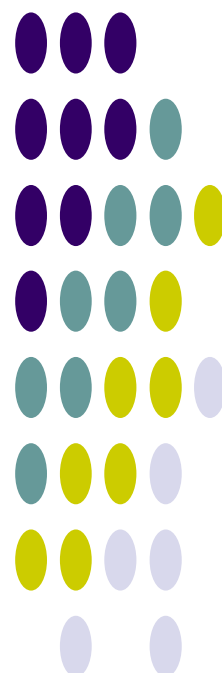


ภาคผนวกที่ 4

เอกสารสอบเทียบความถูกต้องของเครื่องมือ



ใบรับรองการสอบเทียบ “เครื่องชั่ง”

(Calibration Certificate of Electronic Balance)

Mettler-Toledo (Thailand) Limited
846/4 - 846/5 Lasalle Road
Bangna Tai, Bangna, Bangkok 10260
THAILAND
www.mt.com



Accuracy Calibration Certificate

Customer

Company: Emex Association Co., Ltd.
Address: 27,29 Soi Rama 2, Soi 30, Rama 2 Road, Bang Mot
City: Chom Thong Contact: Lamai Boonsri
Zip / Postal: 10150
State / Province: Bangkok
Order Number: 
0 3 3 2 9 7 8 6 2 7

Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: XP105DR Asset Number: N/A
Serial No.: B138280195 Terminal Model: PAT
Building: Office Terminal Serial No.: B138280195
Floor: 4 Terminal Asset No.: N/A
Room: Laboratory

Range	Max. Capacity	Readability (d)
1	31 g	0.00001 g
2	120 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: 24.9 °C	End: 24.5 °C	Start: 47.3 %	End: 53.8 %

As Found Calibration Date: 01-Feb-2024 Calibrator: Surachai P.
As Left Calibration Date: N/A
Issue Date: 02-Feb-2024 Surachai Pidkanpai

Approved Signatory: 
Technical Manager / Head of Calibration Center

Measurement Results

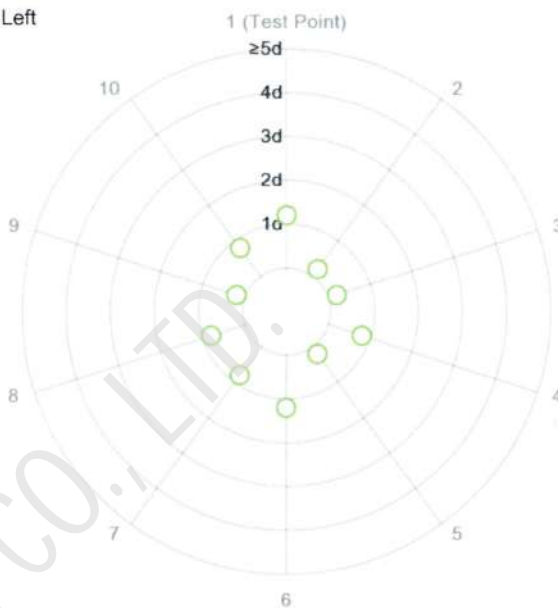
Repeatability

Test Load: 30 g

	As Found	As Left
1	30.00005 g	N/A
2	30.00006 g	N/A
3	30.00006 g	N/A
4	30.00007 g	N/A
5	30.00006 g	N/A
6	30.00005 g	N/A
7	30.00007 g	N/A
8	30.00007 g	N/A
9	30.00006 g	N/A
10	30.00007 g	N/A

Standard Deviation	0.000008 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.

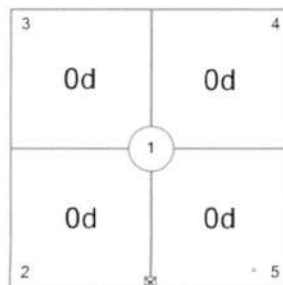
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 50 g

Position	As Found	As Left
1	50.0000 g	N/A
2	50.0000 g	N/A
3	50.0000 g	N/A
4	50.0000 g	N/A
5	50.0000 g	N/A

Maximum Deviation	0.0000 g	N/A
-------------------	----------	-----



As Found

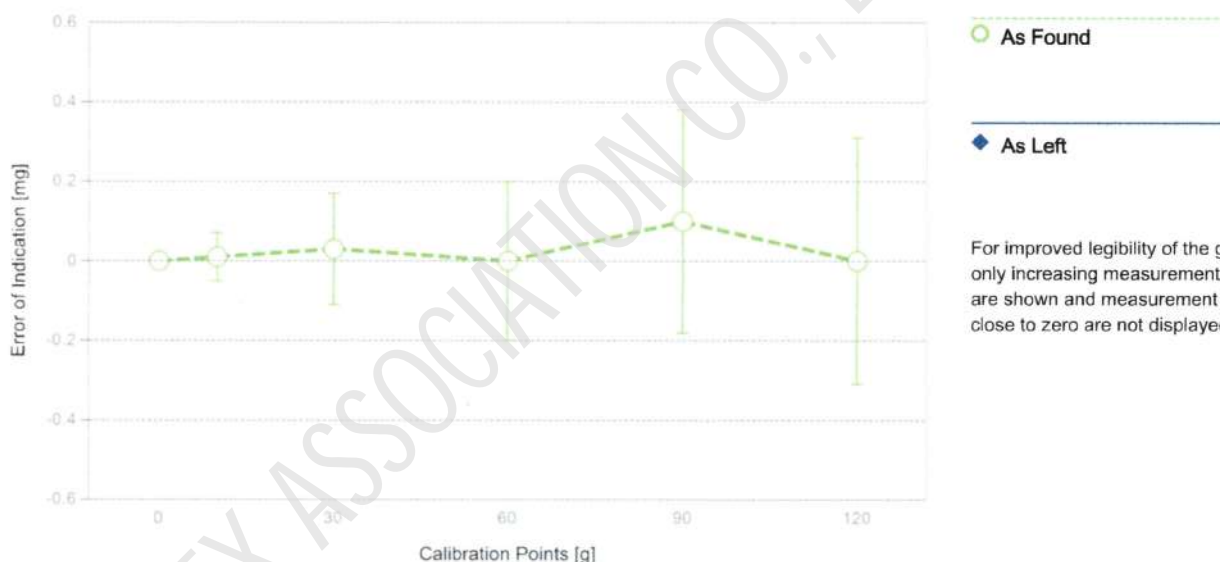
The "d" in the graph represents the readability of the range/interval in which the test was performed.

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.017 mg	2
2	0.01000 g	0.01000 g	0.00000 g	0.019 mg	2
3	0.10000 g	0.10000 g	0.00000 g	0.023 mg	2
4	0.50000 g	0.50000 g	0.00000 g	0.028 mg	2
5	1.00001 g	1.00001 g	0.00000 g	0.032 mg	2
6	5.00001 g	5.00001 g	0.00000 g	0.048 mg	2
7	10.00001 g	10.00002 g	0.00001 g	0.061 mg	2
8	30.00003 g	30.00006 g	0.00003 g	0.14 mg	2
9 ¹	60.0000 g	60.0000 g	0.0000 g	0.20 mg	2
10	90.0000 g	90.0001 g	0.0001 g	0.28 mg	2
11 ¹	120.0001 g	120.0001 g	0.0000 g	0.31 mg	2

¹The calculated uncertainty was replaced by the CMC (Calibration and Measurement Capabilities) value because the calculated uncertainty was smaller than the CMC value.



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.:	WS93	Date of Issue:	27-Jul-2023
Certificate Number:	C321203759-1	Calibration Due Date:	24-Nov-2024

Thermo Hygrometer

Equipment No.:	IN305	Date of Issue:	11-Oct-2023
Certificate Number:	SG-H-00655/66	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: $1.0 \cdot 10^{-6} / K$

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

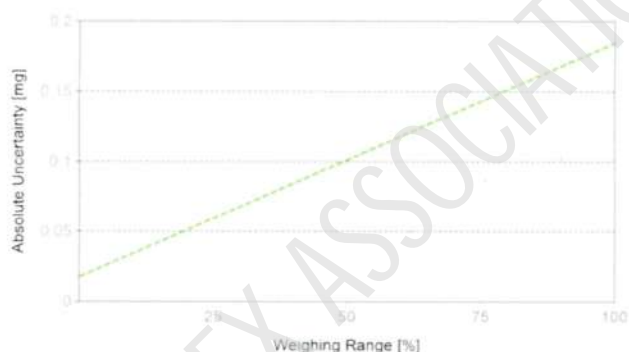
Linearization of Uncertainty Equation

Range			As Found	As Left
	d	Max		
1	0.00001 g	31 g	$U_1 = 0.018 \text{ mg} + 0.00539 \text{ mg/g} \cdot R$	N/A
2	0.0001 g	120 g	$U_2 = 0.19 \text{ mg} + 0.00584 \text{ mg/g} \cdot (R - 31 \text{ g})$	N/A

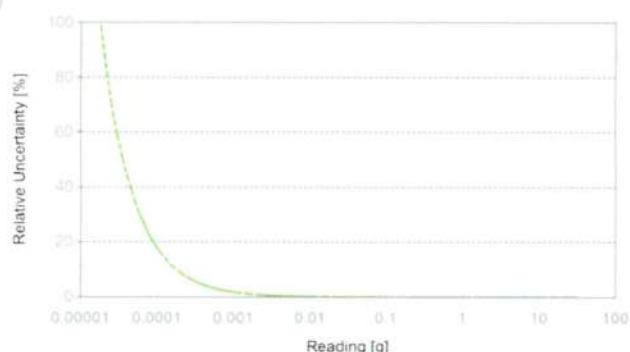
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

Net Indication	As Found		As Left	
0.00120 g	0.018 mg	1.5%	N/A	N/A
0.01200 g	0.018 mg	0.15%	N/A	N/A
0.12000 g	0.019 mg	0.016%	N/A	N/A
1.20000 g	0.024 mg	0.0020%	N/A	N/A
120.0000 g	0.71 mg	0.00059%	N/A	N/A



As Found



As Left

The weighing range shown in the absolute uncertainty graph refers to the first interval/range of the device.

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: 0.01500 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					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.017860 g	0.035915 g	0.054167 g	0.091277 g	0.187750 g
0.2%	0.008906 g	0.017860 g	0.026863 g	0.045016 g	0.091277 g
0.5%	0.003557 g	0.007121 g	0.010693 g	0.017860 g	0.035915 g
1%	0.001777 g	0.003557 g	0.005338 g	0.008906 g	0.017860 g
2%	0.000888 g	0.001777 g	0.002667 g	0.004447 g	0.008906 g
5%	0.000355 g	0.000711 g	0.001066 g	0.001777 g	0.003557 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					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.017860 g	0.035915 g	0.054167 g	0.091277 g	0.187750 g
0.2%	0.008906 g	0.017860 g	0.026863 g	0.045016 g	0.091277 g
0.5%	0.003557 g	0.007121 g	0.010693 g	0.017860 g	0.035915 g
1%	0.001777 g	0.003557 g	0.005338 g	0.008906 g	0.017860 g
2%	0.000888 g	0.001777 g	0.002667 g	0.004447 g	0.008906 g
5%	0.000355 g	0.000711 g	0.001066 g	0.001777 g	0.003557 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: 30 g

Tolerance	Control Limit	As Found		As Left	
		Std. Deviation	Result	Std. Deviation	Result
0.1%	0.000008 g	0.000008 g	✗	0.000008 g	✗
0.2%	0.000015 g		✓		⚠
0.5%	0.000038 g		✓		✓
1%	0.000075 g		✓		✓
2%	0.000150 g		✓		✓
5%	0.000375 g		✓		✓

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

Eccentricity

Test Load: 50 g

Tolerance	Control Limit	As Found		As Left	
		Deviation	Result	Deviation	Result
0.1%	0.0250 g	0.0000 g	✓	0.0000 g	✓
0.2%	0.0500 g		✓		✓
0.5%	0.1250 g		✓		✓
1%	0.2500 g		✓		✓
2%	0.5000 g		✓		✓
5%	1.2500 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%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A
10.00001 g	0.00001 g	0.00500 g	0.01000 g	0.02500 g	0.05000 g	0.10000 g	0.25000 g
30.00003 g	0.00003 g	0.01500 g	0.03000 g	0.07500 g	0.15000 g	0.30000 g	0.75000 g
60.0000 g	0.0000 g	0.0300 g	0.0600 g	0.1500 g	0.3000 g	0.6000 g	1.5000 g
90.0000 g	0.0001 g	0.0450 g	0.0900 g	0.2250 g	0.4500 g	0.9000 g	2.2500 g
120.0001 g	0.0000 g	0.0600 g	0.1200 g	0.3000 g	0.6000 g	1.2000 g	3.0000 g
Result		✓	✓	✓	✓	✓	✓

As Left

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A
10.00001 g	0.00001 g	0.00500 g	0.01000 g	0.02500 g	0.05000 g	0.10000 g	0.25000 g
30.00003 g	0.00003 g	0.01500 g	0.03000 g	0.07500 g	0.15000 g	0.30000 g	0.75000 g
60.0000 g	0.0000 g	0.0300 g	0.0600 g	0.1500 g	0.3000 g	0.6000 g	1.5000 g
90.0000 g	0.0001 g	0.0450 g	0.0900 g	0.2250 g	0.4500 g	0.9000 g	2.2500 g
120.0001 g	0.0000 g	0.0600 g	0.1200 g	0.3000 g	0.6000 g	1.2000 g	3.0000 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.

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N.W. 67

ใบรับรองการสอบเทียบ “เครื่อง pH Meter”
(Calibration Certificate of pH Meter)



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.: 23CHO529

Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenCompact
Serial No. : B535358167
ID No. : 0403-0102-16
Condition As-Received: Used Item
Received Date : 04 September 2023
Calibration Date : 05 September 2023
Reference : 2309-0046ON-9
Submitted by : Emex Association Co.,Ltd.
27,29 Soi Rama II, Soi 30, Bangmod
Jomthong, Bangkok 10150
Calibration Place : LABORATORY 7
Ambient Temperature : (25.8 - 25.3) °C
Relative Humidity : (54.7 - 53.5) %
Calibration Procedure : In - house method :
- CP-OCH2 by direct measurement with standard
voltage calibrator and direct measurement with
certified reference material (CRM)

Calibrated by : Khit Ruttanaprapachai

Approved by :

Approved Signatory

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

Issue Date : 15 September 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0058287



Cert. No.: 23CHO529

Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument : -

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Digital Thermometer	307901	70RC137	23I928	11 Aug 2024

This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials : The measurement results are traceable to SI through Merck Ltd.,
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15185-01-00

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
* pH 2.01	Merck	HC03981033	30 Sep 2023
pH 4.008	CPA chem	913598	14 Jul 2025
pH 6.986	CPA chem	863833	28 Dec 2023
pH 9.997	CPA chem	913600	14 Jul 2024

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

Calibration Results

Function : pH Measurement

Performing four buffers standard curve by using buffer nominal pH (2,4,7,10)

<u>Unit Under Calibration</u>	<u>Standard pH Buffer Solution</u>	<u>Actual pH Reading</u>	<u>Actual mV Reading (mV)</u>	<u>Uncertainty of pH measurement (±)</u>	<u>Coverage factor k</u>
pH Electrode S/N.: 2087140	*2.01	2.023	296.2	0.021	2.00
	4.008	4.014	179.6	0.0061	2.11
	6.986	6.971	6.3	0.0092	2.00
	9.997	10.029	-172.9	0.011	2.00

Remark : * = Not NSC-ONSC Accredited


21 Nov. 66
Santhip



Cert.No.: 23CHO529

Page.: 3 of 3

Calibration Results**Function : mV Measurement****Performing standard curve by Fluke at pH (2,4,7,10)**

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (\pm mV)	Coverage factor <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: B535358167	0.000	414.12	413.8	0.000	0.058	2.00
	1.000	354.96	354.7	1.000	0.058	2.00
	2.000	295.80	295.6	2.000	0.058	2.00
	3.000	236.64	236.5	3.000	0.058	2.00
	4.000	177.48	177.3	4.000	0.058	2.00
	5.000	118.32	118.2	5.000	0.058	2.00
	6.000	59.16	59.0	6.000	0.058	2.00
	7.000	0.00	-0.1	7.000	0.058	2.00
	8.000	-59.16	-59.2	8.000	0.058	2.00
	9.000	-118.32	-118.3	9.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00
	11.000	-236.64	-236.6	11.000	0.058	2.00
	12.000	-295.80	-295.8	12.000	0.058	2.00
	13.000	-354.96	-354.9	13.000	0.058	2.00
	14.000	-414.12	-414.1	14.000	0.058	2.00

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

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Signature
21-9-21
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ใบรับรองการสอบเทียบ “เครื่อง Hot Air Oven”
(Calibration Certificate of Hot Air Oven)



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.: 23TM1282

Page : 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven

Manufacturer : Memmert

Model : UFB 500

Serial No. : G509.0594

ID No. : 0407-0101-09

Submitted by : Emex Association Co.,Ltd.
27,29 Soi Rama II, Soi 30,
Bangmod, Jomthong,
Bangkok 10150

Location : ห้องปฏิบัติการ 8

Received Order : 04 September 2023

Calibration Date : 04 - 05 September 2023

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Preecha Hlahib

Approved by :

Approved Signatory

- () Pornthippa Tameyakul
() Ponpan Paipim
(✓) Suwit Imjai

Issue Date : 15 September 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0053638



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2309-0046ON-3

Cert. No.: 23TM1282

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:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY59003411	22LM165	TPA	26 Nov 2023

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

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

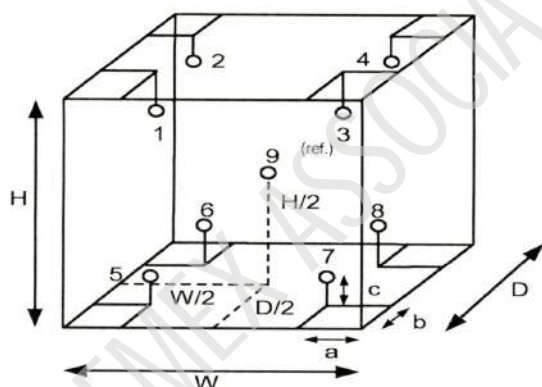
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	27
REL.Humid. (%)	35	34
AC Supply (Volt)	220	220



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

Ref. Std. ID No.: @ Calibration Point		
Position :	(104) °C	(150,180) °C
1	20RTD-2/1	18-20TC-01
2	20RTD-2/2	18-20TC-02
3	20RTD-2/3	18-20TC-03
4	20RTD-2/4	18-20TC-04
5	20RTD-2/5	18-20TC-05
6	20RTD-2/6	18-20TC-06
7	20RTD-2/7	18-20TC-07
8	20RTD-2/8	18-20TC-08
9 (ref.)	20RTD-2/9	18-20TC-09

[Signature]
21 Nov 2023
[Signature]

a 1179957



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2309-0046ON-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 23TM1282

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	0.058	0.69	1.0	2
150.0	149.5	149.5	0.10	0.90	1.4	2
180.0	179.5	179.5	0.11	1.3	2.1	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	103.520	103.686	103.580	103.530	104.348	103.676	104.466	103.692	103.791	0.43
150.0	149.838	149.790	149.261	149.306	150.466	149.832	150.574	149.441	149.737	1.1
180.0	179.990	179.924	179.151	179.267	180.877	180.183	181.105	179.565	179.858	1.1

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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21.11.2023
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a 1179955

ใบรับรองการสอบเทียบ “เครื่อง Water Bath”
(Calibration Certificate of Water Bath)



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.: 23TM717

Page : 1 of 3

Certificate of Calibration

Equipment : Water Bath

Manufacturer : M-LAB

Model : WBN 30

Serial No. : 0138

ID No. : 0408-0101-09

Submitted by : Emex Association Co.,Ltd.
27,29 Soi Rama II, Soi 30,
Bangmod, Jomthong,
Bangkok 10150

Location : LABORATORY 8

Received Order : 04 September 2023
Calibration Date : 04 September 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Khit Ruttanaprapachai

Approved by :

Approved Signatory

- () Pornthippa Tameyakul
() Ponpan Paipim
(✓) Suwit Imjai

Issue Date :

15 September 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0053640



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2309-0046ON-1

Cert. No.: 23TM717

Page : 2 of 3

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Traceable</u>	<u>Due Date</u>
1) Data Acquisition	MY49001451	23LM27	TPA	25 Feb 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.

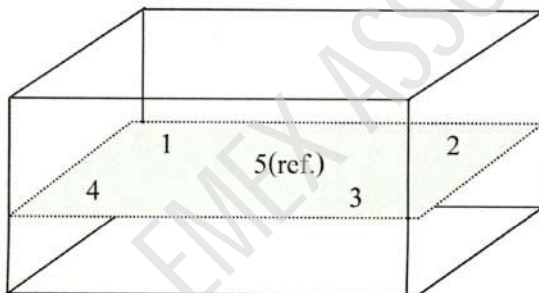
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply (Volt)
	(°C)	(%R.H.)	
Beginning of Calibration	25	47	220
Finished of Calibration	26	49	221



Front

Position :	Ref. Std. ID No.:
1	N37P301419
2	N37P300732
3	N37P301420
4	N37P301421
5(ref.)	N37P301425

[Signature]
21 Nov 16
[Signature]



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2309-0046ON-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 23TM717

Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			Position					
			1	2	3	4	5 (ref.)	
85.0	85.0	85.0	84.936	84.986	84.999	84.974	85.027	0.17

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor <i>k</i>
85.0	0.19	0.10	2

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

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

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

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

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

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21/04/11
Gauri

ใบรับรองการสอบเทียบ “เครื่อง Incubator”
(Calibration Certificate of Incubator)



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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Cert. No.: 23TM1280

Page : 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : Accuplus
Model : i250
Serial No. : i250402-0609-0265
ID No. : 0401-0101-09
Submitted by : Emex Association Co.,Ltd.
27,29 Soi Rama II, Soi 30,
Bangmod, Jomthong,
Bangkok 10150
Location : ห้องปฏิบัติการ 9
Received Order : 04 September 2023
Calibration Date : 04 September 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Preecha Hlahib

Approved by :

Approved Signatory

- () Pornthippa Tameyakul
() Ponpan Paipim
(✓) Suwit Imjai

Issue Date : 15 September 2023

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 0053636



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2309-0046ON-5

Cert. No.: 23TM1280

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).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY59003411	22LM165	TPA	26 Nov 2023

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

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

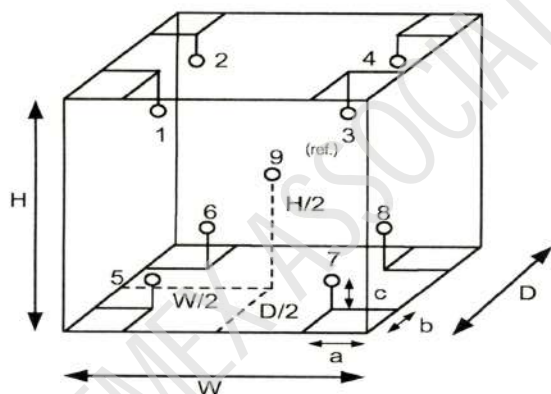
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	27
REL.Humid. (%)	44	48
AC Supply (Volt)	220	220



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

Probe Installation Details :

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

Dimension of Chamber :

D = 0.49 m
W = 0.48 m
H = 1.2 m
Capacity = 0.28 m³

Handwritten signature and date: 21 Nov 2023

a 1179951



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2309-0046ON-5
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 23TM1280

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>
20.0	19.5	19.4	0.41	0.34	0.88	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.712	19.820	19.815	19.836	19.917	19.985	19.819	19.754	19.835	0.59

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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21.11.2023
Gaurav

a 1179949