3 %  | Int .....0.0027.....<br>RSD .....1.61.....% |
| Conditions.: max conc.: 1.7 µg/L PMT-voltage: .....444.....V |                            |   |
| Blank-solution   |                            | Int .....0.0043.....                        |
| with enrichment / FBR 30 ng/L                                | Int > 0.008<br>RSD < 3 %   | Int .....0.0171.....<br>RSD .....1.81.....% |
| Fok.- factor ( Int <sub>2</sub> / Int <sub>1</sub> )         | > 3.5                      | 6.33  |
| <b>Analytical parameters Absorption cell</b>                 |                            |   |
| Blank-solution   |                            | Ext .....0.0004.....                        |
| without enrichment / FBR 100 ng/L                            | Ext. > 0.0012<br>RSD < 5 % | Ext .....0.0025.....<br>RSD .....3.17.....% |
| <b>Comments</b>  |                            |   |
| # Sensitivity check (Without enrichment / FBR / 100 ng/L)    |                            |   |
| Int. Blank = 0.0008  |                            |   |
| Int. 100 ng/L = 0.0097                                       |                            |   |
| RSD % = 0.96   |                            |   |

Signature Technician

Place, Date (DD/MM/YYYY)




Signature Customer

12/02/2024  
Place, Date (DD/MM/YYYY)

Markenname Produkt Name (U) Name (U) plus | update 27.06.2018 Version 2.1 Kawa  
Analytik Jena AG | Kontakt: Juse-Str. 1 | 07745 Jena | Germany

## เอกสารไม่ควบคุม

## Service Report

|   |  |  |  |  |            |
|---|--|--|--|--|------------|
| Customer's address :<br><i>State of Kerala, Kollam District, Kollam City,<br/>Kollam District, Kollam City</i>  |  | Customer's Ref. No. :<br><i>CO-16, SPN 24-0-02</i>   |  | <input checked="" type="checkbox"/> Analytik Jena Instruments (Thailand) Ltd.<br><input type="checkbox"/> Analytik Jena Far East (Thailand) Ltd.   |            |
| E-mail :  |  | Phone :  |  | Fax :  |            |
| Job No. : <i>SPN 24-0-02</i>  |  | User : <i>gandong</i>  |  | Service Engineer : <i>ns/ke shree</i>  |            |
| Instrument model :  |  | Serial No. : <i>K170A0153</i>  |  | Date : <i>12/1/2014</i> Page : <i>1/1</i>  |            |
| <input type="checkbox"/> Repair (RE) <input checked="" type="checkbox"/> Maintenance (PM) <input type="checkbox"/> Installation (IN) <input type="checkbox"/> Warranty <input type="checkbox"/> Application (AP) <input type="checkbox"/> Site Prep (SP) <input type="checkbox"/> Validation (VI) |  | Software Version No. : <i>4.7.9.0</i>  |  |  |            |
| Fault / Claim : <i>Reactive Maintenance (PM a/c)</i>  |  |  |  | <input type="checkbox"/> Error Code  |            |
| Action taken :<br>- Maintenance of the Basic Unit<br>- Check device parameter.<br>- Check gas flow.<br>- Check liquid flow.<br>- Check Advantiveous light - valves<br>* Test run Analytical parameter Fluorescence cell<br>* Test run Analytical parameter Absorption cell                        |  | <br><i>* gas inlet valve<br/>function testing</i> |  | <i>* maintenance (a/c) (a/c) (a/c)</i><br><i>Adv. Maint. Equipment</i><br><br><i>* maintenance (a/c) (a/c) (a/c)</i><br><i>Adv. Maint. Equipment</i><br> |            |
| Action Performed / Recommendation :<br><i>performed maintenance of the</i>  |  | * Sensitivity check (Without enrichment / FBR / 100 ng/L)<br>Int. Blank = 0.0006<br>Int. 100 ng/L = 0.0089<br>RSD % = 0.69           |  | <i>* standard PM will be</i><br><i>performed after the maintenance</i><br><i>provided the low pressure line</i><br><i>for Fluorescence cell &amp;</i><br><i>for Absorption cell</i>  |            |
| <input type="checkbox"/> Spare Part <input type="checkbox"/> Instrument Configuration :   |  |  |  |  |            |
| Item No.  |  | Name   |  | Quantity   | Unit Price |
| 1.  |  |  |  |  |            |
| 2.  |  |  |  |  |            |
| 3.  |  |  |  |  |            |
| 4.  |  |  |  |  |            |
| 5.  |  |  |  |  |            |
| 6.  |  |  |  |  |            |
| 7.  |  |  |  |  |            |
| 8.  |  |  |  |  |            |
| Herewith the undersigned confirm the time devoted,<br>the work performed, the perfect function of the device,<br>and the acceptability of the specified spare parts.<br>(Traveled hours and kilometers can only be entered<br>after the return of the service engineer.                           |  | Date / Signature of Customer<br><i>12/1/2014</i>   |  | Date / Signature of Service Engineer<br><i>ns/ke shree</i><br>Work completed?<br><input checked="" type="checkbox"/> Yes<br><input type="checkbox"/> No  |            |

Services are subject to the General Terms and Conditions of Analytik Jena AG, which will be sent on request.

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## Mercur

|                  |                                      |                      |                          |
|------------------|--------------------------------------|----------------------|--------------------------|
| Report file:     | C:\WinAAS\TMP\2024\Result\W01Pro_009 |                      |                          |
| Program version: | 4.7.9.0                              | Printed on:          | 12/02/2024 16:11         |
|                  |                                      | Recording started on | 12/02/2024 16:00 GMT+7.0 |
| Operator:        |                                      |                      |                          |
| Laboratory:      |                                      |                      |                          |
| Code:            |                                      |                      |                          |
| Remarks:         |                                      |                      |                          |

### Method parameters

|            |  |
|------------|--|
| Method     | Without Enr. /FBR/0.10 ng/L_12-02-2024 |
| Created on | 12/02/2024 Time 15:54                  |
| Program    | ---                                    |

Parameters **Mercur Technique:** Hg fluorescence

|                  |             |                 |         |
|------------------|-------------|-----------------|---------|
| Line             | 253.7 nm    |                 |         |
| Lamp type        | Hg-LP       |                 |         |
| Integr. mode     | Peak height | Integr. time    | 35 s    |
| PMT              | 464 V       |                 |         |
| AZ time          | 5 s         | Peak smoothing  | 12/5    |
| Delay            | 0 s         |                 |         |
|                  | ---         |                 |         |
| Working mode     | w/o enrich. | System cleaning | Off     |
| FBR technique    | on          | Wash time acid  | 10 s    |
| Pump speed       | 3           | Soaking time    | 20 s    |
| Sample load time | 10 s        | Gas load time   | 5 NL/h  |
| Reaction time    | 6 s         |                 |         |
| Waiting time AZ  | 5 s         |                 |         |
| Delay            | 0 s         |                 |         |
| Purge time1      | 30 s        |                 |         |
| Purge time2      | 15 s        | Gas wash time2  | 10 NL/h |

Mercur

## เอกสารไม่ควบคุม

## QC parameters

|                    |                 |                  |                 |
|--------------------|-----------------|------------------|-----------------|
| QC type            | Conc. check     | QC check samp. 2 | ---             |
| QC check samp. 1   | ---             | Conc.            | ---             |
| Conc.              | ---             | Error limit      | ---             |
| Error limit        | off             | Reaction         | flag + continue |
| Rep. measurement   | off             | QC std.2 no.     | 3(0.100 µg/L)   |
| QC std.1 no.       | 1(100.000 µg/L) | QC std.2 limit   | ± 20.00%        |
| QC std.1 limit     | ± 20.00%        |                  |                 |
| QC std. act.       | flag + continue |                  |                 |
| Expect. blank abs. | 0.0100± 0.0100  | Reaction         | flag + continue |
| QC precision       | off             | Reaction         | off             |
|                    |                 | QC Recal.factor  | Off             |

### Calibration settings

|                    |                 |                   |          |
|--------------------|-----------------|-------------------|----------|
| Calib. meth        | Standard calib. | Calibr. unit      | µg/L     |
| No. standards      | 1               | Conversion fac.   | 1000     |
| Type of standards  | ---             | Standard prep.    | Premixed |
|                    |                 | Blank correct.    | ---      |
|                    |                 | Recalib. std. no. | ---      |
| Output unit        | µg/L            | Conversion fac.   | 1000     |
| Calib. stat.       | Mean            | Meas. cycles      | 3        |
|                    |                 | Blind cycles      | 1        |
| Stock sol. 1       | ---             | Stock sol. 2      | ---      |
| Stock sol. 3       | ---             | Stock sol. 4      | ---      |
| Type of cal. curve | linear          | Intercept         | Zero     |
| Weighted cal.      | off             | Grubbs stat.      | off      |

### Sample statistics

|               |        |              |   |
|---------------|--------|--------------|---|
| Stat. mode    | Mean   | Meas. cycles | 3 |
| Confid. level | 95.4 % | Blind cycles | 1 |
| Grubbs stat.  | off    |              |   |

### Calibration standards

| No | Name     | State | Pos | Conc./<br>µg/L | Ints                      | SD                   | RSD/%          |
|----|----------|-------|-----|----------------|---------------------------|----------------------|----------------|
| 1  | Cal-Zero | (--)  | ##  | 0.000          | H: 0.000878<br>A: 0.01998 | 0.000052<br>0.001015 | 6.030<br>5.081 |
| 2  | Cal-Std1 | (--)  | ##  | 100.000        | H: 0.009799<br>A: 0.1316  | 0.000094<br>0.00082  | 0.969<br>0.870 |

Mercur

## เอกสารไม่ควบคุม

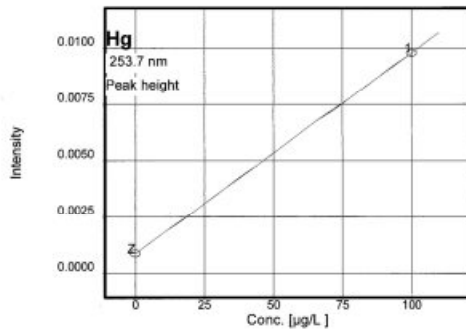
## Calibration function 1 12/02/2024 16:10 Calibration (Peak height)

Ints=k1+k2\*conc

k1=0.000878 k2=0.000089

Recal. factor: ---

|                 |                     |              |           |
|-----------------|---------------------|--------------|-----------|
| Slope           | 0.00009 Ints/(µg/L) | R2-adjusted  | 1.0000    |
| sc0             | 1.00000 µg/L        |              |           |
| Lower limit     | 0 µg/L              | Upper limit  | 110. µg/L |
| Detection limit | ---                 | Deter. limit | ---       |



## Measurements and events (sorted by time)

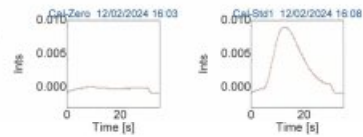
| Hg ID       | Without Enr. /FBR/0.10 ng/L_12-02-2024 | 12/02/2024 16:00 |
|-------------|--|------------------|
| Conc.       | Ints                                   | Time             |
| Cal-Zero    | 0.000939                               | 16:03            |
|             | 0.000845                               | 16:04            |
|             | 0.000849                               | 16:05            |
| 0µg/L       | 0.000878                               | 16:05            |
|             | 0.00052940                             | 6.030            |
| Cal-Std1    | 0.008896                               | 16:08            |
|             | 0.008706                               | 16:09            |
|             | 0.008794                               | 16:10            |
| 100.0µg/L   | 0.008799                               | 16:10            |
| Calibration | Calibration function: 01               | 16:10            |

Mercur

เอกสารไม่ควบคุม

## Peak plots

Hg



## Mercur

Report file: C:\WinAAS\TMP\2024\Result\WO\Pro\_006  
 Program version: 4.7.9.0 Printed on: 12/02/2024 14:32  
 Recording started on 12/02/2024 14:21 GMT+7.0  
 Operator:  
 Laboratory:  
 Code:  
 Remarks:

## Method parameters

Method Without Enrichment / FBR / 30 µg/L\_PM\_12-02-2024  
 Created on 12/02/2024 Time 11:09  
 Program ---

## Parameters Mercur Technique: Hg fluorescence

|                  |             |                 |         |
|------------------|-------------|-----------------|---------|
| Line             | 253.7 nm    |                 |         |
| Lamp type        | Hg-LP       |                 |         |
| Integr. mode     | Peak height | Integr. time    | 35 s    |
| PMT              | 451 V       |                 |         |
| AZ time          | 5 s         | Peak smoothing  | 12/5    |
| Delay            | 0 s         |                 |         |
| Working mode     | w/o enrich. | System cleaning | Off     |
| FBR technique    | on          | Wash time acid  | 10 s    |
| Pump speed       | 3           | Soaking time    | 20 s    |
| Sample load time | 12 s        | Gas load time   | 10 NL/h |
| Reaction time    | 12 s        |                 |         |
| Waiting time AZ  | 5 s         |                 |         |
| Delay            | 0 s         |                 |         |
| Purge time1      | 30 s        |                 |         |
| Purge time2      | 15 s        | Gas wash time2  | 10 NL/h |

Hg

Mercur

เอกสารไม่ควบคุม

## QC parameters

|                    |                 |                  |
|--------------------|-----------------|------------------|
| QC type            | Conc. check     |                  |
| QC check samp. 1   | ---             | QC check samp. 2 |
| Conc.              | ---             | Conc.            |
| Error limit        | ---             | Error limit      |
| Rep. measurement   | off             | Reaction         |
| QC std. 1 no.      | 1(30.000 ng/L)  | QC std. 2 no.    |
| QC std. 1 limit    | ± 20.00%        | QC std. 2 limit  |
| QC std. act.       | flag + continue |                  |
| Expect. blank abs. | 0.0100± 0.0100  | Reaction         |
| QC precision       | off             | Reaction         |
|                    |                 | QC Recal.factor  |

## Calibration settings

|                     |                 |                   |          |
|---------------------|-----------------|-------------------|----------|
| Calib. meth         | Standard calib. | Calibr. unit      | ng/L     |
| No. standards       | 1               | Conversion fac.   | 1000000  |
| Type of standards   | ---             | Standard prep.    | Premixed |
|                     |                 | Blank correct.    | ---      |
|                     |                 | Recalib. std. no. | ---      |
| Output unit         | µg/L            | Conversion fac.   | 1000     |
| Calib. stat.        | Mean            | Meas. cycles      | 3        |
|                     |                 | Blind cycles      | 1        |
| Stock sol. 1        | ---             | Stock sol. 2      | ---      |
| Stock sol. 3        | ---             | Stock sol. 4      | ---      |
| Type of cal. curve  | linear          | Intercept         | Zero     |
| Weighted cal.       | off             | Grubbs stat.      | off      |
| Check of cal. curve | no outlier test |                   |          |

## Sample statistics

|               |        |              |   |
|---------------|--------|--------------|---|
| Stat. mode    | Mean   | Meas. cycles | 3 |
| Confid. level | 95.4 % | Blind cycles | 1 |
| Grubbs stat.  | off    |              |   |

## Calibration standards

Hg

| No | Name     | State | Pos | Conc./ ng/L | Ints                      | SD                   | RSD/%          |
|----|----------|-------|-----|-------------|---------------------------|----------------------|----------------|
| 1  | Cal-Zero | (--)  | ##  | 0.000       | H: 0.000587<br>A: 0.01383 | 0.000024<br>0.000359 | 4.137<br>2.597 |
| 2  | Cal-Std1 | (--)  | ##  | 30.000      | H: 0.002754<br>A: 0.04278 | 0.000049<br>0.000186 | 1.814<br>0.437 |

Mercur

เอกสารไม่ควบคุม

## Calibration function 1

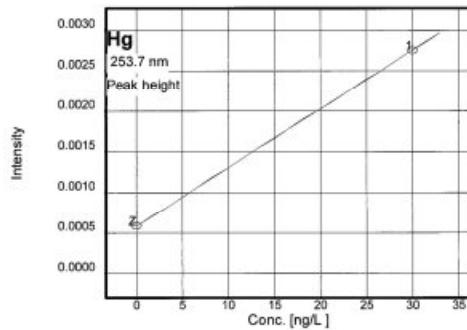
12/02/2024 14:31 Calibration (Peak height)

Ints=k1+k2\*conc

k1=0.000588 k2=0.000072

Recal. factor: ---

|                 |                     |              |           |
|-----------------|---------------------|--------------|-----------|
| Slope           | 0.00007 Ints/(ng/L) | R2-adjusted  | 1.0000    |
| sc0             | 1.00000 ng/L        |              |           |
| Lower limit     | 0 ng/L              | Upper limit  | 33.0 ng/L |
| Detection limit | ---                 | Deter. limit | ---       |



## Measurements and events (sorted by time)

| Hg          | Without Enrichment / FBR / 30 µg/L_PM_12-02-2024 | 12/02/2024 14:21 |
|-------------|--|------------------|
| ID          | Conc.  | Ints             |
| Cal-Zero    |  | 0.000588         |
|             |  | 0.000564         |
|             |  | 0.000612         |
|             | 0 ng/L   | 0.000587         |
|             |  | 0.00024310       |
|             |  | 4.137            |
| Cal-Std1    |  | 0.002810         |
|             |  | 0.002740         |
|             |  | 0.002713         |
|             | 30.00 ng/L                                       | 0.002754         |
|             |  | 0.00049980       |
|             |  | 1.814            |
| Calibration | Calibration function: 01                         | 14:31            |

Mercur

เอกสารไม่ควบคุม

## Mercur

Report file: C:\WinAAS\TMP\2024\Result\WO\Pro\_007

Program version: 4.7.9.0 Printed on: 12/02/2024 14:55

Operator: Recording started on 12/02/2024 14:41 GMT+7.0

Laboratory:

Code:

Remarks:

## Method parameters

Method With Enrichment / FBR / 30 µg/L\_PM\_12-02-2024

Created on 12/02/2024 Time 11:37

Program ---

## Parameters Mercur Technique: Hg fluorescence

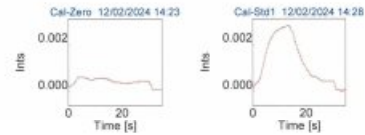
|                  |                  |                   |         |
|------------------|------------------|-------------------|---------|
| Line             | 253.7 nm         |                   |         |
| Lamp type        | Hg-LP            |                   |         |
| Integr. mode     | Peak height      | Integr. time      | 20 s    |
| PMT              | 444 V            |                   |         |
| AZ time          | 5 s              | Peak smoothing    | 12/5    |
| Delay            | 0 s              |                   |         |
|                  | ---              |                   |         |
| Working mode     | Enr. w/o reload. | System cleaning   | Off     |
| FBR technique    | on               | Wash time acid    | 10 s    |
| Pump speed       | 3                | Soaking time      | 20 s    |
| Sample load time | 10 s             | Gas load time     | 5 NL/h  |
| Reaction time    | 10 s             |                   |         |
| Waiting time AZ  | 5 s              |                   |         |
| Delay            | 0 s              |                   |         |
| Purge time1      | 20 s             |                   |         |
| Purge time2      | 15 s             | Gas wash time2    | 5 NL/h  |
| Purge time3      | 10 s             | Gas wash time3    | 10 NL/h |
| Heat time coll.1 | 20 s             | Cool. time coll.1 | 25 s    |

Mercur

เอกสารไม่ควบคุม

## Peak plots

Hg



## QC parameters

|                    |                 |                  |
|--------------------|-----------------|------------------|
| QC type            | Conc. check     |                  |
| QC check samp. 1   | ---             | QC check samp. 2 |
| Conc.              | ---             | Conc.            |
| Error limit        | ---             | Error limit      |
| Rep. measurement   | off             | Reaction         |
| QC std. 1 no.      | 1(30.000 µg/L)  | QC std. 2 no.    |
| QC std. 1 limit    | ± 50.00%        | QC std. 2 limit  |
| QC std. act.       | flag + continue |                  |
| Expect. blank abs. | 0.0100± 0.0100  | Reaction         |
| QC precision       | off             | flag + continue  |
|                    |                 | Reaction         |
|                    |                 | QC Recal.factor  |
|                    |                 | Off              |

## Calibration settings

|                     |                 |                   |          |
|---------------------|-----------------|-------------------|----------|
| Calib. meth         | Standard calib. | Calibr. unit      | µg/L     |
| No. standards       | 1               | Conversion fac.   | 1000     |
| Type of standards   | ---             | Standard prep.    | Premixed |
|                     |                 | Blank correct.    | ---      |
|                     |                 | Recalib. std. no. | ---      |
| Output unit         | µg/L            | Conversion fac.   | 1000     |
| Calib. stat.        | Mean            | Meas. cycles      | 3        |
|                     |                 | Blind cycles      | 1        |
| Stock sol. 1        | ---             | Stock sol. 2      | ---      |
| Stock sol. 3        | ---             | Stock sol. 4      | ---      |
| Type of cal. curve  | linear          | Intercept         | Zero     |
| Weighted cal.       | off             | Grubbs stat.      | off      |
| Check of cal. curve | no outlier test |                   |          |

## Sample statistics

|               |        |              |   |
|---------------|--------|--------------|---|
| Stat. mode    | off    | Meas. cycles | 1 |
| Confid. level | 95.4 % | Blind cycles | 1 |
| Grubbs stat.  | ---    |              |   |

## Calibration standards

| No | Name     | State | Pos | Conc./ µg/L | Ints                      | SD                   | RSD%           |
|----|----------|-------|-----|-------------|---------------------------|----------------------|----------------|
| 1  | Cal-Zero | (--)  | ##  | 0.000       | H: 0.004358<br>A: 0.01659 | 0.000018<br>0.000277 | 0.417<br>1.673 |
| 2  | Cal-Std1 | (--)  | ##  | 30.000      | H: 0.01710<br>A: 0.06278  | 0.000152<br>0.000816 | 0.889<br>0.982 |

Hg

Mercur

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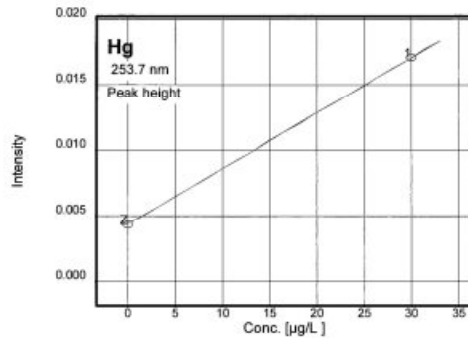
## Calibration function 1 12/02/2024 14:55 Calibration (Peak height)

Ints=k1+k2\*conc

k1=0.004358 k2=0.000425

Recal. factor: ---

|                 |                     |              |           |
|-----------------|---------------------|--------------|-----------|
| Slope           | 0.00042 Ints/(µg/L) | R2-adjusted  | 1.0000    |
| sc0             | 1.00000 µg/L        |              |           |
| Lower limit     | 0 µg/L              | Upper limit  | 33.0 µg/L |
| Detection limit | ---                 | Deter. limit | ---       |



## Measurements and events (sorted by time)

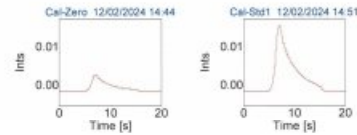
| Hg          | With Enrichment / FBR / 30 µg/L_PM_12-02-2024 |          |    |             |       | 12/02/2024 | 14:41 |
|-------------|---|----------|----|-------------|-------|------------|-------|
| ID          | Conc.   | Ints     | BG | SD          | RSD/% | Int. type  | Time  |
| Cal-Zero    |   | 0.004343 |    |             |       | PkH        | 14:44 |
|             |   | 0.004378 |    |             |       |            | 14:46 |
|             |   | 0.004352 |    |             |       |            | 14:47 |
|             | 0µg/L   | 0.004358 |    | 0.000018180 | 0.417 |            | 14:47 |
| Cal-Std1    |   | 0.01726  |    |             |       | PkH        | 14:51 |
|             |   | 0.01695  |    |             |       |            | 14:52 |
|             |   | 0.01708  |    |             |       |            | 14:54 |
|             | 30.00µg/L                                     | 0.01710  |    | 0.0001520   | 0.889 |            | 14:54 |
| Calibration | Calibration function: 01                      |          |    |             |       |            | 14:55 |

Mercur

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## Peak plots

Hg



## Mercur

Report file: C:\WinAAS\TMP\2024\Result\WO\Pro\_008  
 Program version: 4.7.9.0 Printed on: 12/02/2024 15:22  
 Recording started on 12/02/2024 15:10 GMT+7.0  
 Operator:  
 Laboratory:  
 Code:  
 Remarks:

## Method parameters

Method Without enrichment / FBR 100 ng/L PM\_12-02-2024  
 Created on 12/02/2024 Time 11:54  
 Program ---

## Parameters Mercur Technique: Hg absorption

|                  |             |                 |         |
|------------------|-------------|-----------------|---------|
| Line             | 253.7 nm    |                 |         |
| Lamp type        | Hg-LP       |                 |         |
| Integr. mode     | Peak height | Integr. time    | 40 s    |
| PMT              | 238 V       |                 |         |
| AZ time          | 5 s         | Peak smoothing  | 12/5    |
| Delay            | 0 s         |                 |         |
|                  | ---         |                 |         |
| Working mode     | w/o enrich. | System cleaning | Acid    |
| FBR technique    | off         | Wash time acid  | 15 s    |
| Pump speed       | 4           | Soaking time    | 20 s    |
| Sample load time | 8 s         | Gas load time   | 10 NL/h |
| Reaction time    | 12 s        |                 |         |
| Waiting time AZ  | 15 s        |                 |         |
| Purge time1      | 40 s        |                 |         |

## QC parameters

|                    |                 |                  |                 |
|--------------------|-----------------|------------------|-----------------|
| QC type            | Conc. check     | QC check samp. 2 | ---             |
| QC check samp. 1   | ---             | Conc.            | ---             |
| Error limit        | ---             | Error limit      | ---             |
| Rep. measurement   | off             | Reaction         | flag + continue |
| QC std. 1 no.      | 1(100.00 ng/L)  | QC std. 2 no.    | 1(100.00 ng/L)  |
| QC std. 1 limit    | ± 50.00%        | QC std. 2 limit  | ± 0.00%         |
| QC std. act.       | flag + continue |                  |                 |
| Expect. blank abs. | 0.0100± 0.0100  | Reaction         | flag + continue |
| QC precision       | off             | Reaction         | off             |
|                    |                 | QC Recal factor  | Off             |

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## Calibration settings

|                     |                 |                   |            |
|---------------------|-----------------|-------------------|------------|
| Calib. meth         | Standard calib. | Calibr. unit      | ng/L       |
| No. standards       | 1               | Conversion fac.   | 1000000    |
| Type of standards   | ---             | Standard prep.    | Premixed   |
|                     |                 | Blank correct.    | ---        |
|                     |                 | Recalib. std. no. | ---        |
| Output unit         | µg/L            | Conversion fac.   | 1000       |
| Calib. stat.        | Mean            | Meas. cycles      | 3          |
|                     |                 | Blind cycles      | 1          |
| Stock sol. 1        | ---             | Stock sol. 2      | ---        |
| Stock sol. 3        | ---             | Stock sol. 4      | ---        |
| Type of cal. curve  | linear          | Intercept         | calculated |
| Weighted cal.       | off             | Grubbs stat.      | off        |
| Check of cal. curve | no outlier test |                   |            |

## Sample statistics

|               |        |              |   |
|---------------|--------|--------------|---|
| Stat. mode    | Mean   | Meas. cycles | 2 |
| Confid. level | 95.4 % | Blind cycles | 1 |
| Grubbs stat.  | ---    |              |   |

## Calibration standards

| No | Name     | State | Pos | Conc./ng/L | Abs                        | SD                   | RSD/%          |
|----|----------|-------|-----|------------|----------------------------|----------------------|----------------|
| 1  | Cal-Zero | (-)   | ##  | 0.00       | H: 0.000478<br>A: 0.005393 | 0.000331<br>0.002260 | 69.26<br>41.90 |
| 2  | Cal-Std1 | (-)   | ##  | 100.00     | H: 0.002580<br>A: 0.034199 | 0.000081<br>0.002697 | 3.171<br>7.887 |

## Calibration function 1 12/02/2024 15:22 Calibration (Peak height)

Abs=k1+k2\*conc

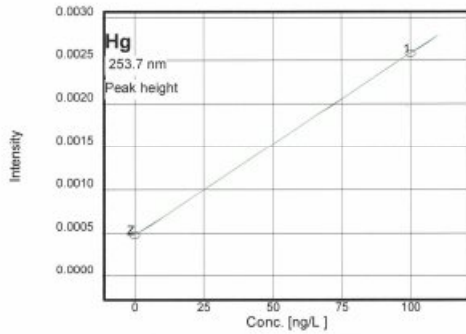
k1=0.000478 k2=0.000021

Recal. factor: ---

|                 |                    |                |                   |
|-----------------|--------------------|----------------|-------------------|
| Slope           | 0.00002 Abs/(ng/L) | R2-adjusted    | 1.0000            |
| sc0             | 1.00000 ng/L       | Charact. conc. | 207.402 (ng/L)/1% |
| Lower limit     | 0 ng/L             | Upper limit    | 110. ng/L         |
| Detection limit | ---                | Deter. limit   | ---               |

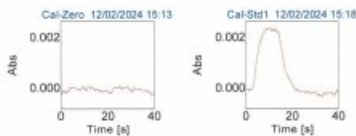
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## Measurements and events (sorted by time)

| Without enrichment / FBR 100 ng/L PM <sub>10</sub> -12-02-2024 |                          |          |    |             |       |
|--|--------------------------|----------|----|-------------|-------|
| ID   | Conc.                    | Abs      | BG | SD          | RSD/% |
| Cal-Zero   |                          | 0.000328 |    |             |       |
|  |                          | 0.000248 |    |             |       |
|  |                          | 0.000658 |    |             |       |
|  | 0ng/L                    | 0.000478 |    | 0.00033131  | 69.26 |
| Cal-Std1   |                          | 0.002638 |    |             |       |
|  |                          | 0.002615 |    |             |       |
|  |                          | 0.002487 |    |             |       |
|  | 100 ng/L                 | 0.002580 |    | 0.000081841 | 3.171 |
| Calibration  | Calibration function: 01 |          |    |             |       |
| Peak plots   | Hg                       |          |    |             |       |



Mercur

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



## Certificate of Calibration

Cert. No.: 24TM548  
Page : 1 of 3

Equipment : Incubator  
Manufacturer : Memmert  
Model : IPP 260  
Serial No. : V615.0187  
ID No. : UAE.MIC.003/2559  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory  
Received Order : 01 April 2024  
Calibration Date : 01 April 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Man Pattanapongpaiboon  
Approved by :   
( ) Ponpan Paipim  
(✓) Suwit Jimjai  
( ) Kunchit Promprat

Issue Date : 7 April 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 : Incubator  
Condition As-Received : Used Item  
Reference : 2404-0003OC-1

Cert. No.: 24TM548  
Page : 2 of 3

## Procedure Used :-

Calibration was 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-

| Instrument           | Serial No. | Cert. No. | Traceable | Due Date    |
|----------------------|------------|-----------|-----------|-------------|
| 1 ) Data Acquisition | MY49023932 | 23LM122   | TPA       | 26 Jul 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.

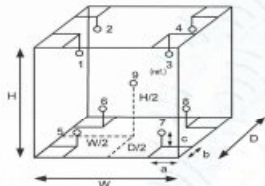
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

| Environment during calibration |           |          |
|--------------------------------|-----------|----------|
|                                | Beginning | Finished |
| Temp. ( °C )                   | 24        | 24       |
| REL.Humid. ( % )               | 54        | 57       |
| AC Supply ( Volt )             | 221       | 223      |



## Probe Installation Details :

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

## Dimension of Chamber :

D = 0.50 m  
W = 0.64 m  
H = 0.80 m  
Capacity = 0.26 m<sup>3</sup>

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1          | 19-16RTD-01       |
| 2          | 19-16RTD-02       |
| 3          | 19-16RTD-03       |
| 4          | 19-16RTD-04       |
| 5          | 19-16RTD-05       |
| 6          | 19-16RTD-06       |
| 7          | 21-16RTD-07       |
| 8          | 19-16RTD-08       |
| 9 (ref.)   | 19-16RTD-09       |



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2404-0003OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 24TM548  
Page : 3 of 3

| Calibration Point ( °C ) | UUC* Setting ( °C ) | UUC* Reading ( °C ) | Temperature stability ( ± °C ) | Temperature uniformity ( °C ) | Overall Variation ( °C ) | Coverage Factor k |
|--------------------------|---------------------|---------------------|--------------------------------|-------------------------------|--------------------------|-------------------|
| 35.0                     | 35.0                | 35.0                | 0.028                          | 0.13                          | 0.24                     | 2                 |

| Calibration Point ( °C ) | Measured Temperature ( °C ) |        |        |        |        |        |        |        |          | Uncertainty ( ± °C ) |
|--------------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|----------|----------------------|
|                          | 1                           | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9 (ref.) |                      |
| 35.0                     | 34.908                      | 35.004 | 34.989 | 35.099 | 35.089 | 35.095 | 34.921 | 34.936 | 35.002   | 0.30                 |

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม

เอกสารไม่ควบคุม





## Certificate of Calibration

Cert. No.: 24TM651  
Page : 1 of 3

Equipment : Incubator  
Manufacturer : Memmert  
Model : IPP 260  
Serial No. : V618.0033  
ID No. : UAE.MIC.021/2561  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory (302)  
Received Order : 01 April 2024  
Calibration Date : 02 April 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Man Pattanapongpaiboon  
Approved by :   
( ) Ponpan Paipim  
(✓) Suwit Imjai  
( ) Kunchit Promprat  
Issue Date : 7 April 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.

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Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2404-0003OC-3  
Procedure Used :-

Cert. No.: 24TM651  
Page : 2 of 3

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:-

| Instrument           | Serial No. | Cert. No. | Traceable | Due Date    |
|----------------------|------------|-----------|-----------|-------------|
| 1 ) Data Acquisition | MY49023932 | 23LM122   | TPA       | 26 Jul 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.

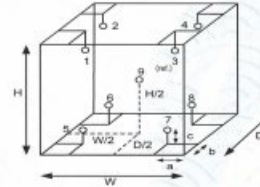
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

| Environment during calibration |           |          |
|--------------------------------|-----------|----------|
|                                | Beginning | Finished |
| Temp. ( °C )                   | 25        | 25       |
| REL.Humid. ( % )               | 54        | 57       |
| AC Supply ( Volt )             | 221       | 224      |



#### Probe Installation Details :

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

#### Dimension of Chamber :

D = 0.50 m  
W = 0.64 m  
H = 0.80 m  
Capacity = 0.26 m<sup>3</sup>

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1          | 20-16RTD-01       |
| 2          | 20-16RTD-02       |
| 3          | 20-16RTD-03       |
| 4          | 23-16RTD-04       |
| 5          | 22-16RTD-05       |
| 6          | 20-16RTD-06       |
| 7          | 20-16RTD-07       |
| 8          | 22-16RTD-08       |
| 9 (ref.)   | 22-16RTD-09       |

เอกสารไม่ควบคุม



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2404-0003OC-3  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 24TM651  
Page : 3 of 3

| Calibration Point ( °C ) | UUC* Setting ( °C ) | UUC* Reading ( °C ) | Temperature stability ( ± °C ) | Temperature uniformity ( °C ) | Overall Variation ( °C ) | Coverage Factor k |
|--------------------------|---------------------|---------------------|--------------------------------|-------------------------------|--------------------------|-------------------|
| 22.0                     | 22.0                | 22.0                | 0.039                          | 0.22                          | 0.42                     | 2                 |
| 44.0                     | 44.0                | 44.0                | 0.048                          | 0.50                          | 0.90                     | 2                 |

| Calibration Point ( °C ) | Measured Temperature ( °C ) |        |        |        |        |        |        |        |          | Uncertainty ( ± °C ) |
|--------------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|----------|----------------------|
|                          | 1                           | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9 (ref.) |                      |
| 22.0                     | 22.008                      | 22.034 | 22.039 | 22.021 | 21.746 | 21.698 | 21.668 | 21.668 | 21.846   | 0.30                 |
| 44.0                     | 44.267                      | 44.802 | 44.293 | 44.402 | 44.004 | 43.981 | 43.756 | 44.000 | 44.205   | 0.30                 |

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



Cert. No.: 23TM1079  
Page : 1 of 3

## Certificate of Calibration

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WNB 14  
Serial No. : L407.0756  
ID No. : UAE.MIC.024/2550  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory  
Received Order : 10 July 2023  
Calibration Date : 10 July 2023  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Man Pattanapongpaiboon

Approved by :   
Approved Signatory

( ) Pornthipha Tameyakul  
(✓) Malee Buksua  
( ) Suwit Imjai

Issue Date : 20 July 2023

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2307-0087OC-6  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 23TM1079  
Page : 3 of 3

| Calibration point<br>( °C ) | UUC*<br>Setting<br>( °C ) | UUC*<br>Reading<br>( °C ) | Average* Standard Reading ( °C ) |        |        |        |          | Uncertainty<br>( ± °C ) |
|-----------------------------|---------------------------|---------------------------|----------------------------------|--------|--------|--------|----------|-------------------------|
|                             |                           |                           | 1                                | 2      | 3      | 4      | 5 (ref.) |                         |
| 44.5                        | 45.0                      | 45.0                      | 44.428                           | 44.374 | 44.397 | 44.378 | 44.387   | 0.15                    |
| 45.0                        | 45.5                      | 45.5                      | 44.933                           | 44.878 | 44.902 | 44.877 | 44.902   | 0.15                    |

| Calibration point<br>( °C ) | Uniformity<br>( °C ) | Stability<br>( ± °C ) | Coverage Factor<br>k |
|-----------------------------|----------------------|-----------------------|----------------------|
| 44.5                        | 0.084                | 0.040                 | 2                    |
| 45.0                        | 0.19                 | 0.076                 | 2                    |

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

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

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

UUC\* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2307-0087OC-6  
Procedure Used :-

Cert. No.: 23TM1079  
Page : 2 of 3

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

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

1. Reference standard instrument:-

| Instrument           | Serial No. | Cert. No. | Traceable | Due Date    |
|----------------------|------------|-----------|-----------|-------------|
| 1 ) Data Acquisition | MY59003411 | 22LM165   | TPA       | 26 Nov 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.

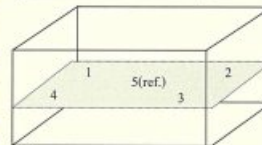
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Heat transfer medium used : Water

|                          | Environmental<br>( °C ) ( %R.H. ) |    | AC Voltage Supply<br>( Volt ) |
|--------------------------|-----------------------------------|----|-------------------------------|
|                          | 25                                | 57 | 222                           |
| Beginning of Calibration | 25                                | 58 | 223                           |
| Finished of Calibration  | 25                                | 58 | 223                           |



Front

| Position : | Ref. Std.<br>ID No.: |
|------------|----------------------|
| 1          | 4804539-001          |
| 2          | 4804539-002          |
| 3          | 4804539-003          |
| 4          | 4804539-004          |
| 5(ref.)    | 4804539-005          |

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## Certificate of Calibration

Equipment: Balance  
Model: PX823  
Serial No. (or ID.): C236754745 (UAE.MIC.055/2565)  
Manufacturer: Ohaus  
Condition: In condition

Certificate No.: C01234158  
Issued Date: 08 December 2023  
Job No.: WO-00011251  
Page: 1 of 3

Customer: United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District,  
Phrakhanong District, Bangkok, THAILAND 10260

Environment Condition: Temperature 25 °C ± 0.5 °C  
Humidity 54 %RH ± 1.7 %RH

Calibration Place: United Analyst and Engineering Consultant Co., Ltd. (301 Microbiology Room)  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District,  
Phrakhanong District, Bangkok, THAILAND 10260

Calibration By: Mr. Adisai Maknoi  
Calibration Date: 07 December 2023

The Method used: In-house method, CAL-WI-47, based on UKAS Lab 14

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02222534

(Mr. Adisai Maknoi)  
Person in charge

(Mr. Rungrod Jenkitrakulchai)  
Authorized signatory

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

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DKSH Technology Limited  
2533 สุขุมวิท ถนนสุขุมวิท กรุงเทพฯ 10260  
2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260  
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/certidto-thailand

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CAL-FM-C01-14: 12 Sep 2022






Certificate No.: C01234158 Page: 2 of 3

#### Calibration Results:

##### Before Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.

|   |   |   |                    |       |     |
|---|---|---|--------------------|-------|-----|
|  |  |  | Nominal Test Value | 200   | (g) |
| Reference Points (g)  |   |   |                    |       |     |
| A   | B   | C   | D                  | E     |     |
| -   | 0.000   | -0.003  | 0.000              | 0.001 |     |

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.001 (g)

| Nominal test value (g) | Standard Deviation |
|------------------------|--------------------|
| 50                     | 0.0006             |
| 500                    | 0.0008             |

Error of indication from nominal or conventional mass value., Readability 0.001 (g)

| Nominal Value<br>(g) | Conventional Mass<br>(g) | Displayed Value<br>(g) | Error of Indication<br>(g) | Uncertainty<br>(g) | k    |
|----------------------|--------------------------|------------------------|----------------------------|--------------------|------|
| 1                    | 1.0000                   | 1.000                  | 0.000                      | 0.0013             | 2.10 |
| 5                    | 5.0001                   | 5.000                  | 0.000                      | 0.0013             | 2.10 |
| 10                   | 10.0001                  | 10.001                 | 0.001                      | 0.0013             | 2.10 |
| 20                   | 20.0000                  | 20.000                 | 0.000                      | 0.0013             | 2.09 |
| 50                   | 50.0001                  | 50.000                 | 0.000                      | 0.0013             | 2.09 |
| 100                  | 100.0001                 | 100.001                | 0.001                      | 0.0013             | 2.09 |
| 200                  | 200.0004                 | 200.002                | 0.002                      | 0.0014             | 2.07 |
| 300                  | 300.0005                 | 300.002                | 0.002                      | 0.0015             | 2.05 |
| 400                  | 400.0006                 | 400.004                | 0.003                      | 0.0016             | 2.03 |
| 500                  | 500.0006                 | 500.008                | 0.007                      | 0.0019             | 2.02 |
| 600                  | 600.0007                 | 600.009                | 0.008                      | 0.0021             | 2.01 |

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DKSH Technology Limited  
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CAL-FM-C01-14: 12 Sep 2022

## After Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.

|   |       |        |   |       |  |   |  |  |                            |  |
|---|-------|--------|---|-------|--|---|--|--|----------------------------|--|
|  |       |        |  |       |  |  |  |  | Nominal Test Value 200 (g) |  |
| Reference Points (g)  |       |        |   |       |  |   |  |  |                            |  |
| A   | B     | C      | D   | E     |  |   |  |  |                            |  |
| -   | 0.001 | -0.002 | -0.002  | 0.001 |  |   |  |  |                            |  |

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.001 (g)

| Nominal test value (g) | Standard Deviation |
|------------------------|--------------------|
| 50                     | 0.0006             |
| 500                    | 0.0008             |

Error of Indication from nominal or conventional mass value., Readability 0.001 (g)

| Nominal Value (g) | Conventional Mass (g) | Displayed Value (g) | Error of Indication (g) | Uncertainty (g) | k    |
|-------------------|-----------------------|---------------------|-------------------------|-----------------|------|
| 1                 | 1.0000                | 1.000               | 0.000                   | 0.0013          | 2.10 |
| 5                 | 5.0001                | 5.000               | 0.000                   | 0.0013          | 2.10 |
| 10                | 10.0001               | 10.000              | 0.000                   | 0.0013          | 2.10 |
| 20                | 20.0000               | 20.000              | 0.000                   | 0.0013          | 2.10 |
| 50                | 50.0001               | 50.000              | 0.000                   | 0.0013          | 2.10 |
| 100               | 100.0001              | 100.000             | 0.000                   | 0.0014          | 2.09 |
| 200               | 200.0004              | 200.000             | 0.000                   | 0.0014          | 2.07 |
| 300               | 300.0005              | 300.001             | 0.001                   | 0.0015          | 2.05 |
| 400               | 400.0006              | 400.002             | 0.001                   | 0.0017          | 2.04 |
| 500               | 500.0006              | 500.001             | 0.000                   | 0.0019          | 2.02 |
| 600               | 600.0007              | 600.002             | 0.001                   | 0.0021          | 2.01 |

The End of Certificate

## Statements of conformity:

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

The error of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, UKAS Lab14. Therefore, those parameters have not been assessed separately.

## Tolerance and Decision rules:

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

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

Rungrod

(Mr. Rungrod Jenkitrakulchai)

Authorized signatory

## Statements of conformity:

## Before Adjustment

Readability: 0.001 g

| Nominal Value g | Error of Indication g | Guard band (w) g | Tolerance (±) g | Conformity |
|-----------------|-----------------------|------------------|-----------------|------------|
| 1               | 0.000                 | 0.0013           | 0.002           | Pass       |
| 5               | 0.000                 | 0.0013           | 0.010           | Pass       |
| 10              | 0.001                 | 0.0013           | 0.020           | Pass       |
| 20              | 0.000                 | 0.0013           | 0.040           | Pass       |
| 50              | 0.000                 | 0.0013           | 0.100           | Pass       |
| 100             | 0.001                 | 0.0013           | 0.200           | Pass       |
| 200             | 0.002                 | 0.0014           | 0.400           | Pass       |
| 300             | 0.002                 | 0.0015           | 0.600           | Pass       |
| 400             | 0.003                 | 0.0016           | 0.800           | Pass       |
| 500             | 0.007                 | 0.0019           | 1.000           | Pass       |
| 600             | 0.008                 | 0.0021           | 1.200           | Pass       |

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

## Statements of conformity:

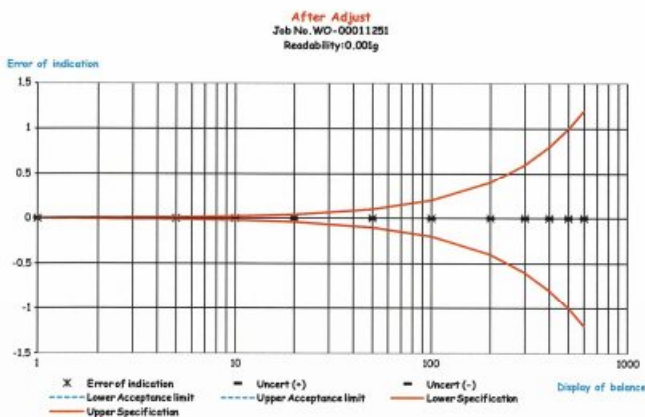
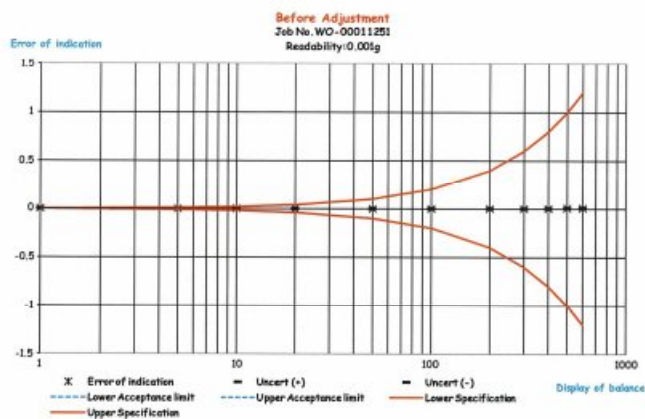
## After Adjustment

Readability: 0.001 g

| Nominal Value g | Error of Indication g | Guard band (w) g | Tolerance (±) g | Conformity |
|-----------------|-----------------------|------------------|-----------------|------------|
| 1               | 0.000                 | 0.0013           | 0.002           | Pass       |
| 5               | 0.000                 | 0.0013           | 0.010           | Pass       |
| 10              | 0.000                 | 0.0013           | 0.020           | Pass       |
| 20              | 0.000                 | 0.0013           | 0.040           | Pass       |
| 50              | 0.000                 | 0.0013           | 0.100           | Pass       |
| 100             | 0.000                 | 0.0014           | 0.200           | Pass       |
| 200             | 0.000                 | 0.0014           | 0.400           | Pass       |
| 300             | 0.001                 | 0.0015           | 0.600           | Pass       |
| 400             | 0.001                 | 0.0017           | 0.800           | Pass       |
| 500             | 0.000                 | 0.0019           | 1.000           | Pass       |
| 600             | 0.001                 | 0.0021           | 1.200           | Pass       |

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

The End of Statements of conformity



เอกสารไม่ควบคุม

## ใบตรวจสอบสภาพเครื่องชั่ง

เลขที่ใบงาน: WO-00011251  
ชนิดเครื่องมือ: Balance รุ่น: PX623 หมายเลขเครื่อง: C236754745

| ตรวจสอบ (รับ)                       |                          | รายการตรวจเช็ค                                    | ตรวจสอบ (ส่ง)                       |                          | หมายเหตุ |
|-------------------------------------|--------------------------|---|-------------------------------------|--------------------------|----------|
| 07 Dec 2023                         |                          |   | 07 Dec 2023                         |                          |          |
| ปกติ                                | ไม่ปกติ                  |   | ปกติ                                | ไม่ปกติ                  |          |
|                                     |                          | General   |                                     |                          |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 1. สายไฟ/Adapter, power supply 220/110V           | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 2. ความสมบูรณ์ชุดกระจกกันลม (Cover)               | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 3. ความสมบูรณ์ชุดของระดับน้ำ                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 4. การปรับระดับของขาตั้งเครื่อง                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 5. การทดสอบสั่นของเบ้าชั่ง                        | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 6. ความสมบูรณ์ของ Display                         | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 7. การแสดงผลของ Display หลังวางน้ำหนัก            | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 8. ชุดรองจานชั่ง (Stopper) / pan support          | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 9. การทำงานของ Function Internal / External       | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 10. ความสะอาดของตัวเครื่องภายนอกและเบ้า load cell | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 11. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง              | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |

หมายเหตุเพิ่มเติม/ข้อแนะนำ :

Mr. Adisai Maknoi  
Service Engineer

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