



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 : Walalak Sirithean

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%

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 0062385



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 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 %

-o0o-



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 :

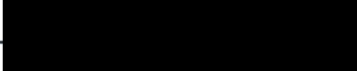
<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
LXI Data Acquisition Switch Unit with Sensor	34972A	MY57003222	MT23-5938	Oct 05, 2024

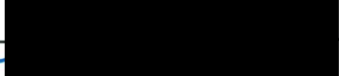
This result of calibration was found accurate as shown on date and place of calibration only.

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 :

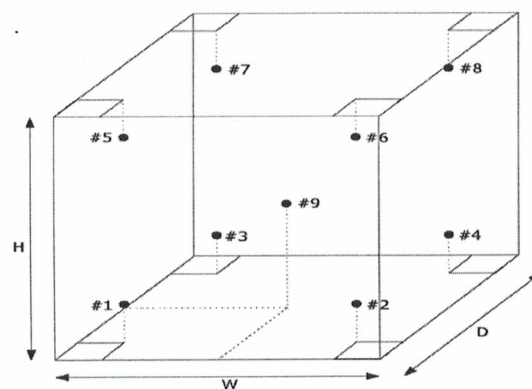
Approved by : 

This calibration certificate shall not be reproduced other than in full except with the prior written approval of Inctech 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 (°C)	Temperature of UUC* at each position (°C)									Uncertainty of measurement (+/- °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 (°C)	Indicating Temperature (°C)	Measured stability (+/- °C)	Measured uniformity (°C)	Overall variation (°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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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

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

Cert.No.: 23TW254

Page.: 1 of 2

Certificate of Testing

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

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.18	8.17	0.0055

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

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a 1192571

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: 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:

Tech

Measurement Results

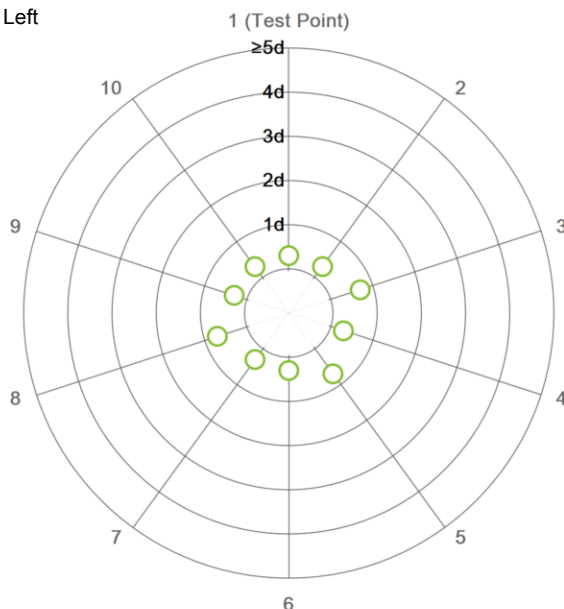
Repeatability

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
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○ As Found
◆ As Left



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

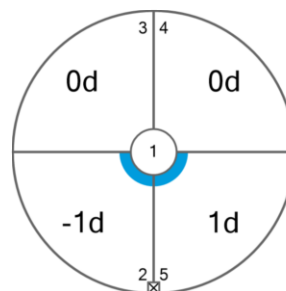
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	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
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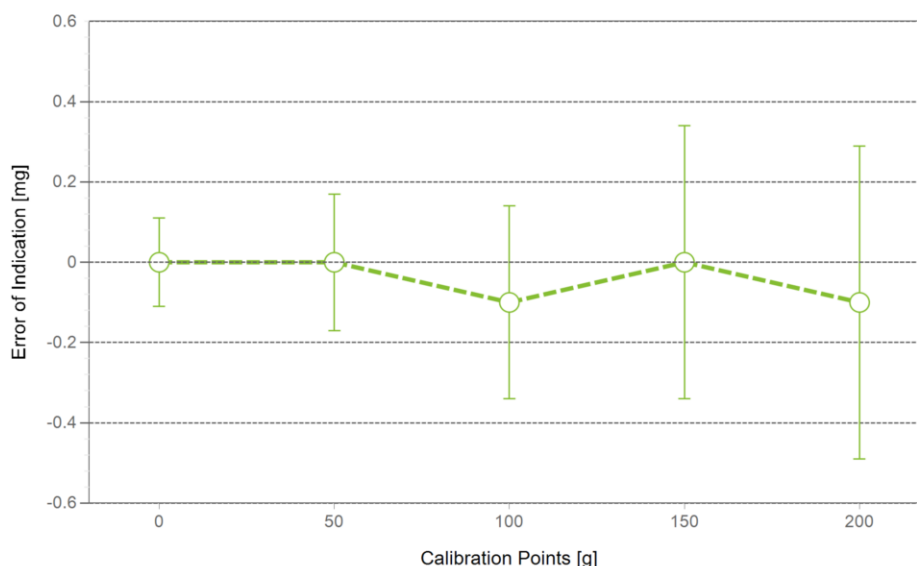
As Found

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



○ 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: $1.5 \cdot 10^{-6} / K$

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

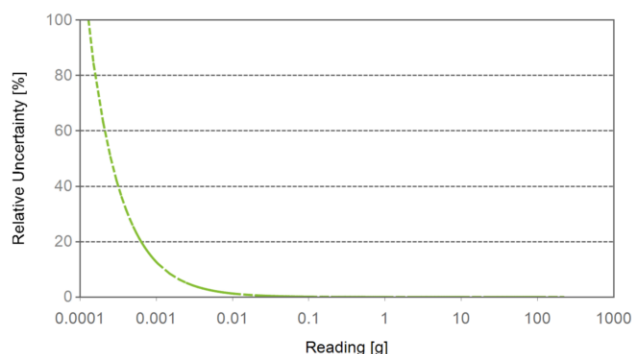
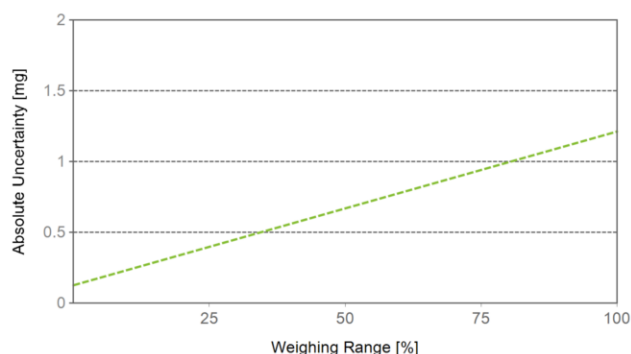
Linearization of Uncertainty Equation

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



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.

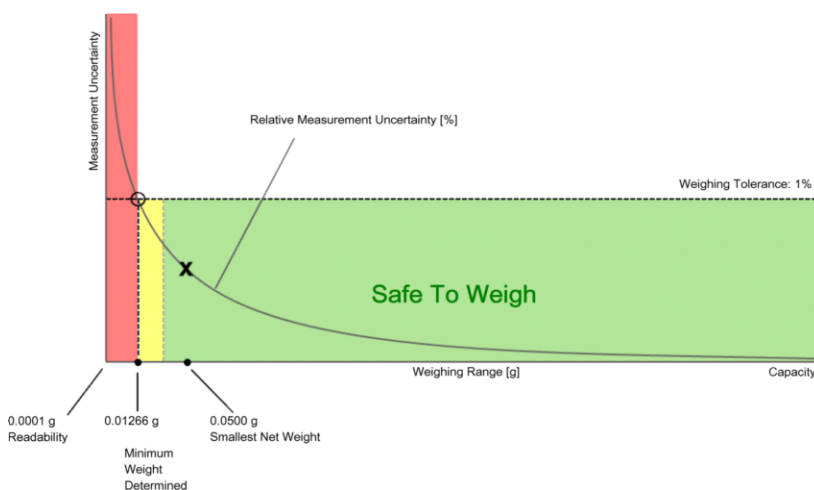
Process Requirements

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)
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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

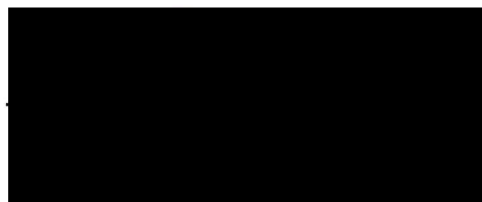
Ambient Temperature : (26 ± 10) °C

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 %

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 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.

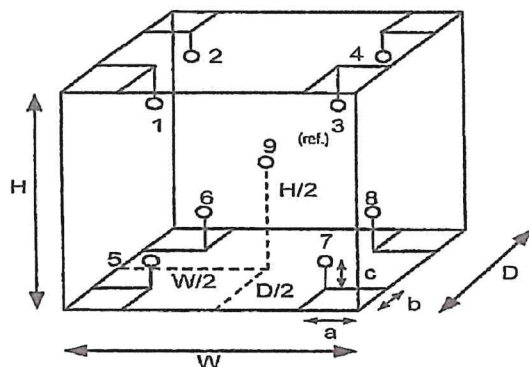
Remark : TPA : Technology Promotion Association (Thailand - Japan)

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 ³	

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



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 Point (°C)	Measured Temperature (°C)									Uncertainty (± °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.
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 : 
Approved Signatory

() Pornthippa Tameyakul
(☒) Ponpan Paipim
() Suwit Imjai

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 0062472



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.

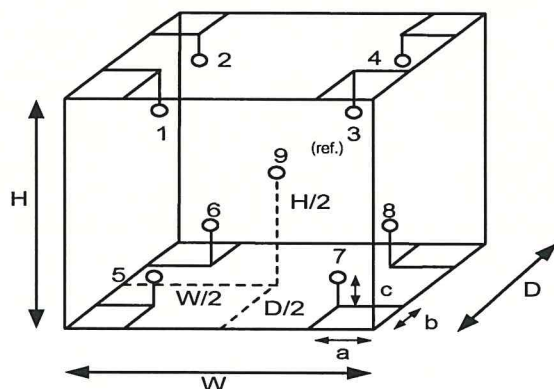
3. This certification is traceable to the International System of Unit.

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 m³



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 (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <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 Point (°C)	Measured Temperature (°C)									Uncertainty (±°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-

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

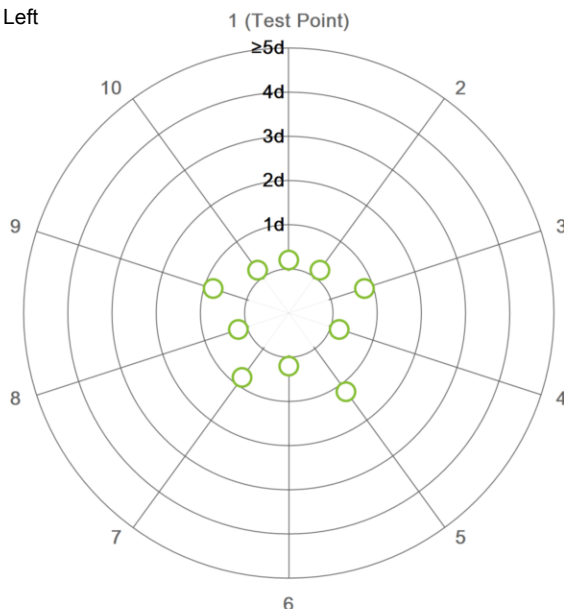
Repeatability

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
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○ As Found
◆ As Left



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

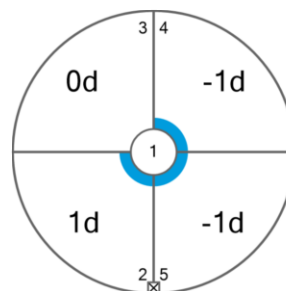
The results of this graph are based upon the absolute values of the differences from the mean value.

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
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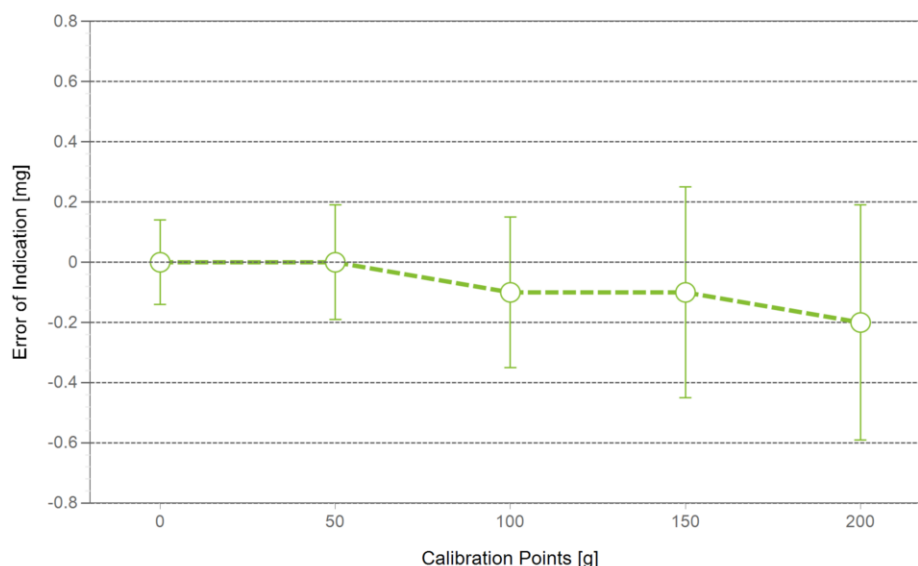
As Found

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

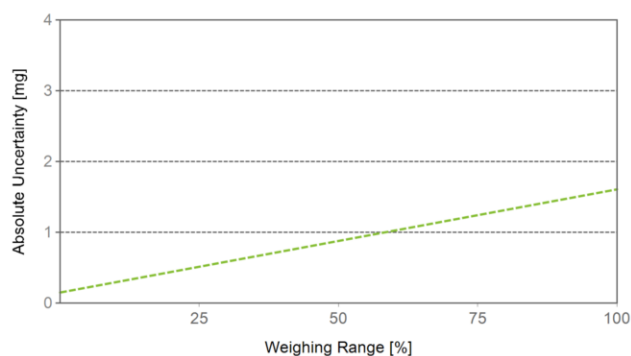
Linearization of Uncertainty Equation

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

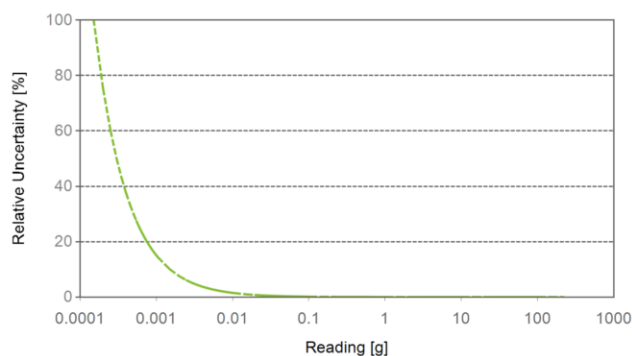
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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.

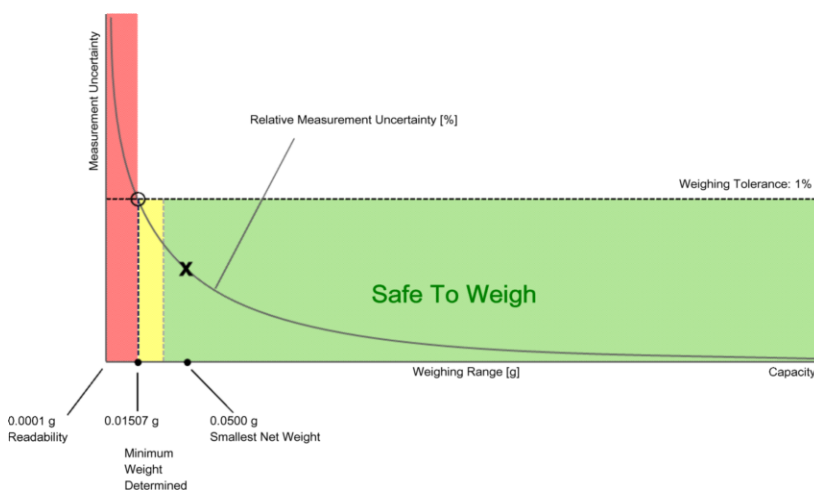
Process Requirements

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 แอนด์ เทคโนโลยี จำกัด 25/114 หมู่ 6 ซ.ชินเขต 1 ถ.งามวงศ์วาน ท่งสองห้อง หลักสี่ กรุงเทพมหานคร 10210 ติดต่อ: คุณรมิตา แดงไทย Tel: 086-633 4490 Fax: -	K- 449	1000299283	06-Jul-2023 PM_1/1



2. Instrument

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

2.2 Heating	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	

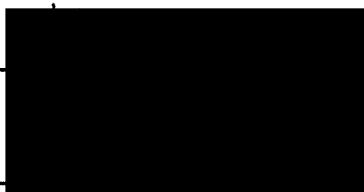


Comments

- Preventive Maintenance + Performance test_1/1
- TEST Run เครื่องทำงานปกติ

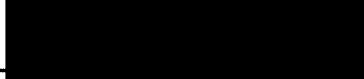
Signature BUCHI

- 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 แอนด์ เทคโนโลยี จำกัด 25/114 หมู่ 6 ซ.ชินเขต 1 ถ.งามวงศ์วาน พุ่งสองห้อง หลักสี่ กรุงเทพมหานคร 10210 ติดต่อ: คุณรมิตา แต่งไทย Tel: 086-633 4490 Fax: -	K- 449	1000299283	06-Jul-2023 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 ₂ O	/		Reagent 1
- Adding NaOH	/		Reagent 2
- Adding H ₃ BO ₃	-		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 ₂ O	/		
- Diaphragm pump for NaOH	/		
- Diaphragm pump for H ₃ BO ₃	-		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

Preventive Maintenance Kjeldahl

3. Function Test

Addition H ₂ O	0 ml	Reaction time	0 min
Addition NaOH	0 ml	Distillation time	5 min
Addition H ₃ BO ₃	0 ml	Steam capacity	100%
		Aspiration	SAM

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

4. Summary



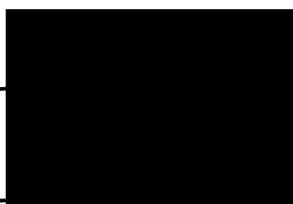
All specifications OK	Specification not OK
OK	

Comments

- Preventive Maintenance + Performance test_1/1
- TEST Run เครื่องทำงานปกติ

Signature BUCHI

- Service by



Date 06 - Jul - 2023

- Approve by

Date 10 - Jul - 2023



Buchi (Thailand) Limited

Performance Test

Service No. PM23-S08-115

1. Customer Information

Customer Name	Instrument	Serial Number	Service Date
บริษัท เอ็นไวรอนเมนท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด 25/114 หมู่ 6 ซอยชินเขต 1 ถนนงามวงศ์วาน แขวงทุ่งสอง ห้อง เขตหลักสี่ กรุงเทพมหานคร 10210 Tel: 02-954-7745 Fax:	K-355 K-449 B-414	1000142231 1000299283 0700002874	06 July 2023 (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 ₂ SO ₄



Buchi (Thailand) Limited

Performance Test

3. Results



No.	Sample	Sample Weight (g)	Volume of titrant (ml)	Nitrogen (%)	Recovery 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
Average				21.12%	99.46 %

Recovery Rate: 99.46 % ☒ Passed ☐ Failed

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

No.	Sample	Sample Weight (g)	Volume of titrant (ml)	Nitrogen (%)	Recovery 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
Average				18.51%	99.31%

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	



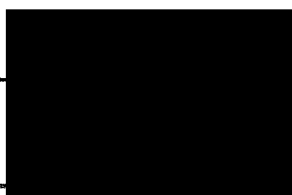
Comments

% Recovery : Pass



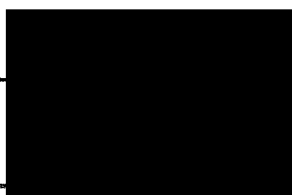
Signature BUCHI

- Service by _____



Date 06 July 2023

- Approve by _____



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 แอนด์ เทคโนโลยี จำกัด 25/114 หมู่ 6 ซ.ชินเขต 1 ถ.งามวงศ์วาน ท้องสองห้อง หลักสี่ กรุงเทพมหานคร 10210 ติดต่อ: คุณรมิตา แดงไทย Tel: 086-633 4490 Fax: -	K- 449	1000299283	06-Jul-2023 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 Na_2CO_3 in 3 L distilled warm water, or
 - dissolve 1.7 kg Na_2CO_3 in 10 H₂O 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%

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

A 0062475



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.

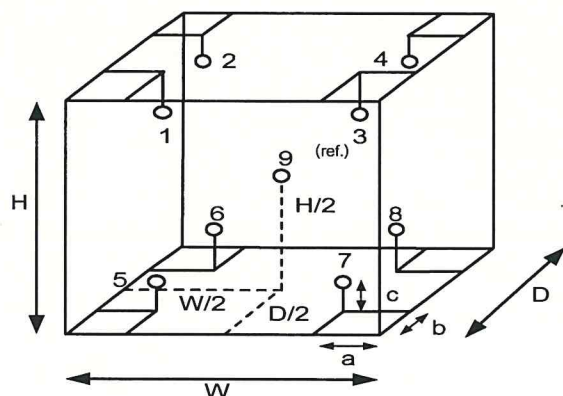
Remark : TPA : Technology Promotion Association (Thailand - Japan)

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 m³



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

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°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 : 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%

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

A 0062474



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)

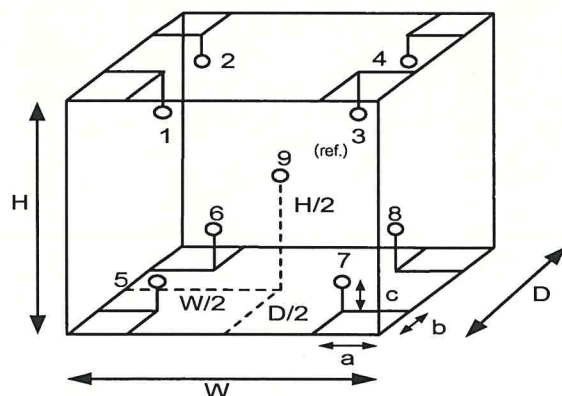
Result of Calibration :- (*) Without Adjustment

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. 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 m³



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

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°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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