

**เอกสารแนบ 6**  
**เอกสารทดสอบเทียบเครื่องมือ**



**LIVING &  
FACILITIES**



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



Cert.No.: 24CH17  
Page.: 1 of 2

## Certificate of Calibration

**Equipment :** pH Meter  
**Manufacturer :** Water Proof  
**Model :** pHTestr 30  
**Serial No. :** 3066320  
**ID No. :** -  
**Condition As-Received:** Used Item  
**Received Date :** 05 January 2024  
**Calibration Date :** 09 January 2024  
**Reference :** 2401-0077DN-3  
**Submitted by :** Environment Research & Technology Company Limited.  
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,  
Toongsonghong, Laksi, Bangkok 10210  
**Ambient Temperature :** (25 ± 2.5) °C  
**Relative Humidity :** (50 ± 15) %  
**Calibration Procedure :** In - house method :  
- CP-CH5 by direct measurement with standard  
voltage calibrator and direct measurement  
with certified reference material (CRM)

**Calibrated by :**



**Approved by :**

Approved Signatory

(✓) Saithip Meangmai  
( ) Warakorn Lerngagtrakul  
( ) Ponpan Paipim

**Issue Date :** 10 January 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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Cert.No.: 24CH17

Page.: 2 of 2

**Condition of this calibration result**

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

| <u>Buffer Solution</u> | <u>Manufacturer</u> | <u>Lot No.</u> | <u>Exp. date</u> |
|------------------------|---------------------|----------------|------------------|
| pH 4.008               | CPA chem            | 940102         | 27 Nov 2025      |
| pH 6.986               | CPA chem            | 931959         | 01 Oct 2024      |
| pH 9.997               | CPA chem            | 940106         | 02 Nov 2024      |

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

**Calibration Results**

**Function : pH Measurement**

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

| Unit Under Calibration        | Standard pH Buffer Solution | Actual pH Reading | Actual mV Reading (mV) | Uncertainty of pH Measurement ( $\pm$ ) | Coverage factor $k$ |
|-------------------------------|-----------------------------|-------------------|------------------------|---|---------------------|
| pH Electrode<br>S/N.: 3066320 | 4.008                       | 4.01              | N/A                    | 0.0071                                  | 2.00                |
|                               | 6.986                       | 7.00              | N/A                    | 0.0093                                  | 2.00                |
|                               | 9.997                       | 10.00             | N/A                    | 0.0095                                  | 2.00                |

**Remark**

- pH meter does not have voltage mode.
- Can not connect the BNC because the plug does not match with the socket.
- N/A = Not Available

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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# Certificate of Calibration

**Certificate No.** : MT23-7846

**Page** : 1 of 2

**Customer** : Environment Research & Technogy Co., Ltd.  
**Address** : 25/114 Moo 6 Soi Chinaket1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok 10210

**Description** : Incubator  
**Manufacturer** : Accuplus  
**Model** : Smart i250  
**Serial No.** : 2059-0218-0002  
**Identification No.** : ERTC-L-IN-143  
**Calibration Place** : Customer Laboratory

**Order No.** : 3936/23  
**Received date** : Dec 12, 2023  
**Calibration date** : Dec 12, 2023  
**Environment Condition :**  
**Temperature** : ( 25+/-10 ) °C  
**Humidity** : ( 50+/-30 ) %RH

**Calibration Method** : Calibration were conducted using In-house calibration procedure *CP-MT-006* According to comparison with LXI Data Acquisition Switch Unit with sensor. The calibration methods based on Euramet Calibration Guide No.20 - guidelines on the Calibration of Temperature and/or Humidity Controlled Enclosures.

## Reference Standard Instruments :

| <u>Instrument</u>                            | <u>Model</u> | <u>Serial No.</u> | <u>Certificate No.</u> | <u>Due Date</u> |
|--|--------------|-------------------|------------------------|-----------------|
| LXI Data Acquisition Switch Unit with Sensor | 34972A       | MY57003222        | MT23-5938              | Oct 05, 2024    |

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

**Traceability** : This measurement are traceable to the International System of Unit (SI), through National Institute of Metrology Thailand ( NIMT )

The reported uncertainty of measurement was based on standard uncertainty multiplied by coverage factor  $k = 2$ , providing a level of confidence of not less than 95%



**Calibrated by :** \_\_\_\_\_  
**Issue date :** \_\_\_\_\_

**Approved by** \_\_\_\_\_

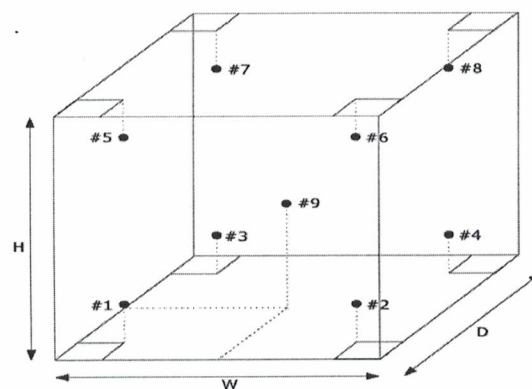
This calibration certificate shall not be reproduced other than in full except with the prior written approval of Intech Metrological Center Co.,Ltd



**Certificate No. : MT23-7846**
**Page : 2 of 2**
**Function : Temperature measurement**
**Result : Without adjustment**
**Calibration point : 20 °C**
**Resolution : 0.1 °C**

| Calibration point<br>( °C ) | Temperature of UUC* at each position ( °C ) |        |        |        |        |        |        |        |        | Uncertainty of measurement<br>( +/- °C ) |
|-----------------------------|---|--------|--------|--------|--------|--------|--------|--------|--------|--|
|                             | Ch.1  | Ch.2   | Ch.3   | Ch.4   | Ch.5   | Ch.6   | Ch.7   | Ch.8   | Ch.9   |  |
| 20                          | 20.542                                      | 20.166 | 20.504 | 20.211 | 20.551 | 20.501 | 20.477 | 20.728 | 19.867 | 0.46                                     |

| Setting temperature<br>( °C ) | Indicating Temperature<br>( °C ) | Measured stability<br>( +/- °C ) | Measured uniformity<br>( °C ) | Overall variation<br>( °C ) |
|-------------------------------|----------------------------------|----------------------------------|-------------------------------|-----------------------------|
| 20.0                          | 20 to 20.3                       | 0.25                             | 1.0                           | 1.3                         |


**Front view**

- #1 Lower Left Front
- #2 Lower Right Front
- #3 Lower Left Rear
- #4 Lower Right Rear
- #5 Upper Left Front
- #6 Upper Right Front
- #7 Upper Left Rear
- #8 Upper Right Rear
- #9 Geometric Center

**UUC\*** = Unit under calibration

**Uniformity** = Maximum and Minimum difference of measured temperature at any probes and the measured temperature at the reference and same time.

**Overall Variation** = Difference of temperature value between the maximum and minimum any time.

**Stability** = One half of the maximum difference of measured temperatures at any one probe.



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**Cert.No.:** 23TW254

**Page.:** 1 of 2

## Certificate of Testing

|  |  |
|--|--|
| <b>Equipment :</b>   | DO Meter   |
| <b>Manufacturer :</b>  | YSI  |
| <b>Model :</b>   | 5000-115   |
| <b>Serial No. :</b>  | 17H104220  |
| <b>ID No. :</b>  | ERTC-L-In.137  |
| <b>Received Date :</b>   | 29 November 2023   |
| <b>Test Date :</b>   | 30 November 2023   |
| <b>Reference :</b>   | 2311-0939DN-1  |
| <b>Submitted by :</b>  | Environment Research & Technology Company Limited.<br>25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,<br>Toongsonghong, Laksi, Bangkok 10210 |
| <b>Laboratory Condition :</b>  | Temperature ( $25 \pm 5$ ) °C<br>Humidity ( $50 \pm 20$ ) %  |
| <b>Test Procedure :</b>  | In - house method : CP-CH9<br>by Comparison Technique with Azide Modification Method   |
| <b>Tested by :</b>   | Walalak Sirithean<br>                                    |
| <b>Approved by :</b>   | <br>Approved Signatory                                   |
| (✓) Saithip Meangmai<br>( ) Warakorn Lernagtrakul<br>( ) Ponpan Paipim |  |
| <b>Issue Date :</b>  | 4 December 2023  |



Cert.No.: 23TW254

Page.: 2 of 2

**Condition of this result of calibration**

1. Reference Standard Instruments :

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

| <u>Instruments</u> | <u>Serial No.</u> | <u>ID No.</u> | <u>Certificate No.</u> | <u>Due Date</u> |
|--------------------|-------------------|---------------|------------------------|-----------------|
| 1) Burette         | -                 | 130BU10       | 23CG1172               | 22 Mar 2025     |
| 2) Balance         | 1124013382        | 140RC006      | 23MM18                 | 20 Feb 2024     |

2. Standard Material :-

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

**Result :**      **Dissolved Oxygen Meter Adjustment With Air 100 %**  
**Dissolved Oxygen Probe No.:**      17J100003

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

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

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Mettler-Toledo (Thailand) Ltd.

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Bangna District, Bangkok 10260

+662 723 0382

MT-TH.ServiceSupport@mt.com



NSC-TISI-TIS 17025  
CALIBRATION 0062

## Accuracy Calibration Certificate

### Customer

**Company:** Environment Research & Technology Co., Ltd.  
**Address:** 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Rd., Toongsonghong  
**City:** Laksi **Contact:** Ramita Taengthai  
**Zip / Postal:** 10210  
**State / Province:** Bangkok  
**Order Number:**   
0 3 3 2 9 6 3 6 1 1

### Weighing Device

**Manufacturer:** Mettler Toledo **Instrument Type:** Weighing Instrument  
**Model:** MS204S/01 **Asset Number:** ERTC-L-IN-088  
**Serial No.:** B334691537 **Terminal Model:** N/A  
**Building:** N/A **Terminal Serial No.:** N/A  
**Floor:** 5 **Terminal Asset No.:** N/A  
**Room:** 504

| 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: 27.5 °C | End: 26.9 °C | Start: 44.1 % | End: 44.8 % |

**As Found Calibration Date:** 15-Jan-2024  
**As Left Calibration Date:** N/A  
**Issue Date:** 15-Jan-2024

**Calibrator:**   
**Approved Signatory:**

Technical Manager / Head of Calibration Center



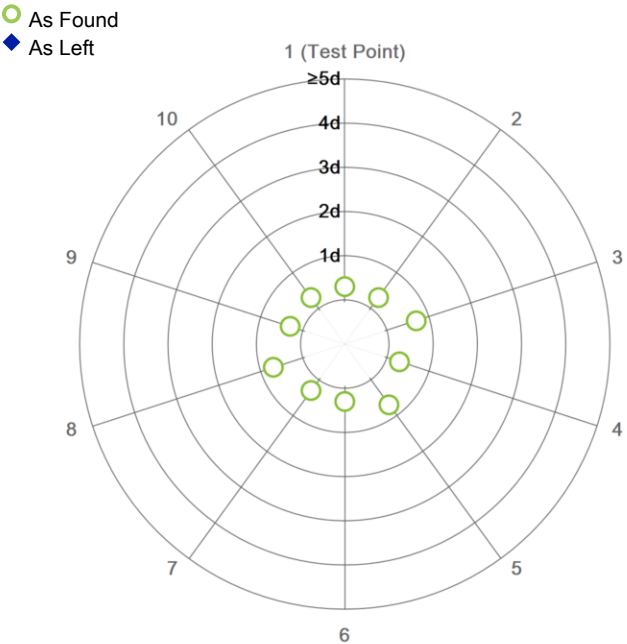
Measurement Results

Repeatability

Test Load: 100 g

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

|                    |           |     |
|--------------------|-----------|-----|
| Standard Deviation | 0.00005 g | N/A |
|--------------------|-----------|-----|



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

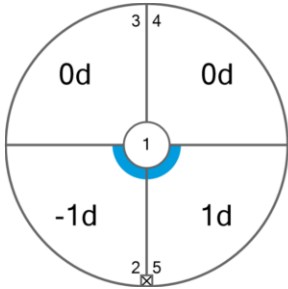
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

| Position | As Found   | As Left |
|----------|------------|---------|
| 1        | 100.0000 g | N/A     |
| 2        | 99.9999 g  | N/A     |
| 3        | 100.0000 g | N/A     |
| 4        | 100.0000 g | N/A     |
| 5        | 100.0001 g | N/A     |

|                   |          |     |
|-------------------|----------|-----|
| Maximum Deviation | 0.0001 g | N/A |
|-------------------|----------|-----|



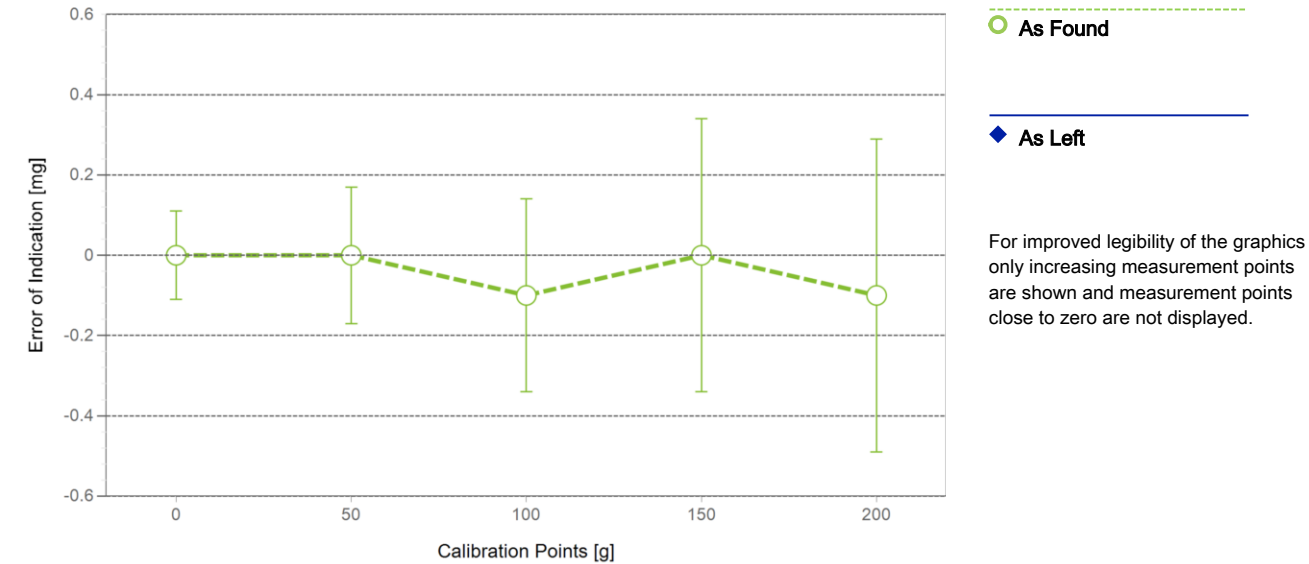
As Found

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            | 0.11 mg              | 2 |
| 2  | 0.0500 g        | 0.0500 g   | 0.0000 g            | 0.13 mg              | 2 |
| 3  | 0.1000 g        | 0.1000 g   | 0.0000 g            | 0.13 mg              | 2 |
| 4  | 0.5000 g        | 0.5000 g   | 0.0000 g            | 0.13 mg              | 2 |
| 5  | 1.0000 g        | 1.0000 g   | 0.0000 g            | 0.13 mg              | 2 |
| 6  | 5.0000 g        | 5.0000 g   | 0.0000 g            | 0.13 mg              | 2 |
| 7  | 10.0000 g       | 10.0000 g  | 0.0000 g            | 0.14 mg              | 2 |
| 8  | 50.0000 g       | 50.0000 g  | 0.0000 g            | 0.17 mg              | 2 |
| 9  | 100.0001 g      | 100.0000 g | -0.0001 g           | 0.24 mg              | 2 |
| 10 | 150.0001 g      | 150.0001 g | 0.0000 g            | 0.34 mg              | 2 |
| 11 | 200.0000 g      | 199.9999 g | -0.0001 g           | 0.39 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. The results of this calibration certificate relate only to the calibrated item.

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.:     | WS52   | Date of Issue:        | 22-Nov-2022 |
| Certificate Number: | 182272 | Calibration Due Date: | 21-May-2024 |

Thermo Hygrometer

|                     |               |                       |             |
|---------------------|---------------|-----------------------|-------------|
| Equipment No.:      | IN302         | Date of Issue:        | 11-Oct-2023 |
| Certificate Number: | SG-H-00656/66 | Calibration Due Date: | 08-Oct-2024 |

## Remarks

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FACT adjustment functionality activated

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

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### 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:  $1.5 \cdot 10^{-6} / K$

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

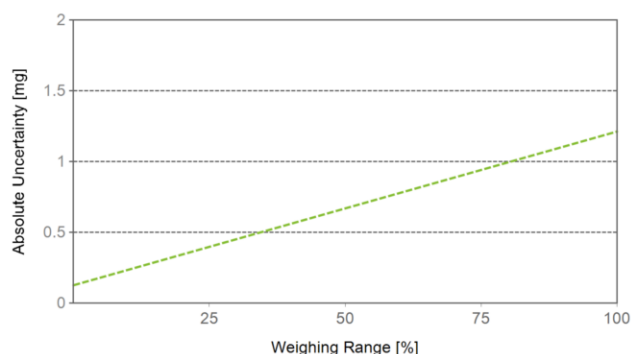
### Linearization of Uncertainty Equation

| Range |          |       | As Found   | As Left |
|-------|----------|-------|--|---------|
|       | d        | Max   |  |         |
| 1     | 0.0001 g | 220 g | $U_1 = 0.13 \text{ mg} + 0.00494 \text{ mg/g} \cdot R$ | N/A     |

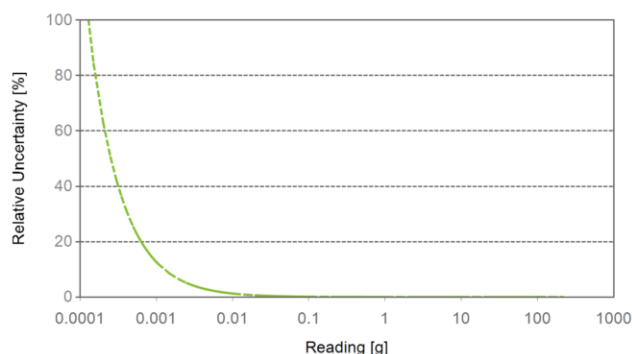
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

| Net Indication | As Found |          | As Left |     |
|----------------|----------|----------|---------|-----|
| 0.0220 g       | 0.13 mg  | 0.59%    | N/A     | N/A |
| 0.2200 g       | 0.13 mg  | 0.060%   | N/A     | N/A |
| 2.2000 g       | 0.14 mg  | 0.0064%  | N/A     | N/A |
| 22.0000 g      | 0.24 mg  | 0.0011%  | N/A     | N/A |
| 220.0000 g     | 1.2 mg   | 0.00055% | N/A     | N/A |



As Found



As Left



# GWP® Certificate



**As  
Found**



**As  
Left**



The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:



As Found



As Left



No adjustments/modifications made. As Left results correspond to As Found.

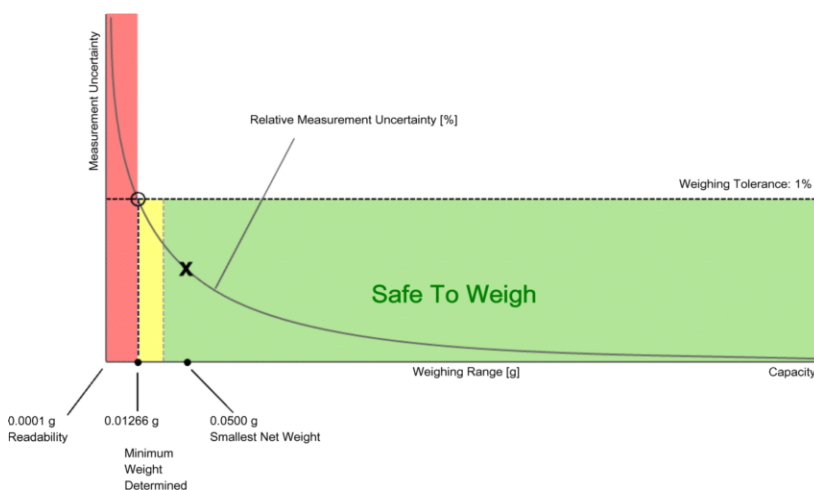
## Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 0.0500 g

Safety Factor: 2

### Safe Weighing Range



While the values in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. This graph reflects As Left testing, unless only As Found was performed.

# Minimum Weight

## As Found Minimum Weight Table

| Minimum weights for different weighing tolerances and safety factors |               |           |           |           |           |
|--|---------------|-----------|-----------|-----------|-----------|
|  | Safety Factor |           |           |           |           |
| Tolerance  | 1             | 2         | 3         | 5         | 10        |
| 0.1%   | 0.12712 g     | 0.25551 g | 0.38518 g | 0.64847 g | 1.33062 g |
| 0.2%   | 0.06340 g     | 0.12712 g | 0.19115 g | 0.32018 g | 0.64847 g |
| 0.5%   | 0.02532 g     | 0.05070 g | 0.07612 g | 0.12712 g | 0.25551 g |
| 1%   | 0.01266 g     | 0.02532 g | 0.03800 g | 0.06340 g | 0.12712 g |
| 2%   | 0.00633 g     | 0.01266 g | 0.01899 g | 0.03166 g | 0.06340 g |
| 5%   | 0.00253 g     | 0.00506 g | 0.00759 g | 0.01266 g | 0.02532 g |



Pass: The determined minimum weight meets the requirement for the smallest net weight.

## As Left Minimum Weight Table

| Minimum weights for different weighing tolerances and safety factors |               |           |           |           |           |
|--|---------------|-----------|-----------|-----------|-----------|
|  | Safety Factor |           |           |           |           |
| Tolerance  | 1             | 2         | 3         | 5         | 10        |
| 0.1%   | 0.12712 g     | 0.25551 g | 0.38518 g | 0.64847 g | 1.33062 g |
| 0.2%   | 0.06340 g     | 0.12712 g | 0.19115 g | 0.32018 g | 0.64847 g |
| 0.5%   | 0.02532 g     | 0.05070 g | 0.07612 g | 0.12712 g | 0.25551 g |
| 1%   | 0.01266 g     | 0.02532 g | 0.03800 g | 0.06340 g | 0.12712 g |
| 2%   | 0.00633 g     | 0.01266 g | 0.01899 g | 0.03166 g | 0.06340 g |
| 5%   | 0.00253 g     | 0.00506 g | 0.00759 g | 0.01266 g | 0.02532 g |



Pass: The determined minimum weight meets the requirement for the smallest net weight.

At these net minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with  $k = 2$  and based on the linear formula of the measurement uncertainty of the weighing device in use.

The safety factor for As Found is always 1. This implies no safety factor. As Found testing looks at the behavior of the instrument from the past until test occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.

### Notes on minimum weight values in above table:

1. If "N/A" is shown above, no appropriate value could be calculated.
2. METTLER TOLEDO is not responsible for the definition of the process requirements.

# Measurement Results

## Results Summary

|          | Repeatability | Eccentricity | Error of Indication |
|----------|---------------|--------------|---------------------|
| As Found | ✓             | ✓            | ✓                   |
| As Left  | ✓             | ✓            | ✓                   |

✓ = Passed

✗ = Failed

⚠ = Safety Factor not met

## Repeatability

Test Load: 100 g

| Tolerance | Control Limit | As Found       |        | As Left        |        |
|-----------|---------------|----------------|--------|----------------|--------|
|           |               | Std. Deviation | Result | Std. Deviation | Result |
| 0.1%      | N/A           | 0.00005 g*     | N/A    | 0.00005 g*     | N/A    |
| 0.2%      | 0.00005 g     |                | ✓      |                | ⚠      |
| 0.5%      | 0.00013 g     |                | ✓      |                | ✓      |
| 1%        | 0.00025 g     |                | ✓      |                | ✓      |
| 2%        | 0.00050 g     |                | ✓      |                | ✓      |
| 5%        | 0.00125 g     |                | ✓      |                | ✓      |

\*The calculated standard deviation value is below the rounding error of the balance. The  $0.41 \cdot d$  rule is used for the assessment of this repeatability test and the calculation of the minimum weight.

The weighing tolerance is met if the standard deviation is less than or equal to the corresponding control limit.

## Eccentricity

Test Load: 100 g

| Tolerance | Control Limit | As Found  |        | As Left   |        |
|-----------|---------------|-----------|--------|-----------|--------|
|           |               | Deviation | Result | Deviation | Result |
| 0.1%      | 0.0500 g      | 0.0001 g  | ✓      | 0.0001 g  | ✓      |
| 0.2%      | 0.1000 g      |           | ✓      |           | ✓      |
| 0.5%      | 0.2500 g      |           | ✓      |           | ✓      |
| 1%        | 0.5000 g      |           | ✓      |           | ✓      |
| 2%        | 1.0000 g      |           | ✓      |           | ✓      |
| 5%        | 2.5000 g      |           | ✓      |           | ✓      |

The weighing tolerance is met if the deviation is less than or equal to the corresponding control limit.

**Error of Indication****As Found**

|                 |           | Control limits for various weighing tolerances |          |          |          |          |          |
|-----------------|-----------|--|----------|----------|----------|----------|----------|
| Reference Value | Error     | 0.1%   | 0.2%     | 0.5%     | 1%       | 2%       | 5%       |
| 0.0000 g        | 0.0000 g  | N/A  | N/A      | N/A      | N/A      | N/A      | N/A      |
| 50.0000 g       | 0.0000 g  | 0.0250 g                                       | 0.0500 g | 0.1250 g | 0.2500 g | 0.5000 g | 1.2500 g |
| 100.0001 g      | -0.0001 g | 0.0500 g                                       | 0.1000 g | 0.2500 g | 0.5000 g | 1.0000 g | 2.5000 g |
| 150.0001 g      | 0.0000 g  | 0.0750 g                                       | 0.1500 g | 0.3750 g | 0.7500 g | 1.5000 g | 3.7500 g |
| 200.0000 g      | -0.0001 g | 0.1000 g                                       | 0.2000 g | 0.5000 g | 1.0000 g | 2.0000 g | 5.0000 g |
| Result          |           | ✓  | ✓        | ✓        | ✓        | ✓        | ✓        |

**As Left**

|                 |           | Control limits for various weighing tolerances |          |          |          |          |          |
|-----------------|-----------|--|----------|----------|----------|----------|----------|
| Reference Value | Error     | 0.1%   | 0.2%     | 0.5%     | 1%       | 2%       | 5%       |
| 0.0000 g        | 0.0000 g  | N/A  | N/A      | N/A      | N/A      | N/A      | N/A      |
| 50.0000 g       | 0.0000 g  | 0.0250 g                                       | 0.0500 g | 0.1250 g | 0.2500 g | 0.5000 g | 1.2500 g |
| 100.0001 g      | -0.0001 g | 0.0500 g                                       | 0.1000 g | 0.2500 g | 0.5000 g | 1.0000 g | 2.5000 g |
| 150.0001 g      | 0.0000 g  | 0.0750 g                                       | 0.1500 g | 0.3750 g | 0.7500 g | 1.5000 g | 3.7500 g |
| 200.0000 g      | -0.0001 g | 0.1000 g                                       | 0.2000 g | 0.5000 g | 1.0000 g | 2.0000 g | 5.0000 g |
| Result          |           | ✓  | ✓        | ✓        | ✓        | ✓        | ✓        |

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.





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



Cert. No.: 24TM92

Page : 1 of 3

## Certificate of Calibration

**Equipment :** Hot Air Oven

**Manufacturer :** Binder

**Model :** FED 115 E2

**Serial No. :** 11-22823

**ID No. :** ERTC-L-In.-076

**Submitted by :** Environment Research & Technology Company Limited.  
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,  
Toongsonghong, Laksi,  
Bangkok 10210

**Location :** Laboratory (ERTC)

**Received Order :** 03 January 2024

**Calibration Date :** 03 January 2024

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

**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Tawatchai Pama

**Approved by :**

( ) Pointhippa Tameyakul  
( ✓ ) Ponpan Paipim  
( ) Suwit Imjai

**Issue Date :**

16 January 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.

A 0062471



Equipment : Hot Air Oven  
 Condition As-Received : Used Item  
 Reference : 2401-0001ON-2  
 Procedure Used :-

Cert. No.: 24TM92  
 Page : 2 of 3

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

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 | MY57013823 | 23LM66    | TPA       | 25 Mar 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.

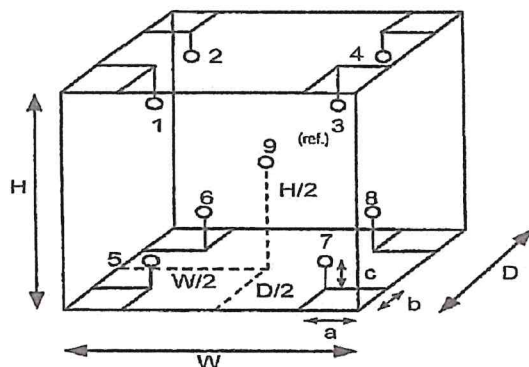
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

| Environment during calibration |           |          |
|--------------------------------|-----------|----------|
|                                | Beginning | Finished |
| Temp. ( °C )                   | 30        | 33       |
| REL.Humid. ( % )               | 53        | 41       |
| AC Supply ( Volt )             | 226       | 225      |



| Probe Installation Details : |     |    | Dimension of Chamber : |      |                |
|------------------------------|-----|----|------------------------|------|----------------|
| a =                          | 5.0 | cm | D =                    | 0.40 | m              |
| b =                          | 5.0 | cm | W =                    | 0.60 | m              |
| c =                          | 5.0 | cm | H =                    | 0.48 | m              |
|                              |     |    | Capacity =             | 0.12 | m <sup>3</sup> |

| Ref. Std. ID No.: @ Calibration Point |             |            |
|---------------------------------------|-------------|------------|
| Position :                            | ( 104 ) °C  | ( 180 ) °C |
| 1                                     | 21-17RTD-01 | 22-17TC-01 |
| 2                                     | 21-17RTD-02 | 23-17TC-02 |
| 3                                     | 17RTD-03    | 19-17TC-03 |
| 4                                     | 23-17RTD-10 | 19-17TC-04 |
| 5                                     | 17RTD-05    | 19-17TC-05 |
| 6                                     | 17RTD-06    | 19-17TC-06 |
| 7                                     | 17RTD-07    | 19-17TC-07 |
| 8                                     | 23-17RTD-08 | 19-17TC-08 |
| 9 (ref.)                              | 23-17RTD-09 | 19-17TC-09 |

a 1197881



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2401-0001ON-2  
**Result of Calibration :-** ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 24TM92  
Page : 3 of 3

| Calibration Point ( °C ) | UUC* Setting ( °C ) | UUC* Reading ( °C ) | Temperature stability ( ± °C ) | Temperature uniformity ( °C ) | Overall Variation ( °C ) | Coverage Factor <i>k</i> |
|--------------------------|---------------------|---------------------|--------------------------------|-------------------------------|--------------------------|--------------------------|
| 104                      | 104                 | 104                 | 0.10                           | 1.8                           | 2.1                      | 2                        |
| 180                      | 180                 | 180                 | 0.27                           | 4.4                           | 5.0                      | 2                        |

| Calibration<br>Point<br>( °C ) | Measured Temperature ( °C ) |         |         |         |         |         |         |         |          | Uncertainty<br><br>( ±°C ) |
|--------------------------------|-----------------------------|---------|---------|---------|---------|---------|---------|---------|----------|----------------------------|
|                                | Position                    |         |         |         |         |         |         |         |          |                            |
|                                | 1                           | 2       | 3       | 4       | 5       | 6       | 7       | 8       | 9 (ref.) |                            |
| 104                            | 104.379                     | 103.463 | 103.443 | 103.893 | 104.213 | 103.223 | 105.222 | 104.297 | 103.494  | 0.77                       |
| 180                            | 179.045                     | 177.562 | 181.299 | 179.300 | 180.773 | 177.931 | 182.136 | 178.131 | 178.019  | 1.6                        |

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

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

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

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

UUC\* : Unit Under Calibration

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

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

-o0o-





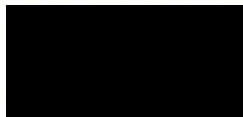

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 24TM93

Page : 1 of 3

## Certificate of Calibration

|   |   |
|---|---|
| Equipment :   | Hot Air Oven  |
| Manufacturer :  | Memmert   |
| Model :   | UF 110  |
| Serial No. :  | B414.0652   |
| ID No. :  | ERTC-L-In.-098  |
| Submitted by :  | Environment Research & Technology Company Limited.<br>25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,<br>Toongsonghong, Laksi,<br>Bangkok 10210 |
| Location :  | Laboratory (ERTC)   |
| Received Order :                                      | 03 January 2024   |
| Calibration Date :                                    | 03 January 2024   |
| Ambient Temperature :                                 | ( 26 ± 10 ) °C  |
| Relative Humidity :                                   | ( 50 ± 30 ) %   |
| Calibrated by :                                       | Tawatchai Pama<br>  |
| Approved by :   | <br>Approved Signatory                                      |
| ( ) Pornthippa Tameyakul                              |   |
| ( <input checked="" type="checkbox"/> ) Ponpan Paipim |   |
| ( ) Suwit Imjai                                       |   |

Issue Date : 16 January 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.

A 0062472

11.6/19



**Equipment :** Hot Air Oven  
**Condition As-Received :** Used Item  
**Reference :** 2401-0001ON-3

**Cert. No.:** 24TM93

**Page :** 2 of 3

**Procedure Used :-**

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

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

| <u>Instrument</u>    | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Traceable</u> | <u>Due Date</u> |
|----------------------|-------------------|------------------|------------------|-----------------|
| 1 ) Data Acquisition | MY57013823        | 23LM66           | TPA              | 25 Mar 2024     |

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

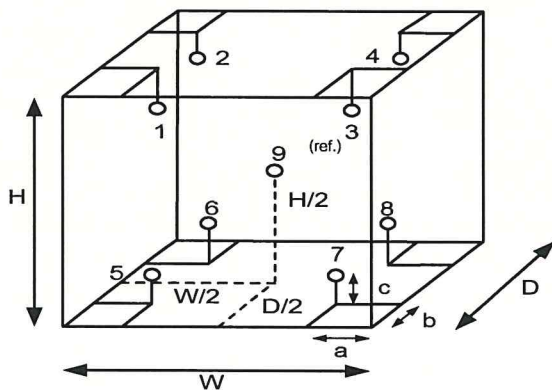
3. This certification is traceable to the International System of Unit.

**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 )                   | 30        | 30       |
| REL.Humid. ( % )               | 53        | 53       |
| AC Supply ( Volt )             | 226       | 225      |

**Ref. Std. ID No.: @  
Calibration Point**

| Position : | ( 104 ) °C  | ( 180 ) °C |
|------------|-------------|------------|
| 1          | 21-17RTD-01 | 22-17TC-01 |
| 2          | 21-17RTD-02 | 23-17TC-02 |
| 3          | 17RTD-03    | 19-17TC-03 |
| 4          | 23-17RTD-10 | 19-17TC-04 |
| 5          | 17RTD-05    | 19-17TC-05 |
| 6          | 17RTD-06    | 19-17TC-06 |
| 7          | 17RTD-07    | 19-17TC-07 |
| 8          | 23-17RTD-08 | 19-17TC-08 |
| 9 (ref.)   | 23-17RTD-09 | 19-17TC-09 |

**Probe Installation Details :**

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

**Dimension of Chamber :**

D = 0.40 m  
W = 0.56 m  
H = 0.48 m  
Capacity = 0.11 m<sup>3</sup>

a 1197879

u.6/20



**Equipment :** Hot Air Oven  
**Condition As-Received :** Used Item  
**Reference :** 2401-0001ON-3  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Close

**Cert. No.:** 24TM93

**Page :** 3 of 3

| Calibration Point<br>( °C ) | UUC* Setting<br>( °C ) | UUC* Reading<br>( °C ) | Temperature stability<br>( ± °C ) | Temperature uniformity<br>( °C ) | Overall Variation<br>( °C ) | Coverage Factor<br><i>k</i> |
|-----------------------------|------------------------|------------------------|-----------------------------------|----------------------------------|-----------------------------|-----------------------------|
| 104.0                       | 104.0                  | 104.0                  | 0.075                             | 1.2                              | 2.4                         | 2                           |
| 180.0                       | 180.0                  | 180.0                  | 0.41                              | 3.4                              | 3.9                         | 2                           |

| Calibration<br>Point<br>( °C ) | Measured Temperature ( °C ) |         |         |         |         |         |         |         |          | Uncertainty<br><br>( ±°C ) |
|--------------------------------|-----------------------------|---------|---------|---------|---------|---------|---------|---------|----------|----------------------------|
|                                | Position                    |         |         |         |         |         |         |         |          |                            |
|                                | 1                           | 2       | 3       | 4       | 5       | 6       | 7       | 8       | 9 (ref.) |                            |
| 104.0                          | 105.068                     | 102.783 | 103.239 | 103.695 | 104.855 | 103.867 | 102.799 | 103.295 | 103.959  | 0.42                       |
| 180.0                          | 179.954                     | 177.587 | 177.414 | 178.118 | 181.087 | 179.869 | 179.584 | 178.045 | 180.704  | 1.3                        |

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

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

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

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

**UUC\* :** Unit Under Calibration

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

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

-o0o-

a 1197878

u.6/21



Mettler-Toledo (Thailand) Ltd.

846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District

Bangna District, Bangkok 10260

+662 723 0382

MT-TH.ServiceSupport@mt.com



NSC-TISI-TIS 17025  
CALIBRATION 0062

## Accuracy Calibration Certificate

### Customer

**Company:** Environment Research & Technology Co., Ltd.  
**Address:** 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Rd., Toongsonghong  
**City:** Laksi **Contact:** Ramita Taengthai  
**Zip / Postal:** 10210  
**State / Province:** Bangkok  
**Order Number:**   
0 3 3 2 9 6 3 6 1 1

### Weighing Device

**Manufacturer:** Mettler Toledo **Instrument Type:** Weighing Instrument  
**Model:** MS204TS/00 **Asset Number:** ERTC-L-IN-114  
**Serial No.:** B547728937 **Terminal Model:** N/A  
**Building:** N/A **Terminal Serial No.:** N/A  
**Floor:** 5 **Terminal Asset No.:** N/A  
**Room:** 504

| 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: 26.9 °C | End: 27.0 °C | Start: 44.5 % | End: 44.6 % |

**As Found Calibration Date:** 15-Jan-2024  
**As Left Calibration Date:** N/A  
**Issue Date:** 15-Jan-2024

**Calibrator:**

**Approved Signatory:**

## Measurement Results

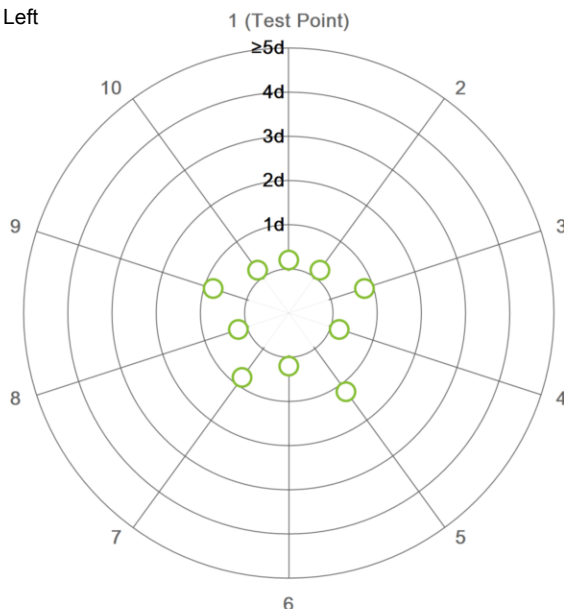
### Repeatability

Test Load: 100 g

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

|                    |           |     |
|--------------------|-----------|-----|
| Standard Deviation | 0.00006 g | N/A |
|--------------------|-----------|-----|

○ As Found  
◆ As Left



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

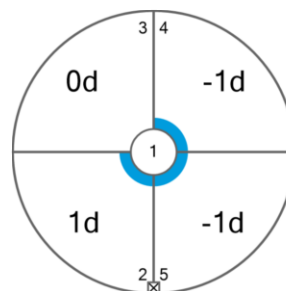
The results of this graph are based upon the absolute values of the differences from the mean value.

### Eccentricity

Test Load: 100 g

| Position | As Found   | As Left |
|----------|------------|---------|
| 1        | 100.0000 g | N/A     |
| 2        | 100.0001 g | N/A     |
| 3        | 100.0000 g | N/A     |
| 4        | 99.9999 g  | N/A     |
| 5        | 99.9999 g  | N/A     |

|                   |          |     |
|-------------------|----------|-----|
| Maximum Deviation | 0.0001 g | N/A |
|-------------------|----------|-----|



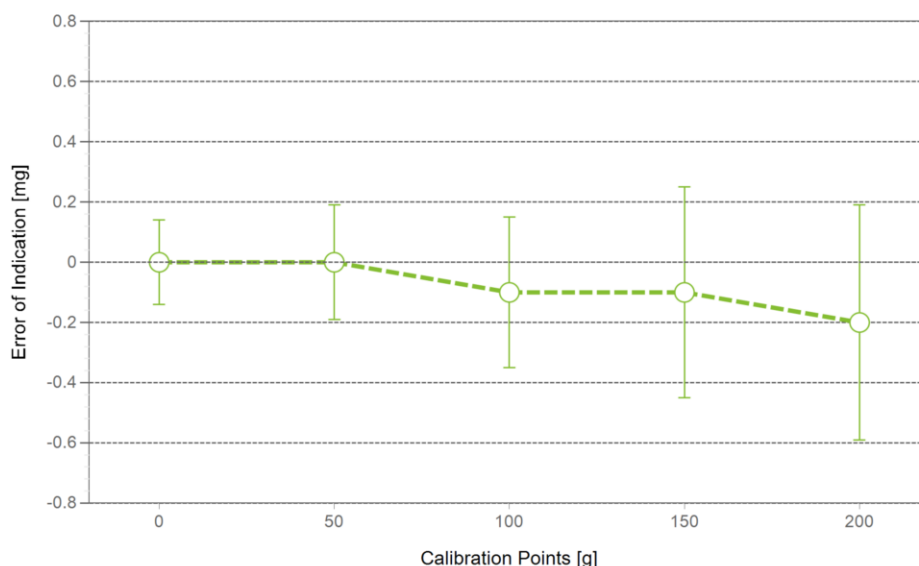
As Found

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            | 0.14 mg              | 2 |
| 2  | 0.0500 g        | 0.0500 g   | 0.0000 g            | 0.15 mg              | 2 |
| 3  | 0.1000 g        | 0.1000 g   | 0.0000 g            | 0.15 mg              | 2 |
| 4  | 0.5000 g        | 0.5001 g   | 0.0001 g            | 0.15 mg              | 2 |
| 5  | 1.0000 g        | 1.0000 g   | 0.0000 g            | 0.15 mg              | 2 |
| 6  | 5.0000 g        | 5.0001 g   | 0.0001 g            | 0.16 mg              | 2 |
| 7  | 10.0000 g       | 10.0000 g  | 0.0000 g            | 0.16 mg              | 2 |
| 8  | 50.0000 g       | 50.0000 g  | 0.0000 g            | 0.19 mg              | 2 |
| 9  | 100.0001 g      | 100.0000 g | -0.0001 g           | 0.25 mg              | 2 |
| 10 | 150.0001 g      | 150.0000 g | -0.0001 g           | 0.35 mg              | 2 |
| 11 | 200.0000 g      | 199.9998 g | -0.0002 g           | 0.39 mg              | 2 |



○ As Found

◆ As Left

For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

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. The results of this calibration certificate relate only to the calibrated item.

## 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.:     | WS52   | Date of Issue:        | 22-Nov-2022 |
| Certificate Number: | 182272 | Calibration Due Date: | 21-May-2024 |

### Thermo Hygrometer

|                     |               |                       |             |
|---------------------|---------------|-----------------------|-------------|
| Equipment No.:      | IN302         | Date of Issue:        | 11-Oct-2023 |
| Certificate Number: | SG-H-00656/66 | Calibration Due Date: | 08-Oct-2024 |

## Remarks

---

FACT adjustment functionality activated

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

---

### 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:  $3.0 \cdot 10^{-6} / K$

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

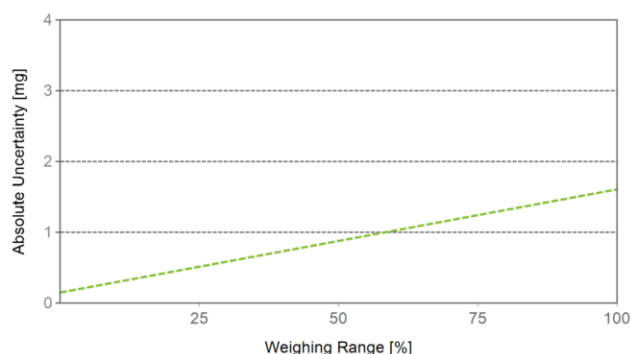
### Linearization of Uncertainty Equation

| Range |          |       | As Found   | As Left |
|-------|----------|-------|--|---------|
|       | d        | Max   |  |         |
| 1     | 0.0001 g | 220 g | $U_1 = 0.15 \text{ mg} + 0.00663 \text{ mg/g} \cdot R$ | N/A     |

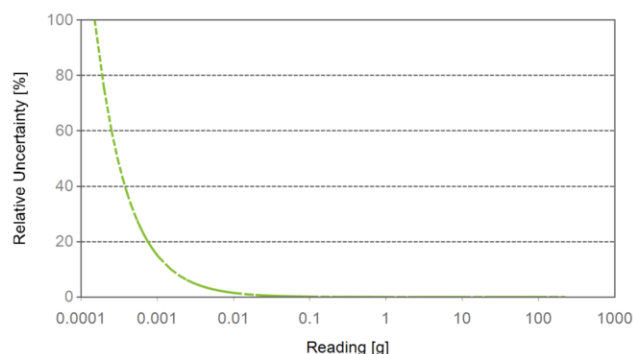
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

| Net Indication | As Found |          | As Left |     |
|----------------|----------|----------|---------|-----|
| 0.0220 g       | 0.15 mg  | 0.68%    | N/A     | N/A |
| 0.2200 g       | 0.15 mg  | 0.069%   | N/A     | N/A |
| 2.2000 g       | 0.16 mg  | 0.0075%  | N/A     | N/A |
| 22.0000 g      | 0.30 mg  | 0.0013%  | N/A     | N/A |
| 220.0000 g     | 1.6 mg   | 0.00073% | N/A     | N/A |



As Found



As Left

# GWP® Certificate



**As  
Found**



**As  
Left**



The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:



As Found



As Left



No adjustments/modifications made. As Left results correspond to As Found.

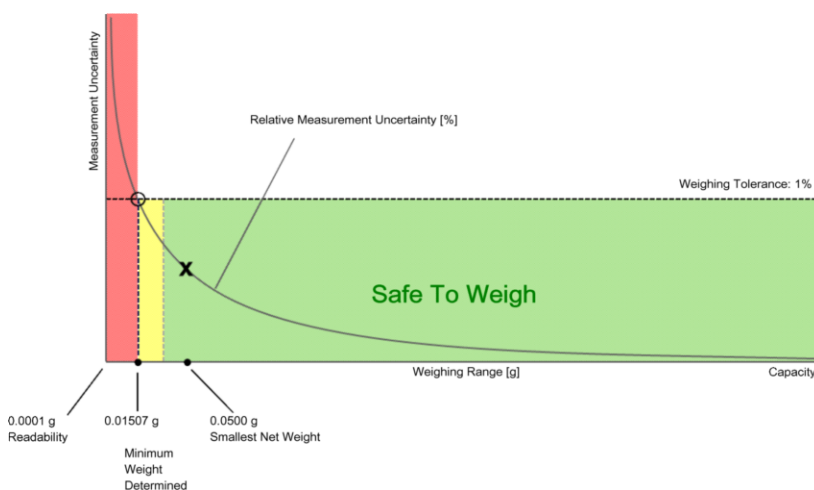
## Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 0.0500 g

Safety Factor: 2

### Safe Weighing Range



While the values in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. This graph reflects As Left testing, unless only As Found was performed.



# Minimum Weight

## As Found Minimum Weight Table

| Minimum weights for different weighing tolerances and safety factors |               |           |           |           |           |
|--|---------------|-----------|-----------|-----------|-----------|
|  | Safety Factor |           |           |           |           |
| Tolerance  | 1             | 2         | 3         | 5         | 10        |
| 0.1%   | 0.15156 g     | 0.30515 g | 0.46083 g | 0.77857 g | 1.61241 g |
| 0.2%   | 0.07553 g     | 0.15156 g | 0.22810 g | 0.38273 g | 0.77857 g |
| 0.5%   | 0.03015 g     | 0.06038 g | 0.09069 g | 0.15156 g | 0.30515 g |
| 1%   | 0.01507 g     | 0.03015 g | 0.04526 g | 0.07553 g | 0.15156 g |
| 2%   | 0.00753 g     | 0.01507 g | 0.02261 g | 0.03770 g | 0.07553 g |
| 5%   | 0.00301 g     | 0.00602 g | 0.00904 g | 0.01507 g | 0.03015 g |



Pass: The determined minimum weight meets the requirement for the smallest net weight.

## As Left Minimum Weight Table

| Minimum weights for different weighing tolerances and safety factors |               |           |           |           |           |
|--|---------------|-----------|-----------|-----------|-----------|
|  | Safety Factor |           |           |           |           |
| Tolerance  | 1             | 2         | 3         | 5         | 10        |
| 0.1%   | 0.15156 g     | 0.30515 g | 0.46083 g | 0.77857 g | 1.61241 g |
| 0.2%   | 0.07553 g     | 0.15156 g | 0.22810 g | 0.38273 g | 0.77857 g |
| 0.5%   | 0.03015 g     | 0.06038 g | 0.09069 g | 0.15156 g | 0.30515 g |
| 1%   | 0.01507 g     | 0.03015 g | 0.04526 g | 0.07553 g | 0.15156 g |
| 2%   | 0.00753 g     | 0.01507 g | 0.02261 g | 0.03770 g | 0.07553 g |
| 5%   | 0.00301 g     | 0.00602 g | 0.00904 g | 0.01507 g | 0.03015 g |



Pass: The determined minimum weight meets the requirement for the smallest net weight.

At these net minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with  $k = 2$  and based on the linear formula of the measurement uncertainty of the weighing device in use.

The safety factor for As Found is always 1. This implies no safety factor. As Found testing looks at the behavior of the instrument from the past until test occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.

### Notes on minimum weight values in above table:

1. If "N/A" is shown above, no appropriate value could be calculated.
2. METTLER TOLEDO is not responsible for the definition of the process requirements.

# Measurement Results

## Results Summary

|          | Repeatability | Eccentricity | Error of Indication |
|----------|---------------|--------------|---------------------|
| As Found | ✓             | ✓            | ✓                   |
| As Left  | ✓             | ✓            | ✓                   |

✓ = Passed

✗ = Failed

⚠ = Safety Factor not met

## Repeatability

Test Load: 100 g

| Tolerance | Control Limit | As Found       |        | As Left        |        |
|-----------|---------------|----------------|--------|----------------|--------|
|           |               | Std. Deviation | Result | Std. Deviation | Result |
| 0.1%      | N/A           | 0.00006 g*     | N/A    | 0.00006 g*     | N/A    |
| 0.2%      | 0.00005 g     |                | ✗      |                | ✗      |
| 0.5%      | 0.00013 g     |                | ✓      |                | ✓      |
| 1%        | 0.00025 g     |                | ✓      |                | ✓      |
| 2%        | 0.00050 g     |                | ✓      |                | ✓      |
| 5%        | 0.00125 g     |                | ✓      |                | ✓      |

\*The calculated standard deviation value is below the rounding error of the balance. The  $0.41 \cdot d$  rule is used for the assessment of this repeatability test and the calculation of the minimum weight.

The weighing tolerance is met if the standard deviation is less than or equal to the corresponding control limit.

## Eccentricity

Test Load: 100 g

| Tolerance | Control Limit | As Found  |        | As Left   |        |
|-----------|---------------|-----------|--------|-----------|--------|
|           |               | Deviation | Result | Deviation | Result |
| 0.1%      | 0.0500 g      | 0.0001 g  | ✓      | 0.0001 g  | ✓      |
| 0.2%      | 0.1000 g      |           | ✓      |           | ✓      |
| 0.5%      | 0.2500 g      |           | ✓      |           | ✓      |
| 1%        | 0.5000 g      |           | ✓      |           | ✓      |
| 2%        | 1.0000 g      |           | ✓      |           | ✓      |
| 5%        | 2.5000 g      |           | ✓      |           | ✓      |

The weighing tolerance is met if the deviation is less than or equal to the corresponding control limit.

**Error of Indication****As Found**

|                 |           | Control limits for various weighing tolerances |          |          |          |          |          |
|-----------------|-----------|--|----------|----------|----------|----------|----------|
| Reference Value | Error     | 0.1%   | 0.2%     | 0.5%     | 1%       | 2%       | 5%       |
| 0.0000 g        | 0.0000 g  | N/A  | N/A      | N/A      | N/A      | N/A      | N/A      |
| 50.0000 g       | 0.0000 g  | 0.0250 g                                       | 0.0500 g | 0.1250 g | 0.2500 g | 0.5000 g | 1.2500 g |
| 100.0001 g      | -0.0001 g | 0.0500 g                                       | 0.1000 g | 0.2500 g | 0.5000 g | 1.0000 g | 2.5000 g |
| 150.0001 g      | -0.0001 g | 0.0750 g                                       | 0.1500 g | 0.3750 g | 0.7500 g | 1.5000 g | 3.7500 g |
| 200.0000 g      | -0.0002 g | 0.1000 g                                       | 0.2000 g | 0.5000 g | 1.0000 g | 2.0000 g | 5.0000 g |
| Result          |           | ✓  | ✓        | ✓        | ✓        | ✓        | ✓        |

**As Left**

|                 |           | Control limits for various weighing tolerances |          |          |          |          |          |
|-----------------|-----------|--|----------|----------|----------|----------|----------|
| Reference Value | Error     | 0.1%   | 0.2%     | 0.5%     | 1%       | 2%       | 5%       |
| 0.0000 g        | 0.0000 g  | N/A  | N/A      | N/A      | N/A      | N/A      | N/A      |
| 50.0000 g       | 0.0000 g  | 0.0250 g                                       | 0.0500 g | 0.1250 g | 0.2500 g | 0.5000 g | 1.2500 g |
| 100.0001 g      | -0.0001 g | 0.0500 g                                       | 0.1000 g | 0.2500 g | 0.5000 g | 1.0000 g | 2.5000 g |
| 150.0001 g      | -0.0001 g | 0.0750 g                                       | 0.1500 g | 0.3750 g | 0.7500 g | 1.5000 g | 3.7500 g |
| 200.0000 g      | -0.0002 g | 0.1000 g                                       | 0.2000 g | 0.5000 g | 1.0000 g | 2.0000 g | 5.0000 g |
| Result          |           | ✓  | ✓        | ✓        | ✓        | ✓        | ✓        |

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.

# Preventive Maintenance Block Digestion

Service No. PM23-S08-115

## 1. Customer Information

| Customer Name  | Instrument | Serial Number | Service Date              |
|--|------------|---------------|---------------------------|
| บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช<br>แอนด์ เทคโนโลยี จำกัด<br>25/114 หมู่ 6 ซ.ชินเขต 1<br>ถ.งามวงศ์วาน ท่งสองห้อง<br>หลักสี่ กรุงเทพมหานคร 10210<br><br>ติดต่อ: คุณรมิตา แดงไทย<br><br>Tel: 086-633 4490<br>Fax: - | K- 449     | 1000299283    | 06-Jul-2023<br><br>PM_1/1 |



## 2. Instrument

|                                   | OK | NOT OK | Remark |
|-----------------------------------|----|--------|--------|
| <b>2.1 Housing</b>                |    |        |        |
| - Clean the housing               | /  |        |        |
| - Visual check                    | /  |        |        |
| - Check for defects (e.g. cracks) | /  |        |        |

| <b>2.2 Heating</b>      | OK | NOT OK | Remark     |
|-------------------------|----|--------|------------|
| - Clean aluminum block  | /  |        |            |
| - Visual check          | /  |        |            |
| - Check heating element |    | /      | เสื่อมสภาพ |

## Preventive Maintenance Block Digestion

| 2.3 Visual Check        | OK | NOT OK | Remark |
|-------------------------|----|--------|--------|
| - Connection to suction | /  |        |        |
| - PTFE seal             | /  |        |        |
| - O-ring                | /  |        |        |
| - Glass holder set      | /  |        |        |
| - Suction module        | /  |        |        |

### 2.4 Function test (This test does not use digestion vessels!)



- Select and store in .Program 9 by following parameters:
  - Step 1 Ramp 1 Temp. 55°C Time 2 min.
  - Step 2 Ramp 2 Temp. 70°C Time 2 min.
  - Step 3 Ramp 3 Temp. 85°C Time 2 min.
  - Step 4 Ramp 4 Temp. 100°C Time 2 min.
  - Step 5 Cool Time 10 min.
- Check following functions:
  - Press key "Start": Start Time 00.00
  - 0 min. press key .Start. again starts heating from room temperature (LED Heating on)
  - 5 min. reaches 55°C (LED off) Lift goes down (K-438 only)
  - 6 min. starts heating again (LED on)
  - 7 min. reaches 70°C (LED off)
  - 8 min. starts heating again (LED on)
  - 9 min. reaches 85°C (LED off)
  - 10 min. starts heating again (LED on)
  - 11 min. reaches 100°C (LED off)
  - 12 min. starts cooling (fan on) Lift goes up (K-438 only)
  - 22 min. End / Scrubber off; LED still flashing displays 'power off delay - cooling' (Instrument will switch off automatically, if temperature of the heating block drops below 60°C)
- Note:
  - This are only approximate times starting from room temperature and they can vary slightly!
  - Not all heating positions have exactly the same heating output! (Constructive matter)
  - Temperatures may overshoot set temperatures. (only below 100°C)

Function test

☒ OK

☐ NOT OK



Buchi (Thailand) Limited

## Preventive Maintenance Block Digestion

| 2.5 System control | OK | NOT OK | Remark |
|--------------------|----|--------|--------|
| - Keyboard         | /  |        |        |
| - Display          | /  |        |        |
| - Program          | /  |        |        |

### 3. Summary

| All specifications OK | Specification not OK |
|-----------------------|----------------------|
| OK                    |                      |



#### Comments

- Preventive Maintenance + Performance test\_1/1
- TEST Run เครื่องทำงานปกติ

#### Signature BUCHI

- Service by \_\_\_\_\_

Date 06 - Jul - 2023

- Approve by \_\_\_\_\_

Date 10 - Jul - 2023



Buchi (Thailand) Limited



# Preventive Maintenance Kjeldahl

Service No. PM23-S08-115

## 1. Customer Information

| Customer Name  | Instrument | Serial Number | Service Date              |
|--|------------|---------------|---------------------------|
| บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช<br>แอนด์ เทคโนโลยี จำกัด<br>25/114 หมู่ 6 ซ.ชินเขต 1<br>ถ.งามวงศ์วาน พุ่งสองห้อง หลักสี่<br>กรุงเทพมหานคร 10210<br><br>ติดต่อ: คุณรมิตา แต่งไทย<br>Tel: 086-633 4490<br>Fax: - | K- 449     | 1000299283    | 06-Jul-2023<br><br>PM_1/1 |

## 2. Instrument

| 2.1 Cooling water (If it connected) | OK | NOT OK | Remark        |
|-------------------------------------|----|--------|---------------|
| - Temperature 15 – 20 °C            | /  |        | CTL-911       |
| - Cooling water inlet               | /  |        |               |
| - Cooling water outlet              | /  |        |               |
| - Control Temperature               | /  |        | Set temp 15 C |

| 2.2 Cleaning         | DONE | NOT DONE | Remark |
|----------------------|------|----------|--------|
| - Outside Instrument | /    |          |        |
| - Inside Instrument  | /    |          |        |
| - Splash protector   | /    |          |        |
| - Condenser          | /    |          |        |

## Preventive Maintenance Kjeldahl



| 2.3 Visual Test   | OK | NOT OK | Remark |
|---|----|--------|--------|
| - Screw Coupling (between splash protector and condenser) | /  |        |        |
| - Condenser   | /  |        |        |
| - Splash protector  | /  |        |        |
| - Hypalon connection (connection tube)                    | /  |        |        |
| - Rubber bung   | /  |        |        |
| - Ventilation valve                                       | /  |        |        |
| - PTFE tube   | /  |        |        |
| - Cooling water inlet                                     | /  |        |        |
| - Cooling water outlet                                    | /  |        |        |
| - Magnetic valve  | /  |        |        |

| 2.4 System control                      | OK | NOT OK | Remark      |
|---|----|--------|-------------|
| - Key board                             | /  |        |             |
| - Display                               | /  |        |             |
| - Program                               | /  |        |             |
| - Adding H <sub>2</sub> O               | /  |        | Reagent 1   |
| - Adding NaOH                           | /  |        | Reagent 2   |
| - Adding H <sub>3</sub> BO <sub>3</sub> | -  |        | Do not have |
| - Aspiration                            | -  |        | Do not have |

## Preventive Maintenance Kjeldahl



| 2.5 System Distillation    | OK | NOT OK | Remark      |
|----------------------------|----|--------|-------------|
| - Boiler                   | /  |        | 7.1 Amp     |
| - Water level sensor       | /  |        |             |
| - One way valve            | /  |        |             |
| - Pressure switch          | /  |        |             |
| - Thermostat               | /  |        |             |
| - Steam valve1 (Y4)        | /  |        |             |
| - Steam valve2 (Y5)        | -  |        | Do not have |
| - Drain valve (Y3)         | -  |        | Do not have |
| - Water 3/2 way valve (Y1) | -  |        | Do not have |

| 2.6 Hose        | OK | NOT OK | Remark      |
|-----------------|----|--------|-------------|
| - Unisil hose   | /  |        |             |
| - Hypalon hose  | /  |        |             |
| - Drain hose    | -  |        | Do not have |
| - Viton hose    | /  |        |             |
| - Silicone hose | -  |        | Do not have |

| 2.7 Diaphragm pump                                  | OK | NOT OK | Remark      |
|---|----|--------|-------------|
| - Diaphragm pump for H <sub>2</sub> O               | /  |        |             |
| - Diaphragm pump for NaOH                           | /  |        |             |
| - Diaphragm pump for H <sub>3</sub> BO <sub>3</sub> | -  |        | Do not have |

| 2.8 Program test | OK | NOT OK | Remark      |
|------------------|----|--------|-------------|
| - Distillation   | -  |        | Do not have |
| - Aspiration     | -  |        | Do not have |
| - Preheating     | -  |        | Do not have |
| - Cleaning       | -  |        | Do not have |



Buchi (Thailand) Limited

## Preventive Maintenance Kjeldahl

### 3. Function Test

|   |      |                   |       |
|---|------|-------------------|-------|
| Addition H <sub>2</sub> O               | 0 ml | Reaction time     | 0 min |
| Addition NaOH                           | 0 ml | Distillation time | 5 min |
| Addition H <sub>3</sub> BO <sub>3</sub> | 0 ml | Steam capacity    | 100%  |
|   |      | Aspiration        | SAM   |

**Result:** Water in receiving vessel now approximately 170 ml, 172 ml

### 4. Summary



| All specifications OK | Specification not OK |
|-----------------------|----------------------|
| OK                    |                      |

#### Comments

- Preventive Maintenance + Performance test\_1/1
- TEST Run เครื่องทำงานปกติ

#### Signature BUCHI

|                    |   |                             |
|--------------------|---|-----------------------------|
| - Service by _____ |  | Date <u>06 - Jul - 2023</u> |
| - Approve by _____ |  | Date <u>10 - Jul - 2023</u> |



Buchi (Thailand) Limited

# Performance Test

Service No. PM23-S08-115

## 1. Customer Information

| Customer Name   | Instrument                      | Serial Number                                  | Service Date                |
|---|---------------------------------|--|-----------------------------|
| บริษัท เอ็นไวรอนเมนท์ รีเสิร์ช<br>แอนด์ เทคโนโลยี จำกัด<br>25/114 หมู่ 6 ซอยชินเขต 1<br>ถนนงามวงศ์วาน แขวงทุ่งสอง<br>ห้อง เขตหลักสี่<br>กรุงเทพมหานคร 10210<br><br>Tel: 02-954-7745<br>Fax: | K-355<br><br>K-449<br><br>B-414 | 1000142231<br><br>1000299283<br><br>0700002874 | 06 July 2023<br><br>(PM1/1) |



## 2. Methods and Reagents

| Digestion (assay 100.1%) |                     |
|--------------------------|---------------------|
| Standard Substance:      | Glycine             |
| Theoretical %N content   | 18.618%             |
|                          |                     |
| Catalyst                 | Mixed catalyst 10 g |
| Sulfuric acid            | 20 ml               |
| Heating Level or Temp    | 420 องศา            |
| Digestion time           | 90 min              |
| Cooling time             | 30 min              |

| Distillation and Titration (assay 100.2%) |                                      |
|---|--------------------------------------|
| Standard Substance                        | Ammonium Sulfate                     |
| Theoretical %N content                    | 21.24%                               |
|   |                                      |
| Titration method                          | Boric acid                           |
| Distilled water                           | 50 ml                                |
| NaOH 32 %                                 | 90 ml                                |
| Boric acid 2 %                            | 60 ml                                |
| Titration                                 | 0.5 N H <sub>2</sub> SO <sub>4</sub> |



## Performance Test

### 3. Results

| No.            | Sample           | Sample Weight<br>(g) | Volume of<br>titrant (ml) | Nitrogen<br>(%) | Recovery<br>Rate (%) |
|----------------|------------------|----------------------|---------------------------|-----------------|----------------------|
| 1              | Blank            | -                    | 0.05                      |                 |                      |
| 2              | Blank            | -                    | 0.05                      |                 |                      |
| 3              | Ammonium Sulfate | 0.2073               | 6.30                      | 21.12           | 99.46                |
| 4              | Ammonium Sulfate | 0.2074               | 6.30                      | 21.11           | 99.41                |
| 5              | Ammonium Sulfate | 0.2072               | 6.30                      | 21.13           | 99.51                |
| 6              | Ammonium Sulfate | 0.2073               | 6.30                      | 21.12           | 99.46                |
| <b>Average</b> |                  |                      |                           | <b>21.12%</b>   | <b>99.46 %</b>       |

Recovery Rate: 99.46 % ☒ Passed ☐ Failed

Relative Standard Deviation (RSD): 0.04 % ☒ Passed ☐ Failed

| No.            | Sample  | Sample Weight<br>(g) | Volume of<br>titrant (ml) | Nitrogen<br>(%) | Recovery<br>Rate (%) |
|----------------|---------|----------------------|---------------------------|-----------------|----------------------|
| 1              | Blank   | -                    | 0.05                      |                 |                      |
| 2              | Blank   | -                    | 0.05                      |                 |                      |
| 3              | Glycine | 0.2058               | 5.50                      | 18.55           | 99.49                |
| 4              | Glycine | 0.2061               | 5.50                      | 18.52           | 99.35                |
| 5              | Glycine | 0.2065               | 5.50                      | 18.48           | 99.16                |
| 6              | Glycine | 0.2063               | 5.50                      | 18.50           | 99.25                |
| <b>Average</b> |         |                      |                           | <b>18.51%</b>   | <b>99.31%</b>        |

Recovery Rate: 99.31 % ☐ Passed ☐ Failed

Relative Standard Deviation (RSD): 0.14 % ☐ Passed ☐ Failed

#### Note:

- The recovery rate should be between 98 – 102 %
- The relative standard deviation should be lower than 1 %



## Performance Test

### 4. Summary

| All specifications OK | Specification not OK |
|-----------------------|----------------------|
| OK                    |                      |



#### Comments

% Recovery : Pass



#### Signature BUCHI

- Service by Jiraporn

Date 06 July 2023

- Approve by Suvaphan C.

Date 07 July 2023

# Preventive Maintenance Scrubber

Service No. PM23-S08-115

## 1. Customer Information

| Customer Name  | Instrument | Serial Number | Service Date              |
|--|------------|---------------|---------------------------|
| บริษัท เอ็นไวรอนเมนต์ รีเสิร์ช<br>แอนด์ เทคโนโลยี จำกัด<br>25/114 หมู่ 6 ซ.ชินเขต 1<br>ถ.งามวงศ์วาน ท้องสองห้อง<br>หลักสี่ กรุงเทพมหานคร 10210<br><br>ติดต่อ: คุณรมิตา แดงไทย<br><br>Tel: 086-633 4490<br>Fax: - | K- 449     | 1000299283    | 06-Jul-2023<br><br>PM_1/1 |



## 2. Instrument

### 2.1 Cooling water (If it connected)

|                          | OK | NOT OK | Remark  |
|--------------------------|----|--------|---------|
| - Temperature 10 – 20 °C | /  |        | CTL-901 |
| - Cooling water inlet    | /  |        |         |
| - Cooling water outlet   | /  |        |         |

### 2.2 Cleaning

|              | DONE | NOT DONE | Remark |
|--------------|------|----------|--------|
| - Housing    | /    |          |        |
| - Condenser  | /    |          |        |
| - Swirl disc | /    |          |        |

## Preventive Maintenance Scrubber

| 2.3 Visual Check             | OK | NOT OK | Remark |
|------------------------------|----|--------|--------|
| - Hose connection to suction | /  |        |        |
| - Glassware                  | /  |        |        |
| - Lip gasket                 | /  |        |        |
| - GL-14 connector            | /  |        |        |
| - Activated charcoal         | /  |        |        |

### 2.4 Flush Pump



Make sure, the bypass valve is closed completely (for maximum suction power).

- Disconnect the silencer, move it down (or take it away from the instrument), and flush out the pump with at least 500 mL of distilled water through the pump inlet, until the collected washing water is clean.
- Switch on the instrument and collect the waste water from the pump output in a suitable vessel.

Flush pump

☒ OK

☐ NOT OK

### 2.5 Washing Solution

- Sodium hydroxide 8-10 %, max. 20 %
- Sodium carbonate
  - dissolve 600 g  $\text{Na}_2\text{CO}_3$  in 3 L distilled warm water, or
  - dissolve 1.7 kg  $\text{Na}_2\text{CO}_3$  in 10 H<sub>2</sub>O in 3 L distilled warm water

Washing solution

☒ OK

☐ NOT OK

## Preventive Maintenance Scrubber

### 3. Summary

| All specifications OK | Specification not OK |
|-----------------------|----------------------|
| OK                    |                      |

#### Comments

- Preventive Maintenance + Performance test\_1/1
- TEST Run เครื่องทำงานปกติ

#### Signature BUCHI

- Service by \_\_\_\_\_

Date 06 - Jul - 2023

- Approve by \_\_\_\_\_

Date 10 - Jul - 2023



Buchi (Thailand) Limited



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



Cert. No.: 24TM96

Page : 1 of 3

## Certificate of Calibration

**Equipment :** Incubator

**Manufacturer :** Ehret

**Model :** BK 4106

**Serial No. :** 22162

**ID No. :** ERTC-L-In.-022

**Submitted by :** Environment Research & Technology Company Limited  
25/114 Moo 6 Soi Chinaket 1,  
Ngamwongwan Road, Toongsonghong, Laksi,  
Bangkok 10210

**Location :** 408/2 ห้องปฏิบัติการบ่มอาหารเลี้ยงเชื้อ

**Received Order :** 03 January 2024  
**Calibration Date :** 04 January 2024  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Suwit Imjai

**Approved by :**

( ) Pornthippa Tameyakul  
( ✓ ) Ponpan Paipim  
( ) Kunchit Promprat

**Issue Date :** 16 January 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.

A 0062475

u.6/44



**Equipment :** Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2401-0001ON-6

**Cert. No.:** 24TM96  
**Page :** 2 of 3

**Procedure Used :-**

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ).

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

| <u>Instrument</u>    | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Traceable</u> | <u>Due Date</u> |
|----------------------|-------------------|------------------|------------------|-----------------|
| 1 ) Data Acquisition | 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.

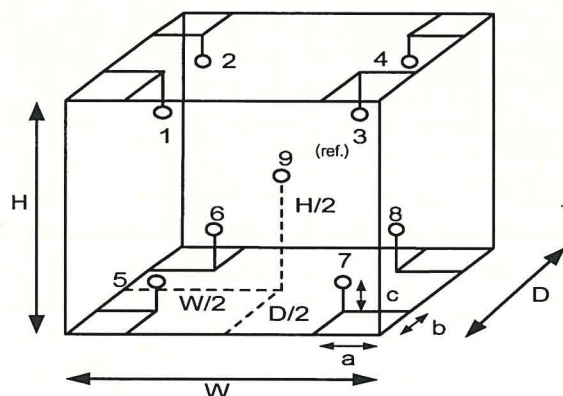
**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

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

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

**Fresh air setting :** Not Available

| Environment during calibration |           |          |
|--------------------------------|-----------|----------|
|                                | Beginning | Finished |
| Temp. ( °C )                   | 26        | 29       |
| REL.Humid. ( % )               | 45        | 50       |
| AC Supply ( Volt )             | 225       | 226      |



| 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       |

**Probe Installation Details :**

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

**Dimension of Chamber :**

D = 0.50 m  
W = 0.60 m  
H = 0.50 m  
Capacity = 0.15 m<sup>3</sup>





**Equipment :** Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2401-0001ON-6  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Not Available

**Cert. No.:** 24TM96

**Page :** 3 of 3

| Calibration Point<br>( °C ) | UUC* Setting<br>( °C ) | UUC* Reading<br>( °C ) | Temperature stability<br>( ± °C ) | Temperature uniformity<br>( °C ) | Overall Variation<br>( °C ) | Coverage Factor<br><i>k</i> |
|-----------------------------|------------------------|------------------------|-----------------------------------|----------------------------------|-----------------------------|-----------------------------|
| 44.5                        | 44.5                   | 45.0                   | 0.20                              | 0.77                             | 1.6                         | 2                           |

| Calibration<br>Point<br>( °C ) | Measured Temperature ( °C ) |        |        |        |        |        |        |        |          | Uncertainty<br><br>( ±°C ) |
|--------------------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|----------|----------------------------|
|                                | Position                    |        |        |        |        |        |        |        |          |                            |
|                                | 1                           | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9 (ref.) |                            |
| 44.5                           | 45.038                      | 45.142 | 45.077 | 45.127 | 43.812 | 44.180 | 44.402 | 44.990 | 44.497   | 0.85                       |

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



Cert. No.: 24TM95

Page : 1 of 3

## Certificate of Calibration

**Equipment :** Incubator

**Manufacturer :** Memmert

**Model :** IF 160

**Serial No. :** D522.0070

**ID No. :** ERTC-L-In.-181

**Submitted by :** Environment Research & Technology Company Limited  
25/114 Moo 6 Soi Chinaket 1,  
Ngamwongwan Road, Toongsonghong, Laksi,  
Bangkok 10210

**Location :** 408/2 ห้องปฏิบัติการบ่มอาหารเลี้ยงเชื้อ

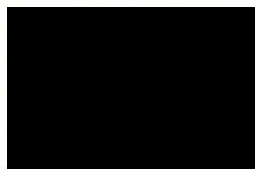
**Received Order :** 03 January 2024

**Calibration Date :** 04 January 2024

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

**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :**



**Approved by :**

Approved Signatory

- ( ) Pornthippa Tameyakul  
( ☒ ) Ponpan Paipim  
( ) Kunchit Promprat

**Issue Date :** 16 January 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 :** Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2401-0001ON-5

**Cert. No.:** 24TM95

**Page :** 2 of 3

**Procedure Used :-**

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ).

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

| <u>Instrument</u>    | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Traceable</u> | <u>Due Date</u> |
|----------------------|-------------------|------------------|------------------|-----------------|
| 1 ) Data Acquisition | 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 )

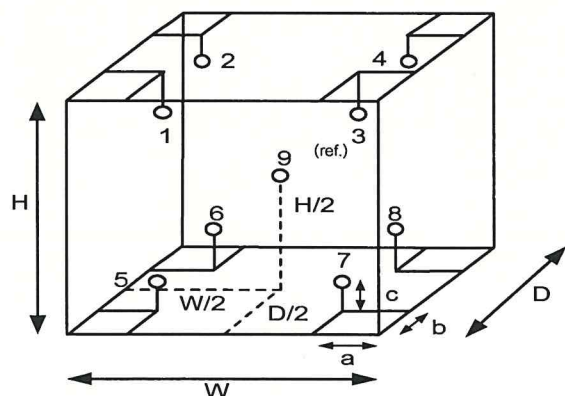
**Result of Calibration :-** ( \* ) Without Adjustment

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

**Fresh air setting :** Close

**Fan setting :** 50%

| Environment during calibration |           |          |
|--------------------------------|-----------|----------|
|                                | Beginning | Finished |
| Temp. ( °C )                   | 26        | 29       |
| REL.Humid. ( % )               | 47        | 50       |
| AC Supply ( Volt )             | 225       | 226      |



| Position : | Ref. Std.<br>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            |

**Probe Installation Details :**

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

**Dimension of Chamber :**

D = 0.40 m  
W = 0.56 m  
H = 0.73 m  
Capacity = 0.16 m<sup>3</sup>



**Equipment :** Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2401-0001ON-5  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Close

**Cert. No.:** 24TM95

**Page :** 3 of 3

| Calibration Point<br>( °C ) | UUC* Setting<br>( °C ) | UUC* Reading<br>( °C ) | Temperature stability<br>( ± °C ) | Temperature uniformity<br>( °C ) | Overall Variation<br>( °C ) | Coverage Factor<br><i>k</i> |
|-----------------------------|------------------------|------------------------|-----------------------------------|----------------------------------|-----------------------------|-----------------------------|
| 35.0                        | 35.0                   | 35.0                   | 0.020                             | 0.15                             | 0.24                        | 2                           |

| Calibration<br>Point<br>( °C ) | Measured Temperature ( °C ) |        |        |        |        |        |        |        |          | Uncertainty<br><br>( ±°C ) |
|--------------------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|----------|----------------------------|
|                                | Position                    |        |        |        |        |        |        |        |          |                            |
|                                | 1                           | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9 (ref.) |                            |
| 35.0                           | 35.043                      | 34.933 | 35.015 | 34.992 | 35.019 | 34.980 | 34.843 | 34.961 | 34.985   | 0.32                       |

**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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