

ภาคผนวก ค : เอกสารสอบเทียบความถูกต้อง  
ของเครื่องมือเก็บตัวอย่าง



JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd  
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Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TISI-TIS 17025  
CALIBRATION 0367

Flow measurement laboratory  
Calibration services department.

## CERTIFICATE OF CALIBRATION

Certificate No. : CL-004-65

Page 1 of 2 Pages

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

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

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

### CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.  
Measurement Condition : The average values during measurement are  $24.7^\circ\text{C}$  and  $52.1\% \text{RH}$ .

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibration procedure:

The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/IMC/W2-dp. The WI-CL-004 was used as a calibration guideline.

### Traceability:

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

### Uncertainty of Measurement:

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

### Calibrated by:

- ☐ Mr. Sorawit Thachalad  
☒ Miss Jittrapun Lertsomphol



Approved signatory: .....

Mr. Parinya Booncharoen  
Calibration Department Manager

### MEASUREMENT RESULTS:

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

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

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

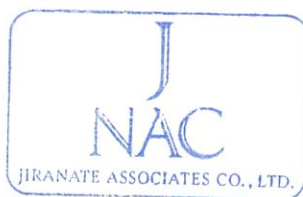
Slope ( $m$ ): 2.04689  
 Intercept ( $b$ ): -0.02301  
 Correlation coefficient ( $r$ ): 0.99987  
 Uncertainty ( $k=2$ ): 0.010  $m^3/min$

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

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

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

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



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

## Certificate of Calibration

Certificate No. : 22P801  
Page : 1 of 2

Equipment : U Tube Manometer

Manufacturer: Dwyer

Model : 1221-36-W/M

Serial No.: -

ID No.: UAE.EFM.178/2561

Condition As-Received: Used Item

Received Date: 03 March 2022

Calibration Date: 12 March 2022

Reference: 2203-0131WSC

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

Ambient Temperature: ( 23 ± 2 ) °C

Relative Humidity: ( 50 ± 15 ) %

Atmospheric Pressure: 1010 mbar

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Corporate Services 3: Equipment Calibration and Testing Services.

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

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

### Condition of this result of calibration

1.Reference standards instruments :

| <u>Instrument</u>      | <u>Model</u> | <u>Serial No.</u> | <u>Certificate No.</u> | <u>Due Date</u> |
|------------------------|--------------|-------------------|------------------------|-----------------|
| 1) Pressure Calibrator | PC106P       | 1189              | MP-0110-21             | 09 Aug 2022     |

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 at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Aussarree  
Issue Date : 14 March 2022

Approved Signatory : Attapol P.  
[ ] Phalinee Prabpaipal  
[ ] Sura Suwannasri  
[x] Attapol Panurach

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Cert.No.: 22P801

Page: 2 of 2

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

| <u>Applied Pressure</u><br>(inH <sub>2</sub> O) | <u>UUC Indication</u>                         |  | <u>ΔP</u><br>(inH <sub>2</sub> O) | <u>Error</u><br>(inH <sub>2</sub> O) |
|---|---|--|-----------------------------------|--------------------------------------|
|   | <u>High-port side</u><br>(inH <sub>2</sub> O) | <u>Low-port side</u><br>(inH <sub>2</sub> O) |                                   |                                      |
| 0.00  | 0.00  | 0.00   | 0.00                              | 0.00                                 |
| 2.00  | 0.98  | -0.94  | 1.92                              | -0.08                                |
| 4.00  | 2.00  | -1.98  | 3.98                              | -0.02                                |
| 6.00  | 3.00  | -2.98  | 5.98                              | -0.02                                |
| 8.00  | 4.00  | -3.98  | 7.98                              | -0.02                                |
| 10.00   | 5.00  | -4.98  | 9.98                              | -0.02                                |
| 12.00   | 6.02  | -5.96  | 11.98                             | -0.02                                |
| 14.00   | 7.02  | -6.96  | 13.98                             | -0.02                                |
| 16.00   | 8.04  | -7.98  | 16.02                             | 0.02                                 |
| 18.00   | 9.04  | -8.98  | 18.02                             | 0.02                                 |
| 20.00   | 10.04   | -9.98  | 20.02                             | 0.02                                 |
| 22.00   | 11.06   | -10.98                                       | 22.04                             | 0.04                                 |
| 24.00   | 12.06   | -12.00                                       | 24.06                             | 0.06                                 |
| 26.00   | 13.06   | -13.00                                       | 26.06                             | 0.06                                 |
| 28.00   | 14.08   | -14.02                                       | 28.10                             | 0.10                                 |
| 30.00   | 15.08   | -15.02                                       | 30.10                             | 0.10                                 |
| 32.00   | 16.08   | -16.04                                       | 32.12                             | 0.12                                 |
| 34.00   | 17.10   | -17.04                                       | 34.14                             | 0.14                                 |
| 35.80   | 17.90   | -17.86                                       | 35.76                             | -0.04                                |

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

\* UUC = Unit Under Calibration

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

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

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H. Apol P.  
เอกสารไม่ควบคุม



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## Certificate of Calibration

Certificate No. : 22P2722

Page : 1 of 2

Equipment : Aneroid Barometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: UAE.ANV.013/2547

Condition As-Received: Used Item

Received Date: 20 July 2022

Calibration Date: 22 July 2022

Reference: 2207-0584WSC

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

Ambient Temperature: ( 23 ± 2 ) °C

Relative Humidity: ( 50 ± 15 ) %

Atmospheric Pressure: 1010 mbar

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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-P10, using " DKD-R 6-1 ; Calibration of Pressure Gauges, Edition 03/2014 " as a guidelines.

### Condition of this result of calibration

1.Reference standards instruments :

| <u>Instrument</u>     | <u>Model</u> | <u>Serial No.</u> | <u>Certificate No.</u> | <u>Due Date</u> |
|-----------------------|--------------|-------------------|------------------------|-----------------|
| 1) Standard Barometer | DPI142       | 1422505046        | MP-0076-22             | 02 May 2023     |

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.Scale and conversion factor is 1 kPa = 7.50062 mmHg

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

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

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 at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Aussarree

Issue Date : 25 July 2022

Approved Signatory :

Attapol P.

[ ] Phalinee Prabpaipal

[ ] Sura Suwannasri

[x] Attapol Panurach

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Cert.No.: 22P2722

Page: 2 of 2

**Result of calibration:- Without adjustment**

**Range :** 720 mmHg to 780 mmHg

**Function:- Absolute Pressure Measurement**

**Scale Interval :** 1 mmHg ( The Fifth Estimate )

**Increasing Pressure**

|                         |        |        |        |        |        |        |        |
|-------------------------|--------|--------|--------|--------|--------|--------|--------|
| Applied Pressure (mmHg) | 718.46 | 729.33 | 739.85 | 750.22 | 760.90 | 772.01 | 785.89 |
| UUC* Indication (mmHg)  | 720.0  | 730.0  | 740.0  | 750.0  | 760.0  | 770.0  | 780.0  |
| Error (mmHg)            | 1.54   | 0.67   | 0.15   | -0.22  | -0.90  | -2.01  | -5.89  |

**Decreasing Pressure**

|                         |        |        |        |        |        |        |        |
|-------------------------|--------|--------|--------|--------|--------|--------|--------|
| Applied Pressure (mmHg) | 785.90 | 771.99 | 760.85 | 750.17 | 739.90 | 729.57 | 718.62 |
| UUC* Indication (mmHg)  | 780.0  | 770.0  | 760.0  | 750.0  | 740.0  | 730.0  | 720.0  |
| Error (mmHg)            | -5.90  | -1.99  | -0.85  | -0.17  | 0.10   | 0.43   | 1.38   |

The uncertainty of measurement was  $\pm 0.24$  mmHg

\* UUC = Unit Under Calibration

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

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Attapol P.  
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## Certificate of Calibration

Certificate No. : 22H771

Page : 1 of 2

Equipment : Dial Thermo-Hygrometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: UAE.ANV.003/2548

Condition As-Received: Used Item

Received Date: 30 March 2022

Calibration Date: 01 April 2022  
to 05 April 2022

Reference: 2203-1124WSC

Ambient Temperature: ( 25 ± 3 ) °C

Relative Humidity: ( 50 ± 20 ) %

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Corporate Services 3: Equipment Calibration and Testing Services.

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

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

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

### Condition of this result of calibration

1.Reference standards instruments :

| <u>Instrument</u>                            | <u>Model</u> | <u>Serial No.</u> | <u>Certificate No.</u> | <u>Due Date</u> |
|--|--------------|-------------------|------------------------|-----------------|
| 1) Standard Chilled Mirror Hygrometer Sensor | Dew Prime II | 31863             | 19714                  | 17 Sep 2022     |
| 2) Standard Humidity/Temperature Meter       | 400          | 10203027          | TH-0063-21             | 01 Jul 2022     |

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 at:-

- National Institute of Standards and Technology (NIST) , The United States of America
- National Institute of Metrology Thailand (NIMT)

Calibrated by : Somchai Dumwor  
Issue Date : 08 April 2022

Approved Signatory :

- ☒ Chakrit Waewanjua  
☐ Pornthippa Tameyakul  
☐ Viporn Tantiyawutti

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Cert. No.: 22H771

Page.: 2 of 2

**Result of Calibration:-**

Without Adjustment

Function:

Humidity measurement.

| Reference<br>Temperature<br>(°C) | Standard<br>Humidity<br>(%R.H.) | UUC*<br>Reading<br>(%R.H.) | Error<br>(%R.H.) | Uncertainty<br>of Measurement<br>(±%R.H.) |
|----------------------------------|---------------------------------|----------------------------|------------------|---|
| 25.0                             | 40.1                            | 42                         | 1.9              | 1.6                                       |
| 25.0                             | 60.0                            | 61                         | 1.0              | 1.8                                       |
| 25.0                             | 80.0                            | 78                         | -2.0             | 2.0                                       |

**Result of Calibration:-**

Without Adjustment

Function:

Temperature measurement.

| Standard<br>Temperature<br>(°C) | UUC*<br>Reading<br>(°C) | Error<br>(°C) | Uncertainty<br>of Measurement<br>(±°C) |
|---------------------------------|-------------------------|---------------|--|
| 20.02                           | 20.0                    | -0.02         | 0.72                                   |
| 29.98                           | 30.0                    | 0.02          | 0.72                                   |
| 35.02                           | 35.0                    | -0.02         | 0.72                                   |
| 40.03                           | 40.0                    | -0.03         | 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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SCARLET | TECH

# Certificate of Calibration

## WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

**Client:** Envir Service Co., Ltd.

**Serial No.:** 2111DT0072

**Calibration Date:** 2022/3/25

**Calibration Expiry Date:** 2023/3/24

### The Result of Calibration

| Velocity             |                    |           |             |        |
|----------------------|--------------------|-----------|-------------|--------|
| Measured Value (m/s) | Actual Value (m/s) | Deviation | Tolerance   | Result |
| 1.0                  | 1.1                | 0.1       | 0.9 - 1.1   | Pass   |
| 2.0                  | 2.0                | 0.0       | 1.8 - 2.2   | Pass   |
| 5.0                  | 4.8                | 0.2       | 4.7 - 5.3   | Pass   |
| 7.0                  | 7.0                | 0.0       | 6.0 - 8.0   | Pass   |
| 10.0                 | 9.9                | 0.1       | 9.5 - 10.5  | Pass   |
| 20.0                 | 20.2               | 0.2       | 19.0 - 21.0 | Pass   |

| Wind Direction |              |           |           |        |
|----------------|--------------|-----------|-----------|--------|
| Measured Value | Actual Value | Deviation | Tolerance | Result |
| 45°            | 45           | 0         | 42 - 48   | Pass   |
| 135°           | 135          | 0         | 132 - 138 | Pass   |
| 225°           | 227          | 2         | 222 - 228 | Pass   |
| 315°           | 314          | 1         | 312 - 318 | Pass   |
| 0°             | 359          | 1         | 357 - 3   | Pass   |

| Inspection Room Temp | Actual Value | Deviation | Tolerance | Result |
|----------------------|--------------|-----------|-----------|--------|
| 24.2°C               | 24.2         | 0.0       | 23.2-25.2 | Pass   |

| Atmospheric Pressure Inspection | Actual Value | Deviation | Tolerance | Result |
|---------------------------------|--------------|-----------|-----------|--------|
| 998                             | 1000         | 2         | 994-1002  | Pass   |

Environment conditions :

Air temperature: 22 °C

Relative humidity: 62 %

Static pressure: 102.2 kPa

Performed by:

Jim Lin

Certified by  
Head of Engineering department

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## Certificate of Calibration

### Customer

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

Certificate No : 22-ACT-374

Request No : Req-2022-0841

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

### Unit Under Calibration Details

Measurement item : Acoustic Calibrator

Class : 1

Manufacturer : 01dB

Range : 94 dB / 1000 Hz

Model : CAL31

Intrument Status : Used

Serial Number : 82795

ID : UAE.EFM.113/2560

### Calibration Environment and Details

Temperature : ( 23 ±2 °C )

Humidity : ( 50 ± 20 %RH )

Barometric Pressure : ( 1013 ±10.0 hPa )

Received Date : 10 May 2022

Calibration Date : 8 June 2022

Location of Calibration : LAB 1 Acoustic

Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

| Reference Standard | Model  | Serial Number | Traceable | Due Calibration |
|--------------------|--------|---------------|-----------|-----------------|
| Sound Calibrator   | SV 35A | 58079         | EEI       | 31 May 2023     |
| THD Multimeter     | 2015   | 1047765       | NIMT      | 2 February 2023 |

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

### Note

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

Calibrated By :



Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By :



Mr. Pacit Mathavorn  
Calibration Engineer Supervisor

Issue Date : 8 June 2022

Certificate No : 22-ACT-374

Request No : Req-2022-0841

**Sound pressure level**

**Calibration Results : Without Adjustment**

| Calibration Range<br>(dB) | Without Adjustment (dB) |       | Adjustment (dB) |       | Uncertainty<br>( ± dB) | Acceptance limit<br>Class 1 ( ± dB) |
|---------------------------|-------------------------|-------|-----------------|-------|------------------------|-------------------------------------|
|                           | Measured                | Error | Measured        | Error |                        |                                     |
| 94 dB / 1000 Hz           | 94.09                   | 0.09  | -               | -     | 0.12                   | 0.25                                |

**Frequency of Sound pressure level**

| Calibration Range<br>(Hz) | Without Adjustment |           | Adjustment    |           | Uncertainty<br>( ± %) | Acceptance limit<br>Class 1 ( ± %) |
|---------------------------|--------------------|-----------|---------------|-----------|-----------------------|------------------------------------|
|                           | Measured (Hz)      | Error (%) | Measured (Hz) | Error (%) |                       |                                    |
| 94 dB / 1000 Hz           | 1000.00            | 0.00      | -             | -         | 0.10                  | 0.70                               |

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

| Calibration Range<br>(Hz) | Without Adjustment | Adjustment   | Uncertainty<br>( ± %) | Acceptance limit<br>Class 1 ( ± %) |
|---------------------------|--------------------|--------------|-----------------------|------------------------------------|
|                           | Measured (%)       | Measured (%) |                       |                                    |
| 94 dB / 1000 Hz           | 0.09               | -            | 0.40                  | 2.5                                |

**Note :**

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

**End of Calibration**

## Certificate of Calibration

### Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 22-ACT-034  
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok Request No : Req-2022-0092  
10260

### Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2  
Manufacturer : LARSON DAVIS Microphone Model : 375A04  
Model : LxT2 Microphone S/N : 329361  
Serial Number : 0005394 Preamplifier Model : PRMLxT2C  
ID : UAE.EFM.031/2564 Preamplifier S/N : 073810  
Resolution : 0.1 dB Intrument Status : Used

### Calibration Environment and Details


Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 14 January 2022  
Calibrated Date : 21 January 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         |
| Multifrequency Calibrator | Quest   | Quest-cal | EFA000234 | 14 June 2022      | TSI          |
| Audio Generator           | Svantek | 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 Luangart  
Calibration Officer

Approved By :   
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 21 January 2022



Certificate No : 22-ACT-034

Request No : Req-2022-0092

1. Indication at the calibration check frequency

| UUC Setting        | Nominal<br>Level<br>(dB) | Before Adjust |             | Adjust      |             | UNCERTAINTY<br>( ± dB) | Acceptance<br>Limit<br>( ± dB) |
|--------------------|--------------------------|---------------|-------------|-------------|-------------|------------------------|--------------------------------|
| FAST / A / 37-139  |                          | UUC<br>(dB)   | ERR<br>(dB) | UUC<br>(dB) | ERR<br>(dB) |                        |                                |
| Calibrator Setting |                          |               |             |             |             |                        |                                |
| 1000 Hz 114.00 dB  | 113.85                   | 113.9         | +0.05       | 113.9       | 0.05        | 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<br>(dB) | UNCERTAINTY<br>( ± dB) |
|---------------|------------------|------------------------|
| FAST / 37-139 |                  |                        |
| UUC Weighting |                  |                        |
| A             | 27.8             | 0.10                   |

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

| UUC Setting   | Measured<br>(dB) | UNCERTAINTY<br>( ± dB) |
|---------------|------------------|------------------------|
| FAST / 37-139 |                  |                        |
| UUC Weighting |                  |                        |
| A             | 27.5             | 0.10                   |
| C             | 27.0             | 0.10                   |
| Z             | 31.8             | 0.10                   |

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

| UUC Setting   | Deviation from various Frequency<br>Weighting Responce curve |           |           | UNCERTAINTY<br>( ± dB) | Acceptance<br>Limit<br>( ± dB) |
|---------------|--|-----------|-----------|------------------------|--------------------------------|
|               | A<br>(dB)  | C<br>(dB) | Z<br>(dB) |                        |                                |
| FAST / 37-139 |  |           |           |                        |                                |
| STD Setting   |  |           |           |                        |                                |
| 125 Hz        | 0.0  | 0.1       | 0.0       | 0.50                   | 2.0                            |
| 1000 Hz       | 0.0  | 0.0       | 0.0       | 0.60                   | 1.0                            |
| 4000 Hz       | 0.2  | 0.3       | 0.2       | 0.60                   | 3.0                            |
| 8000 Hz       | -0.3   | -0.3      | -0.3      | 0.70                   | 5.0                            |

Certificate No : 22-ACT-034

Request No : Req-2022-0092

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 | Weighting Response curve         |        |        |             | Limit      |
| STD Setting   | A (dB)                           | C (dB) | Z (dB) | ( ± dB)     | ( ± dB)    |
| 63 Hz         | -0.2                             | -0.1   | 0.0    | 0.2         | 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    |             | 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<br>( ± dB) | Acceptance |
|---------------|--------|----------|------|------------------------|------------|
| FAST / 37-139 | REF    | UUC      | ERR  |                        | Limit      |
| UUC Weighting | (dB)   | (dB)     | (dB) | 0.2                    | ( ± 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<br>( ± dB) | Acceptance |
|-------------------|--------|----------|------|------------------------|------------|
| 37-139 / A        | REF    | UUC      | ERR  |                        | Limit      |
| UUC Time Response | (dB)   | (dB)     | (dB) | 0.2                    | ( ± 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        |

Certificate No : 22-ACT-034

Request No : Req-2022-0092

### 7. Long Term Stability

| UUC Setting       | Measured | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|----------|----------------------------|------------------------------------|
| FAST / A / 37-139 | UUC      |                            |                                    |
| 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<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------|-----------|------|----------------------------|------------------------------------|
| FAST / A / 37-139 | REF         | UUC       | ERR  |                            |                                    |
| STD dB            | (dB)        | (dB)      | (dB) |                            |                                    |
| 139.00            | 139         | 139.0     | 0.0  | 0.3                        | 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 |                            | 1.1                                |
| 79.00             | 79          | 78.9      | -0.1 |                            | 1.1                                |
| 74.00             | 74          | 73.9      | -0.1 |                            | 1.1                                |
| 69.00             | 69          | 69.0      | 0.0  |                            | 1.1                                |
| 64.00             | 64          | 63.9      | -0.1 |                            | 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  |                            | 0.8                                |
| 44.00             | 44          | 44.1      | 0.1  |                            | 1.1                                |
| 39.00             | 39          | 39.3      | 0.3  |                            | 1.1                                |
| 38.00             | 38          | 38.3      | 0.3  |                            | 1.1                                |
| 37.00             | 37          | 37.5      | 0.5  |                            | 1.1                                |



Certificate No : 22-ACT-034

Request No : Req-2022-0092

9. Level linearity including the level range control

| UUC Setting | STD  | Measured |      | UNCERTAINTY | Acceptance  |
|-------------|------|----------|------|-------------|-------------|
| FAST / A    | REF  | UUC      | ERR  |             | Limit       |
| UUC Range   | (dB) | (dB)     | (dB) | ( $\pm$ dB) | ( $\pm$ dB) |
| 37-139      | 42.8 | 43.0     | 0.2  | 0.3         | 1.1         |
|             | 114  | 114.0    | 0.0  |             | 1.1         |

10. Tone burst response

| UUC Setting       | STD       | Anticipated | Measured |      | UNCERTAINTY | Acceptance  |
|-------------------|-----------|-------------|----------|------|-------------|-------------|
| A / 37-139        | Toneburst | Ref         | UUC      | ERR  |             | Limit       |
| UUC Time Response | (ms)      | (dB)        | (dB)     | (dB) | ( $\pm$ dB) | ( $\pm$ dB) |
| Fast              | 200       | 135.0       | 135.0    | 0.0  | 0.3         | 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       | 128.5    | -0.1 |             | 1           |
|                   | 2         | 109.0       | 108.9    | -0.1 |             | +1.0, -5.0  |
| SEL               | 200       | 129.0       | 129.0    | 0.0  |             | 1           |
|                   | 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  |
|---------------------|-------------|----------|-------|-------------|-------------|
| FAST / C / 95-142   | REF         | UUC      | ERR   |             | Limit       |
| STD Setting         | (dB)        | (dB)     | (dB)  | ( $\pm$ dB) | ( $\pm$ dB) |
| Complete cycle      | 137.4       | 136.8    | -0.60 | 0.2         | 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-034

Request No : Req-2022-0092

## 12. Overload indication

| UUC Setting             | Measured | UNCERTAINTY | Acceptance |
|-------------------------|----------|-------------|------------|
| FAST / A / 37-139       | UUC      |             | Limit      |
| STD Setting             | (dB)     | ( ± dB)     | ( ± dB)    |
| Positive one-half cycle | 141.7    |             |            |
| Negative one-half cycle | 141.8    |             |            |
| Deviated                | -0.1     | 0.2         | 1.5        |

## 13. High Level Stability

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

End of Certificate

## Certificate of Calibration

### Customer

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

Certificate No : 22-ACT-101

Request No : Req-2022-0231

### Unit Under Calibration Details

Measurement item : Sound Level Meter  
Manufacturer : LARSON DAVIS  
Model : LxT2  
Serial Number : 0005405  
ID : UAE.EFM.041/2564  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : 375A04  
Microphone S/N : 329360  
Preamplifier Model : PRMLxT2C  
Preamplifier S/N : 073800  
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 : 31 January 2022  
Calibrated Date : 11 February 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         |
| Multifrequency Calibrator | Quest   | Quest-cal | EFA000234 | 14 June 2022      | TSI          |
| Audio Generator           | Svantek | 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 Luangart  
Calibration Officer

Approved By :   
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 11 February 2022

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

FM-708-SLM-01 Rev.0 Issue date 01/07/15

**เอกสารไม่ควบคุม**



Certificate No : 22-ACT-101

Request No : Req-2022-0231

### 1. Indication at the calibration check frequency

| UUC Setting        | Nominal | Before Adjust |       | Adjust |      | UNCERTAINTY | Acceptance |
|--------------------|---------|---------------|-------|--------|------|-------------|------------|
| FAST / A / 37-139  | Level   | UUC           | ERR   | UUC    | ERR  |             |            |
| Calibrator Setting | (dB)    | (dB)          | (dB)  | (dB)   | (dB) | ( ± dB)     | ( ± dB)    |
| 1000 Hz 114.00 dB  | 113.85  | 113.9         | +0.05 | 113.9  | 0.05 | 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 |
|---------------|----------|-------------|
| FAST / 37-139 |          |             |
| UUC Weighting | (dB)     | ( ± dB)     |
| A             | 27.3     | 0.10        |

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

| UUC Setting   | Measured | UNCERTAINTY |
|---------------|----------|-------------|
| FAST / 37-139 |          |             |
| UUC Weighting | (dB)     | ( ± dB)     |
| A             | 27.6     | 0.10        |
| C             | 27.3     | 0.10        |
| Z             | 33.2     | 0.10        |

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

| UUC Setting   | Deviation from various Frequency Weighting Responce curve |      |      | UNCERTAINTY | Acceptance Limit |
|---------------|---|------|------|-------------|------------------|
| FAST / 37-139 | A   | C    | Z    |             |                  |
| STD Setting   | (dB)  | (dB) | (dB) | ( ± dB)     | ( ± dB)          |
| 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       | 0.2   | 0.2  | 0.2  | 0.60        | 3.0              |
| 8000 Hz       | -0.1  | -0.1 | 0.0  | 0.70        | 5.0              |

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

FM-708-SLM-01 Rev.0 Issue date 01/07/15

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Certificate No : 22-ACT-101

Request No : Req-2022-0231

## 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 | Weighting Response curve         |        |        |             | Limit      |
| STD Setting   | A (dB)                           | C (dB) | Z (dB) | ( ± dB)     | ( ± dB)    |
| 63 Hz         | -0.2                             | 0.0    | 0.0    | 0.2         | 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    |             | 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           |
|---------------|--------|----------|------|-------------|----------------------|
| FAST / 37-139 | REF    | UUC      | ERR  |             |                      |
| UUC Weighting | (dB)   | (dB)     | (dB) | ( $\pm$ dB) | Limit<br>( $\pm$ dB) |
| A             | 114.00 | 114.0    | 0.0  | 0.2         | 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  |             |                      |
| UUC Time Response | (dB)   | (dB)     | (dB) | ( $\pm$ dB) | Limit<br>( $\pm$ dB) |
| Fast              | 114.00 | 114.0    | 0.0  | 0.2         | 0.1                  |
| Slow              | 114.00 | 114.0    | 0.0  |             | 0.1                  |
| Leq               | 114.00 | 114.0    | 0.0  |             | 0.1                  |

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FM-708-SLM-01 Rev.0 Issue date 01/07/19

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Certificate No : 22-ACT-101

Request No : Req-2022-0231

## 7. Long Term Stability

| UUC Setting       | Measured | UNCERTAINTY<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|----------|----------------------------|------------------------------------|
| FAST / A / 37-139 | UUC      |                            |                                    |
| 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<br>( $\pm$ dB) | Acceptance<br>Limit<br>( $\pm$ dB) |
|-------------------|-------------|-----------|------|----------------------------|------------------------------------|
| FAST / A / 37-139 | REF         | UUC       | ERR  |                            |                                    |
| STD dB            | (dB)        | (dB)      | (dB) |                            |                                    |
| 139.00            | 139         | 139.0     | 0.0  | 0.3                        | 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 |                            | 1.1                                |
| 79.00             | 79          | 78.9      | -0.1 |                            | 1.1                                |
| 74.00             | 74          | 74.0      | 0.0  |                            | 1.1                                |
| 69.00             | 69          | 69.0      | 0.0  |                            | 1.1                                |
| 64.00             | 64          | 64.1      | 0.1  |                            | 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                                |

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FM-708-SLM-01 Rev.0 Issue date 01/07/15

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Certificate No : 22-ACT-101

Request No : Req-2022-0231

## 9. Level linearity including the level range control

| UUC Setting | STD  | Measured |      | UNCERTAINTY | Acceptance  |
|-------------|------|----------|------|-------------|-------------|
| FAST / A    | REF  | UUC      | ERR  |             | Limit       |
| UUC Range   | (dB) | (dB)     | (dB) | ( $\pm$ dB) | ( $\pm$ dB) |
| 37-139      | 43.9 | 43.6     | -0.3 | 0.3         | 1.1         |
|             | 114  | 114.0    | 0.0  |             | 1.1         |

## 10. Tone burst response

| UUC Setting       | STD       | Anticipated | Measured |      | UNCERTAINTY | Acceptance  |
|-------------------|-----------|-------------|----------|------|-------------|-------------|
| A / 37-139        | Toneburst | Ref         | UUC      | ERR  |             | Limit       |
| UUC Time Response | (ms)      | (dB)        | (dB)     | (dB) | ( $\pm$ dB) | ( $\pm$ dB) |
| Fast              | 200       | 135.0       | 134.9    | -0.1 | 0.3         | 1           |
|                   | 2         | 118.0       | 117.6    | -0.4 |             | +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       | 108.8    | -0.2 |             | +1.0, -5.0  |
| SEL               | 200       | 129.0       | 129.0    | 0.0  |             | 1           |
|                   | 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 | Acceptance  |
|---------------------|-------------|----------|-------|-------------|-------------|
| FAST / C / 95-142   | REF         | UUC      | ERR   |             | Limit       |
| STD Setting         | (dB)        | (dB)     | (dB)  | ( $\pm$ dB) | ( $\pm$ dB) |
| 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         |

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

FM-708-SLM-01 Rev.0 Issue date 01/07/15

เอกสารไม่ควบคุม

Certificate No : 22-ACT-101

Request No : Req-2022-0231

## 12. Overload indication

| UUC Setting             | Measured | UNCERTAINTY | Acceptance |
|-------------------------|----------|-------------|------------|
| FAST / A / 37-139       | UUC      |             | Limit      |
| STD Setting             | (dB)     | ( ± dB)     | ( ± dB)    |
| Positive one-half cycle | 141.8    |             |            |
| Negative one-half cycle | 141.9    |             |            |
| Deviated                | -0.1     | 0.2         | 1.5        |

## 13. High Level Stability

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

FM-708-SLM-01 Rev.0 Issue date 01/07/19

**เอกสารไม่ควบคุม**

รายการใบรับรองสอบเทียบ ทวนสอบเครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์

| No.  | Instrument/Equipment                       | Parameter          | Manufacturer   | Model/Serial No.             | Calibrator                     | Certification No.            | Date of Calibration | Due date of Calibration* | Remark |
|--|--|--------------------|----------------|------------------------------|--------------------------------|------------------------------|---------------------|--------------------------|--------|
| Laboratory Instrument/Equipmen for Air Quality Analysis. |  |                    |                |                              |                                |                              |                     |                          |        |
| 1  | Analytical Balance<br>(Readability 0.1 mg) | ฝุ่นละอองรวม (TSP) | Mettler-Toledo | AB204-S /<br>1128312528      | Mettler-Toledo (Thailand) Ltd. | TH2058-097-040722-<br>ACC-TH | 7 Apr 22            | 6 Apr 23                 | -      |
| 2  | Analytical Balance<br>(Readability 0.1 mg) |                    | Mettler-Toledo | AB204-S/FACT /<br>B108115858 | Mettler-Toledo (Thailand) Ltd. | TH2058-098-040722-<br>ACC-TH | 7 Apr 22            | 6 Apr 23                 | -      |

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



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NSC-TISI-TIS 17025  
CALIBRATION 0062

## Accuracy Calibration Certificate

### Customer

Company: United Analyst and Engineering Consultant Co., Ltd.  
Address: 3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak  
City: Phra Khanong Contact: Suwit Chotnok  
Zip / Postal: 10260  
State / Province: Bangkok  
Order Number:   
\* 0 3 3 2 4 2 3 9 0 6 \*

### Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument  
Model: AB204-S Asset Number: UAE.AIR.019/2550  
Serial No.: 1128312528 Terminal Model: N/A  
Building: N/A Terminal Serial No.: N/A  
Floor: 2 Terminal Asset No.: N/A  
Room: Balance Room 2 (206)

| Range | Max. Capacity | Readability (d) |
|-------|---------------|-----------------|
| 1     | 220 g         | 0.0001 g        |

### Procedure



Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)  
METTLER TOLEDO Work Instruction: CP/W002/20

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

|          | Temperature    |              | Humidity      |             |
|----------|----------------|--------------|---------------|-------------|
| As Found | Start: 22.5 °C | End: 21.4 °C | Start: 56.1 % | End: 63.2 % |

As Found Calibration Date: 07-Apr-2022 Calibrator:   
As Left Calibration Date: N/A  
Issue Date: 08-Apr-2022  
Approved Signatory:   
☒ Kassakorn Tassanachaisakul  
☐ Santi Jitniyom  
☐ Surachet Sukkate

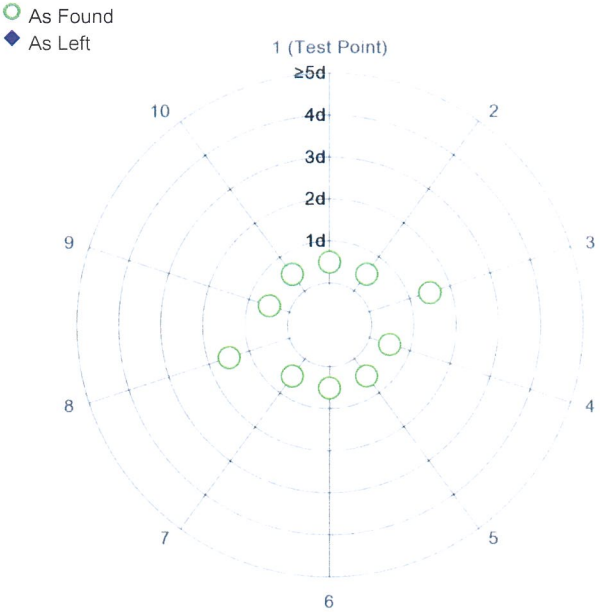
Measurement Results

Repeatability

Test Load: 100 g

|    | As Found   | As Left |
|----|------------|---------|
| 1  | 99.9999 g  | N/A     |
| 2  | 100.0000 g | N/A     |
| 3  | 99.9998 g  | N/A     |
| 4  | 100.0000 g | N/A     |
| 5  | 99.9999 g  | N/A     |
| 6  | 100.0000 g | N/A     |
| 7  | 99.9999 g  | N/A     |
| 8  | 100.0001 g | N/A     |
| 9  | 99.9999 g  | N/A     |
| 10 | 100.0000 g | N/A     |

|                    |           |     |
|--------------------|-----------|-----|
| Standard Deviation | 0.00008 g | N/A |
|--------------------|-----------|-----|



The "d" in the graph represents the readability of the range/interval in which the test was performed.

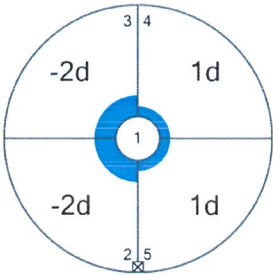
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

| Position | As Found   | As Left |
|----------|------------|---------|
| 1        | 100.0000 g | N/A     |
| 2        | 99.9998 g  | N/A     |
| 3        | 99.9998 g  | N/A     |
| 4        | 100.0001 g | N/A     |
| 5        | 100.0001 g | N/A     |

|                   |          |     |
|-------------------|----------|-----|
| Maximum Deviation | 0.0002 g | N/A |
|-------------------|----------|-----|



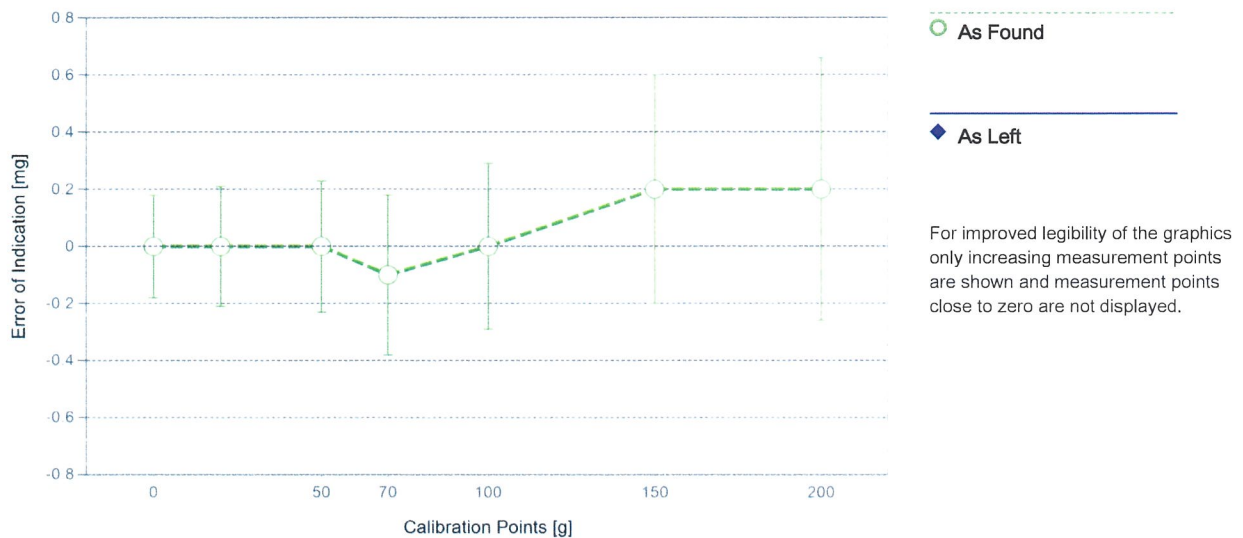
As Found

The "d" in the graph represents the readability of the range/interval in which the test was performed.

## Error of Indication

### As Found

|    | Reference Value | Indication | Error of Indication | Expanded Uncertainty | k |
|----|-----------------|------------|---------------------|----------------------|---|
| 1  | 0.0000 g        | 0.0000 g   | 0.0000 g            | 0.18 mg              | 2 |
| 2  | 0.1000 g        | 0.1000 g   | 0.0000 g            | 0.19 mg              | 2 |
| 3  | 1.0000 g        | 0.9999 g   | -0.0001 g           | 0.19 mg              | 2 |
| 4  | 5.0000 g        | 5.0000 g   | 0.0000 g            | 0.19 mg              | 2 |
| 5  | 10.0000 g       | 9.9999 g   | -0.0001 g           | 0.20 mg              | 2 |
| 6  | 20.0000 g       | 20.0000 g  | 0.0000 g            | 0.21 mg              | 2 |
| 7  | 50.0000 g       | 50.0000 g  | 0.0000 g            | 0.23 mg              | 2 |
| 8  | 70.0001 g       | 70.0000 g  | -0.0001 g           | 0.28 mg              | 2 |
| 9  | 100.0000 g      | 100.0000 g | 0.0000 g            | 0.29 mg              | 2 |
| 10 | 150.0000 g      | 150.0002 g | 0.0002 g            | 0.40 mg              | 2 |
| 11 | 200.0001 g      | 200.0003 g | 0.0002 g            | 0.46 mg              | 2 |



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor  $k$  – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

## Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

### Weight Set 1: OIML E2

|                     |            |                       |             |
|---------------------|------------|-----------------------|-------------|
| Weight Set No.:     | WS80       | Date of Issue:        | 23-Feb-2022 |
| Certificate Number: | C208581631 | Calibration Due Date: | 14-Aug-2023 |

### Thermo Hygrometer

|                     |         |                       |             |
|---------------------|---------|-----------------------|-------------|
| Equipment No.:      | IN161   | Date of Issue:        | 14-Jun-2021 |
| Certificate Number: | 21H1220 | Calibration Due Date: | 01-Jun-2022 |



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## Remarks

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

Test weight by Filter pan : 1 g = 0.9999 g, 3 g = 3.0000 g, 5 g = 5.0000 g

**End of Accredited Section**

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The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with  $k=2$  in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value  $R$  represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use:  $3.0 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

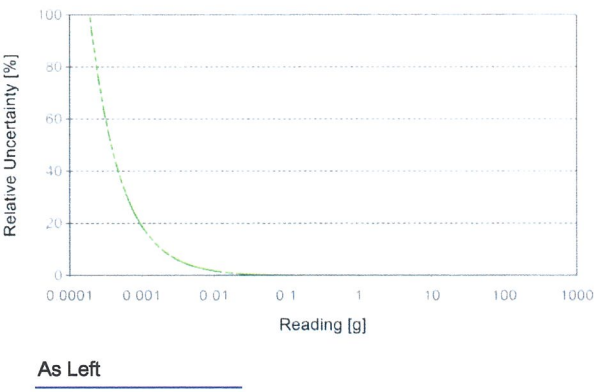
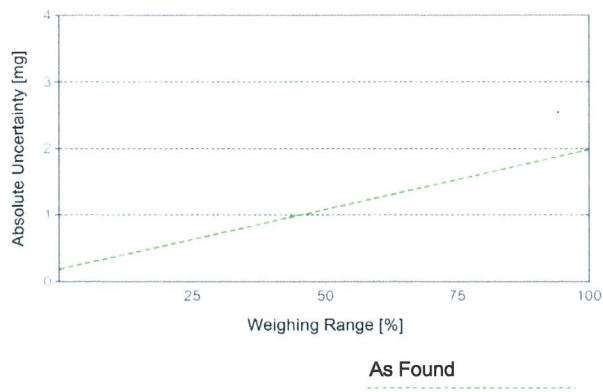
Linearization of Uncertainty Equation

| Range |          |       | As Found   | As Left |
|-------|----------|-------|--|---------|
|       | d        | Max   |  |         |
| 1     | 0.0001 g | 220 g | $U_1 = 0.19 \text{ mg} + 0.00817 \text{ mg/g} \cdot R$ | N/A     |

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

| Net Indication | As Found |          | As Left |     |
|----------------|----------|----------|---------|-----|
| 0.0220 g       | 0.19 mg  | 0.86%    | N/A     | N/A |
| 0.2200 g       | 0.19 mg  | 0.087%   | N/A     | N/A |
| 2.2000 g       | 0.21 mg  | 0.0095%  | N/A     | N/A |
| 22.0000 g      | 0.37 mg  | 0.0017%  | N/A     | N/A |
| 220.0000 g     | 2.0 mg   | 0.00090% | N/A     | N/A |



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## Accuracy Calibration Certificate

### Customer

Company: United Analyst and Engineering Consultant Co., Ltd.  
Address: 3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak  
City: Phra Khanong Contact: Suwit Chotnok  
Zip / Postal: 10260  
State / Province: Bangkok  
Order Number:   
\* 0 3 3 2 4 2 3 9 0 6 \*

### Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument  
Model: AB204-S/FACT Asset Number: UAE.AIR.016/2555  
Serial No.: B108115858 Terminal Model: N/A  
Building: N/A Terminal Serial No.: N/A  
Floor: 2 Terminal Asset No.: N/A  
Room: Balance Room 2 (206)

| Range | Max. Capacity | Readability (d) |
|-------|---------------|-----------------|
| 1     | 220 g         | 0.0001 g        |

### Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)  
METTLER TOLEDO Work Instruction: CP/W002/20

This calibration certificate contains measurements for As Found and As Left calibrations.

The sensitivity/span of the weighing instrument was adjusted before As Found and As Left calibrations with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

|          | Temperature    |              | Humidity      |             |
|----------|----------------|--------------|---------------|-------------|
| As Found | Start: 22.6 °C | End: 22.1 °C | Start: 56.0 % | End: 51.9 % |
| As Left  | Start: 22.3 °C | End: 22.4 °C | Start: 46.2 % | End: 55.8 % |

As Found Calibration Date: 07-Apr-2022  
As Left Calibration Date: 07-Apr-2022  
Issue Date: 08-Apr-2022

Calibrator:   
Sirawit Chamchan

Approved Signatory:   
☒ Kassakorn Tassanachaisakul  
☐ Santi Jitniyom  
☐ Surachet Sukkate

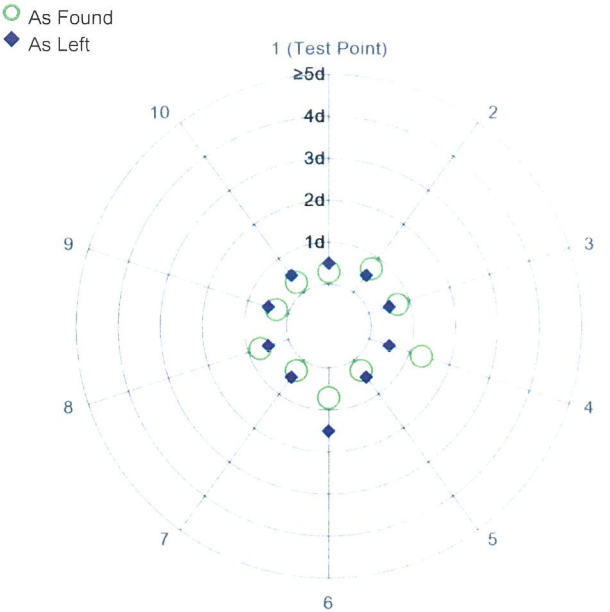


Measurement Results

Repeatability

Test Load: 100 g

|                    | As Found   | As Left    |
|--------------------|------------|------------|
| 1                  | 100.0005 g | 99.9999 g  |
| 2                  | 100.0004 g | 100.0000 g |
| 3                  | 100.0004 g | 99.9999 g  |
| 4                  | 100.0006 g | 100.0000 g |
| 5                  | 100.0005 g | 99.9999 g  |
| 6                  | 100.0004 g | 99.9998 g  |
| 7                  | 100.0005 g | 100.0000 g |
| 8                  | 100.0004 g | 100.0000 g |
| 9                  | 100.0005 g | 100.0000 g |
| 10                 | 100.0005 g | 100.0000 g |
| Standard Deviation | 0.00007 g  | 0.00007 g  |



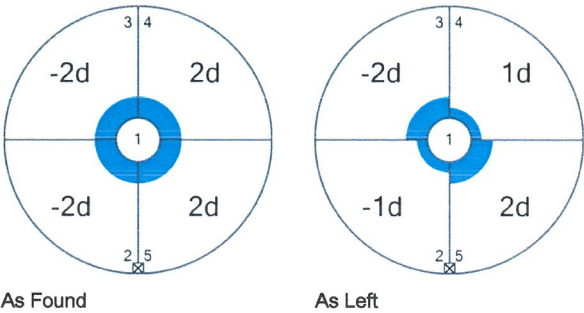
The "d" in the graph represents the readability of the range/interval in which the test was performed.

The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

| Position          | As Found   | As Left    |
|-------------------|------------|------------|
| 1                 | 100.0005 g | 100.0000 g |
| 2                 | 100.0003 g | 99.9999 g  |
| 3                 | 100.0003 g | 99.9998 g  |
| 4                 | 100.0007 g | 100.0001 g |
| 5                 | 100.0007 g | 100.0002 g |
| Maximum Deviation | 0.0002 g   | 0.0002 g   |



As Found

As Left

The "d" in the graph represents the readability of the range/interval in which the test was performed.

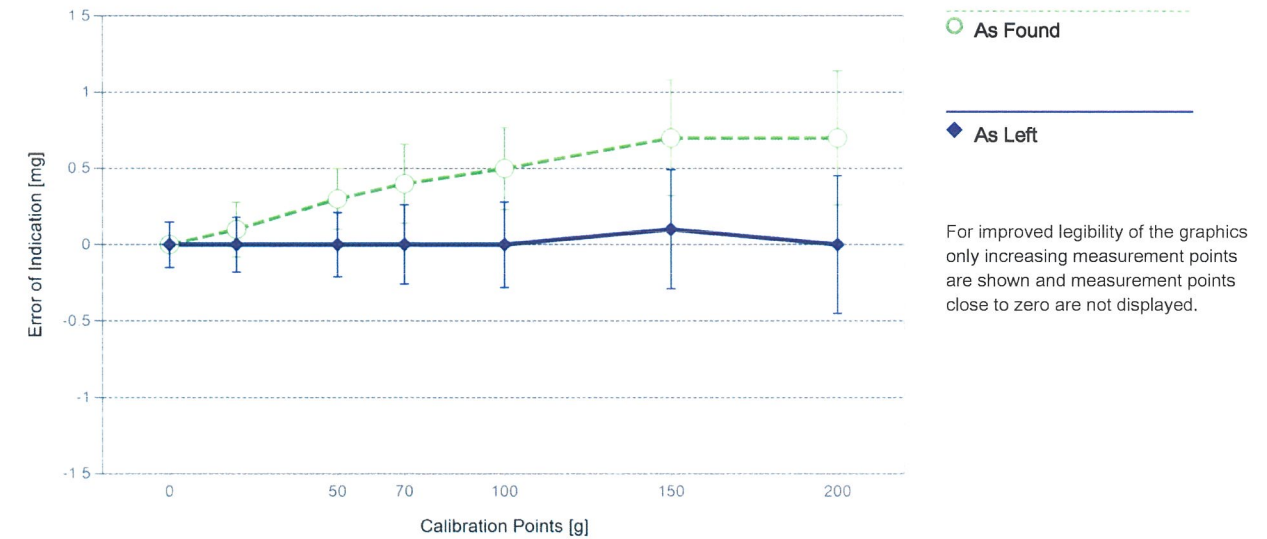
Error of Indication

As Found

|    | Reference Value | Indication | Error of Indication | Expanded Uncertainty | k |
|----|-----------------|------------|---------------------|----------------------|---|
| 1  | 0.0000 g        | 0.0000 g   | 0.0000 g            | 0.15 mg              | 2 |
| 2  | 0.1000 g        | 0.1001 g   | 0.0001 g            | 0.16 mg              | 2 |
| 3  | 1.0000 g        | 0.9999 g   | -0.0001 g           | 0.16 mg              | 2 |
| 4  | 5.0000 g        | 5.0000 g   | 0.0000 g            | 0.16 mg              | 2 |
| 5  | 10.0000 g       | 10.0001 g  | 0.0001 g            | 0.17 mg              | 2 |
| 6  | 20.0000 g       | 20.0001 g  | 0.0001 g            | 0.18 mg              | 2 |
| 7  | 50.0000 g       | 50.0003 g  | 0.0003 g            | 0.20 mg              | 2 |
| 8  | 70.0001 g       | 70.0005 g  | 0.0004 g            | 0.26 mg              | 2 |
| 9  | 100.0000 g      | 100.0005 g | 0.0005 g            | 0.27 mg              | 2 |
| 10 | 150.0000 g      | 150.0007 g | 0.0007 g            | 0.38 mg              | 2 |
| 11 | 200.0001 g      | 200.0008 g | 0.0007 g            | 0.44 mg              | 2 |

As Left

|    | Reference Value | Indication | Error of Indication | Expanded Uncertainty | k |
|----|-----------------|------------|---------------------|----------------------|---|
| 1  | 0.0000 g        | 0.0000 g   | 0.0000 g            | 0.15 mg              | 2 |
| 2  | 0.1000 g        | 0.1000 g   | 0.0000 g            | 0.16 mg              | 2 |
| 3  | 1.0000 g        | 0.9999 g   | -0.0001 g           | 0.17 mg              | 2 |
| 4  | 5.0000 g        | 5.0000 g   | 0.0000 g            | 0.17 mg              | 2 |
| 5  | 10.0000 g       | 10.0000 g  | 0.0000 g            | 0.17 mg              | 2 |
| 6  | 20.0000 g       | 20.0000 g  | 0.0000 g            | 0.18 mg              | 2 |
| 7  | 50.0000 g       | 50.0000 g  | 0.0000 g            | 0.21 mg              | 2 |
| 8  | 70.0001 g       | 70.0001 g  | 0.0000 g            | 0.26 mg              | 2 |
| 9  | 100.0000 g      | 100.0000 g | 0.0000 g            | 0.28 mg              | 2 |
| 10 | 150.0000 g      | 150.0001 g | 0.0001 g            | 0.39 mg              | 2 |
| 11 | 200.0001 g      | 200.0001 g | 0.0000 g            | 0.45 mg              | 2 |



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor  $k$  – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

## Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

### Weight Set 1: OIML E2

|                     |            |                       |             |
|---------------------|------------|-----------------------|-------------|
| Weight Set No.:     | WS80       | Date of Issue:        | 23-Feb-2022 |
| Certificate Number: | C208581631 | Calibration Due Date: | 14-Aug-2023 |

### Thermo Hygrometer

|                     |         |                       |             |
|---------------------|---------|-----------------------|-------------|
| Equipment No.:      | IN161   | Date of Issue:        | 14-Jun-2021 |
| Certificate Number: | 21H1220 | Calibration Due Date: | 01-Jun-2022 |

## Remarks

FACT adjustment functionality activated  
Value of the built-in weight adjusted  
Equipment condition: Good  
Next calibration according to customer's procedure  
Calibration data not decide by calibration laboratory  
Test weight by Filter pan : 1 g = 1.0000 g, 3 g = 3.0000 g, 5 g = 5.0000 g

### End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.



Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: 2.5 · 10<sup>-6</sup> / K

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

Linearization of Uncertainty Equation

| Range |          |       | As Found  | As Left  |
|-------|----------|-------|---|--|
|       | d        | Max   |   |  |
| 1     | 0.0001 g | 220 g | $U_1 = 0.16 \text{ mg} + 0.0111 \text{ mg/g} \cdot R$ | $U_1 = 0.16 \text{ mg} + 0.00592 \text{ mg/g} \cdot R$ |

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

| Net Indication | As Found |         | As Left |          |
|----------------|----------|---------|---------|----------|
| 0.0220 g       | 0.16 mg  | 0.73%   | 0.16 mg | 0.73%    |
| 0.2200 g       | 0.16 mg  | 0.074%  | 0.16 mg | 0.073%   |
| 2.2000 g       | 0.18 mg  | 0.0084% | 0.17 mg | 0.0079%  |
| 22.0000 g      | 0.40 mg  | 0.0018% | 0.29 mg | 0.0013%  |
| 220.0000 g     | 2.6 mg   | 0.0012% | 1.5 mg  | 0.00066% |

