

## ภาคผนวก ง

เอกสารสอบเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์

**ANALYTICAL BALANCE (DU)**

**Model : XS205 DU**

**Serial No. : 1126323724**

Mettler-Toledo (Thailand) Ltd.  
846/4 - 846/5 Laisale Rd., Bangna Tai Sub-District  
Bangna District, Bangkok 10260  
+66 2723 0382  
MT-TH.ServicesSupport@mt.com



## Accuracy Calibration Certificate

### Customer

Company: EASTERN THAI CONSULTING 1992 CO., LTD.  
Address: 663 Moo 11, Sukhaphiban 8 Rd., Nong Kham  
City: Sriracha  
Contact: Sasiporn Nakin  
Zip / Postal: 20230  
State / Province: Chonburi  
Order Number: 4332191691

### Weighing Device

Manufacturer: Mettler Toledo  
Model: XS205DU  
Serial No.: 1126323724  
Building: Laboratory  
Floor: 1  
Room: Laboratory  
Instrument Type: Weighing Instrument  
Asset Number: LABE 05/1  
Terminal Model: SAT  
Terminal Serial No.: 1126323724  
Terminal Asset No.: N/A

### Procedure

Calibration Guideline:  
METTLER TOLEDO Work Instruction:

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.

As Found	Temperature		Humidity	
	Start: 26.9 °C	End: 26.8 °C	Start: 73.8 %	End: 71.9 %

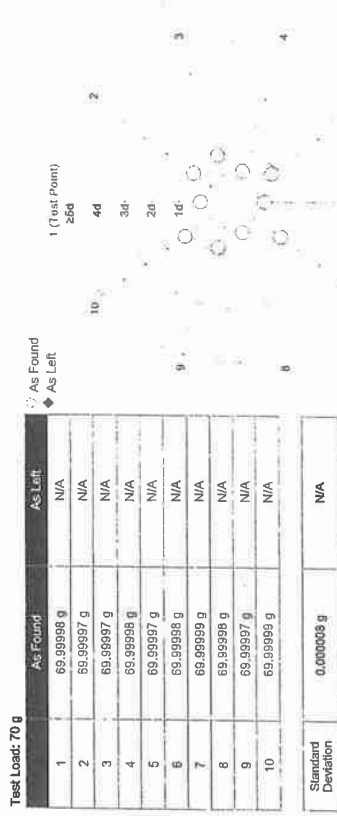
As Found Calibration Date: 22-Jul-2021  
As Left Calibration Date: N/A  
Issue Date: 23-Jul-2021

Calibrator: *Ant*  
Patipat Sweatpanuwat

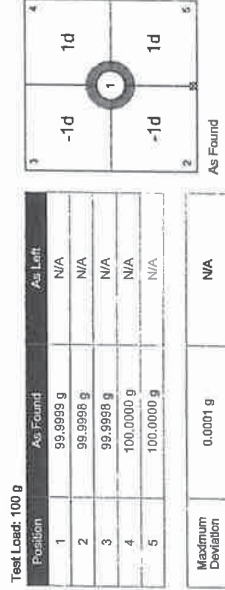
### Approved Signatory:

*Sasiporn*  
☒ Kasakorn Tassanachaisakul  
☐ Sandi Jitinyom  
☐ Surachet Sukkale

## Measurement Results Repeatability



## Eccentricity



**Remarks**

FACT adjustment functionality activated  
Equipment condition: Good  
Next calibration according to customer's procedure

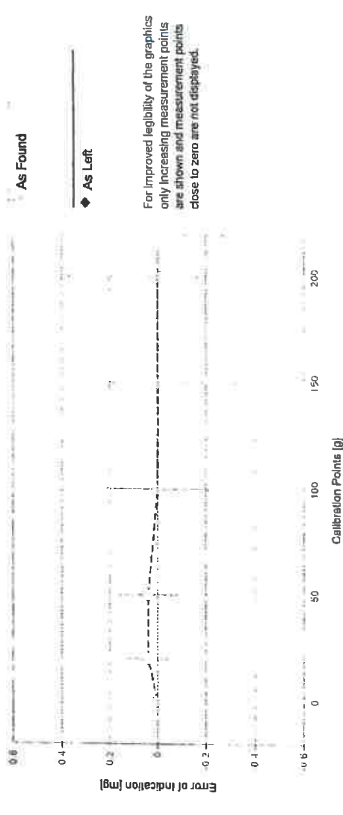
End of Accredited Section

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

**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	0.09999 g	-0.00001 g	0.023 mg	2
4	1.00000 g	1.00000 g	0.00000 g	0.032 mg	2
5	4.99999 g	5.00000 g	0.00002 g	0.048 mg	2
6	9.99999 g	10.00001 g	0.00002 g	0.061 mg	2
7	20.00001 g	20.00005 g	0.00004 g	0.082 mg	2
8*	49.99993 g	49.99997 g	0.00004 g	0.12 mg	2
9	99.9999 g	99.9999 g	0.0000 g	0.21 mg	2
10	149.9998 g	149.9998 g	0.0000 g	0.32 mg	2
11	199.9998 g	199.9998 g	0.0000 g	0.37 mg	2

\*The 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  $k = 2$  which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

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

**Test Equipment**

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

Weight Set 1: OIML E2	WS28	Date of Issue:	17-Nov-2020
Weight Set No.:	170241	Calibration Due Date:	15-May-2022
Certificate Number:			
Thermo Hygrometer	INS1	Date of Issue:	02-Mar-2021
Equipment No.:	211403	Calibration Due Date:	23-Feb-2022
Certificate Number:			





# 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.

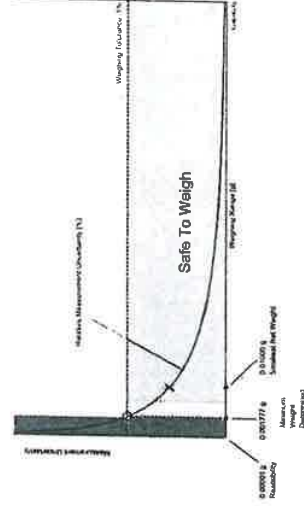
## Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 0.01000 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. The graph reflects As Left results, unless only As Found was performed.

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## 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: 5 K

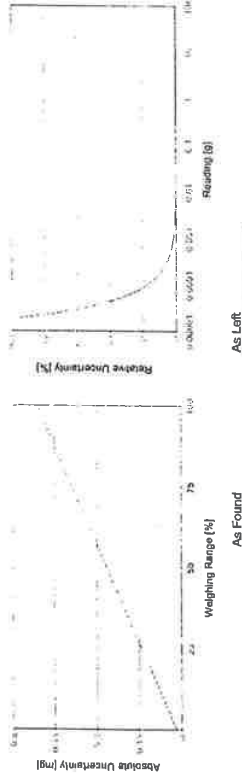
### Linearization of Uncertainty Equation

Range		As Found	As Left	
d	Max			
1	0.00001 g	81 g	$U_1 = 0.018 \text{ mg} + 0.00608 \text{ mg/g} \cdot R$	N/A
2	0.0001 g	220 g	$U_2 = 0.06 \text{ mg} + 0.00603 \text{ mg/g} \cdot R$	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 (Example)

Net Indication	As Found	As Left
0.00220 g	0.018 mg	0.82%
0.02200 g	0.018 mg	0.082%
0.22000 g	0.019 mg	0.0088%
2.20000 g	0.031 mg	0.0014%
22.00000 g	1.4 mg	0.0063%



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

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## Minimum Weight

### As Found Minimum Weight Table

Range 1					
Minimum weights for different weighing tolerances and safety factors					
Tolerance	1	2	3	5	10
0.1%	0.017873 g	0.035965 g	0.054282 g	0.091605 g	0.189140 g
0.2%	0.008909 g	0.017873 g	0.026891 g	0.045095 g	0.091605 g
0.5%	0.003557 g	0.007123 g	0.010697 g	0.017873 g	0.035965 g
1%	0.001777 g	0.003557 g	0.005339 g	0.008909 g	0.017873 g
2%	0.000888 g	0.001777 g	0.002667 g	0.004448 g	0.008909 g
5%	0.000355 g	0.000711 g	0.001066 g	0.001777 g	0.003557 g

The minimum weight table applies to the fine range of the weighing device.

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

### As Left Minimum Weight Table

Range 1					
Minimum weights for different weighing tolerances and safety factors					
Tolerance	1	2	3	5	10
0.1%	0.017873 g	0.035965 g	0.054282 g	0.091605 g	0.189140 g
0.2%	0.008909 g	0.017873 g	0.026891 g	0.045095 g	0.091605 g
0.5%	0.003557 g	0.007123 g	0.010697 g	0.017873 g	0.035965 g
1%	0.001777 g	0.003557 g	0.005339 g	0.008909 g	0.017873 g
2%	0.000888 g	0.001777 g	0.002667 g	0.004448 g	0.008909 g
5%	0.000355 g	0.000711 g	0.001066 g	0.001777 g	0.003557 g

The minimum weight table applies to the fine range of the weighing device.

✓ 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			
As Found	As Left	As Found	As Left
✓	✓	✓	✓

✓ = Passed  
✗ = Failed  
NA = Safety Factor not met

### Repeatability

Test Load: 70 g

Tolerance	Control Limit	As Found	As Left
0.1%	0.000005 g	✗	✗
0.2%	0.000010 g	✓	✓
0.5%	0.000025 g	✓	✓
1%	0.000050 g	✓	✓
2%	0.000100 g	✓	✓
5%	0.000250 g	✓	✓

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
0.1%	0.0500 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.

# METTLER TOLEDO Service

Attachment to Calibration Certificate:  
TH2046-059-072221-ACC-TH  
GWP® Certificate

## Error of Indication

As Found

Reference Value	Error	Control limits for various weighing tolerances				
		0.1%	0.2%	0.5%	1%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A
20.00001 g	0.00004 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.50000 g
49.99993 g	0.00004 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	1.25000 g
99.99999 g	0.00000 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	2.50000 g
149.99998 g	0.00000 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	3.75000 g
199.99998 g	0.00000 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	5.00000 g
Result	✓	✓	✓	✓	✓	✓

As Left

Reference Value	Error	Control limits for various weighing tolerances				
		0.1%	0.2%	0.5%	1%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A
20.00001 g	0.00004 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.50000 g
49.99993 g	0.00004 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	1.25000 g
99.99999 g	0.00000 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	2.50000 g
149.99998 g	0.00000 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	3.75000 g
199.99998 g	0.00000 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	5.00000 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.

# METTLER TOLEDO

Service Date: 2021-07-22  
Document Number: TH2046-542-072221-LABBalanceHR  
EASTERN THAI CONSULTING 1992 CO., LTD.  
893 Moo 11, Sutaphanburi 6 Rd., Nong Kham, Sriracha, Chonburi 20230  
Sasiporn Nakhn

## Balance Health Report

Device Details	
Manufacturer:	Mettler Toledo
Model:	XS205SD
Serial number:	11726323724
Firmware:	4.00 / 5.61
System Details	
Accessory 1:	
Accessory 2:	
Weight set for routine testing:	Yes /
History	
Device History	
Instrument in use:	Yes
Instrument age:	> 10 years
Spares parts available:	Yes
Regulations:	ISO
Process tolerance in %:	1%
Smallest sample net weight:	0.01000 g
Service History	
Last preventive maintenance:	< 1 year
Last instrument calibration:	< 1 year
Last minimum weight determination:	Never
Routine testing performed:	Yes
Check List	
Environmental Conditions	
Room temperature fluctuation	✓
Exposure to direct sun	✓
Vibrations	✓
Draft	✓
Dirt or dust	✓
Static	✓
Mechanical Component Checks	
Draft shield	✓
Weighting pan position	✓
Housing	✓
Other - objections noted as additional remarks	—
General & Functional Checks	
Leveling	✓
Cleanliness	✓
Completeness - missing parts see additional remarks	✓
Settings optimized for operating environment	✓
Other - objections noted as additional remarks	—
Electrical Component Checks	
Power supply	✓
Sliding door drive	—
Internal weight drive	✓
Display	✓
Other - objections noted as additional remarks	—
Recommendations	
Mechanical / Recent Quality	
Instrument calibration	Uninstall instrument
Identify safe weighing range	Replace instrument
GWP verification / risk assessment	Yes
Preventive maintenance	Replace / add parts (see additional remarks)
Perform routine testing with test weights	Orbital repair
User training	Draft / repair
Use of accessories (see additional remarks)	
Contact Name:	Sasiporn Nakhn
Position:	
Phone:	0960513303
Email:	de.ja@ec1992.com
Additional Remarks & Recommendations	
Engineer Details	
Date:	22-Jul-2021
Name:	Palipat Sweatpanuwat
Signature:	

This is not a certificate.

It should not be used to interpret final results for the testing of these devices.

Legend: ✓ Good/Pass    ⚠ Needs Attention    ✗ Bad/Fail    — Not Applicable

## METTLER TOLEDO Service

Report Version: 1.13-Subsidiary Version 2.03, Page 1/1, © METTLER TOLEDO

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Software Version: 1.23.01.28  
Report Version: 2.16.2  
Form Number: F100C

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**ANALYTICAL BALANCE**

**Model : SECURA224-1S**

**Serial No. : 0036707137**





ASIA MEDICAL AND AGRICULTURAL LABORATORY  
AND RESEARCH CENTER CO., LTD.

361,351/1-4 Soi Ladprao 122, (Mahadul 1), Ladprao Road, Phatphala,  
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http://www.amarc.co.th Email: d@amarc.co.th



NSC-TIS-15 17025  
CALIBRATION 0152

Certificate No. : 21-013243  
Sample code : 21-05951-007  
Page 1 of 4

### CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapiban 8 Rd., Nongkham,  
Sriracha, Chonburi 20230  
Location of calibration : EASTERN THAI CONSULTING 1992 CO., LTD.  
(Analytical Balance Room)

Equipment : ELECTRONIC BALANCE

Manufacturer : SARTORIUS

Model : SECURA224-1S

Serial No. : 0036707137

ID No. : LABE 05/2

Date of Receipt : 09 February 2021

Date of Calibration : 09 February 2021

Calibrated by : Mr. Pattarakom Panklong  
Scientist  
Approved by : ( Mr. Somchai Neampunt )  
Signed for Director

Date of Issue : 18 February 2021

The uncertainties are for a confidence probability of approximately 95%.

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Co., Ltd. (AMARC)



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http://www.amarc.co.th Email: d@amarc.co.th



NSC-TIS-15 17025  
CALIBRATION 0152

Certificate No. : 21-013243  
Sample code : 21-05951-007  
Page 2 of 4

### REPORT OF CALIBRATION

Equipment : ELECTRONIC BALANCE  
Manufacturer : SARTORIUS  
Model : SECURA224-1S  
Capacity : Max 220 g  
Resolution : 0.0001 g  
Serial No. : 0036707137  
ID No. : LABE 05/2

#### Result of Calibration :

##### 1. Test weight and repeatability of reading

Repeatability is a measure of the ability of a balance to supply the same result in repetitive weighings with one and the same load under the same measurement condition. The measurement of the repeatability must include both the balance specifications and the ambient (vibration, fluctuating air current/temperature/humidity, etc.) Operator handling of the balance is also included in the standard deviation.

Unit : g  
☒ No adjustment  
☐ Adjustment

☐ Before adjustment  
☐ After adjustment

Range : 220

Nominal value

100 200

Standard weight

99.999959 199.999922

Average reading of indicator

99.9998 199.9998

Standard deviation

0.00005 0.00005

Unit : -

☐ Before adjustment  
☐ After adjustment

Range : -

Nominal value

- -

Standard weight

- -

Average reading of indicator

- -

Standard deviation

- -

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NSC-TISI-TIS 17025  
CALIBRATION 0152

Certificate No. : 21-013243

Sample code : 21-05951-007

Page 3 of 4

## REPORT OF CALIBRATION

### Result of Calibration :

#### 2. Sensitivity or value of a scale division

Change in the output variable of a measuring instrument divided by the associated change in the input variable.

Unit : g

Range : 220

Test Point	Sensitivity, S	Test Point	Sensitivity, S
0	1.00	-	-
100	1.00	-	-
200	1.00	-	-

#### 3. Departure of indication from nominal value, Linearity

Unit : g

Nominal Value	Standard Value	Average Reading	Correction Value	Expanded Uncertainty	Coverage Factor (k)
Unload*	0.0000000	0.0000	0.0000	0.000094	2.01
0.01	0.0100020	0.0100	0.0000	0.000094	2.01
0.1	0.0999987	0.1000	0.0000	0.000094	2.01
1	1.0000133	1.0000	0.0000	0.000095	2.01
2	2.0000023	2.0000	0.0000	0.000095	2.01
5	4.9999988	5.0000	0.0000	0.000096	2.01
10	10.000007	10.0000	0.0000	0.000097	2.01
20	19.999989	20.0000	0.0000	0.00010	2.01
50	49.999972	50.0000	0.0000	0.00012	2.01
100	99.999959	99.9999	0.0001	0.00016	2.00
200	199.999922	199.9998	0.0001	0.00028	2.00

The result expanded uncertainty of measurement  $U$  is stated as the standard uncertainty multiplied by the coverage factor  $k$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

Remarks

\* = Calibrations marked "Not Accredited" in this Certificate have been included for completeness.

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Signature



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AND RESEARCH CENTER CO., LTD.



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NSC-TISI-TIS 17025  
CALIBRATION 0152

Certificate No. : 21-013243

Sample code : 21-05951-007

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## REPORT OF CALIBRATION

### Result of Calibration :

#### 4. Eccentric or off-centre loading

Deviation of the measurement value through off - center (eccentric) loading. The corner load increases with the weight of the load and its removal from the center of the pan support.

Weighing pan	Test weight : 100
<input checked="" type="radio"/> Circle	Unit : g
<input type="radio"/> Triangular	
<input type="radio"/> Rectangular	
Range	220
Position	Reading of indicator
1	99.9998
2	99.9999
3	99.9998
4	99.9997
5	99.9998
6	99.9998
Maximum difference	0.0001

### Condition of Calibration

1. Calibration Method : WI-CL-004 base on UKAS LAB 14 : 2019
2. This result of calibration was found accurate as shown on date and place of calibration only.
3. Reference standard instrument :

Instrument

1) STANDARD WEIGHT 1 mg to 1 kg E2 LB-WE-4(i)

Certificate No.

20-116015

Due date

28 December 2021

4. This certification is traceable to the International System of Unit maintained at :-

- Through the reference standard laboratory of Asia Medical and Agricultural Laboratory and Research Center Co., Ltd.  
( Instrument number 1 )

5. Condition of Calibration item : Normal

End of Report

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**ANALYTICAL BALANCE**

**Model : SECURA224-1S**

**Serial No. : 0036707137**

NSC-TS1-TS17025  
CALIBRATION 0152

Page 1 of 4

Certificate No. : 22-011768

Sample Code : 22-04498-005

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapiban 8 Rd., Nongkham,

Siracha, Chonburi 20230

Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.

(Analytical Balance Room)

Equipment : ELECTRONIC BALANCE

Manufacturer : SARTORIUS

Model : SECURA224-IS

Serial No. : 0036707137

ID No. : LABE 05/2

Date of Receipt : 03 February 2022

Date of Calibration : 03 February 2022

Calibrated by : Mr. Thanadol Pholthep

Scientist

Approved by

(Mr. Somchai Neampunt)

Signed for Director

Issue date : 07 February 2022

The uncertainties are for a confidence probability of approximately 95%.

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

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Rev.05

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Effective Date: 15/10/21

NSC-TS1-TS17025  
CALIBRATION 0152

Page 2 of 4

Certificate No. : 22-011768

Sample Code : 22-04498-005

## REPORT OF CALIBRATION

Equipment : ELECTRONIC BALANCE

Manufacturer : SARTORIUS

Model : SECURA224-IS

Capacity : Max 220 g

Resolution : 0.0001 g

Serial No. : 0036707137

ID No. : LABE 05/2

### Result of Calibration

#### 1. Test weight and repeatability of reading

Repeatability is a measure of the ability of a balance to supply the same result in repetitive weighings with one and the same load under the same measurement condition. The measurement of the repeatability must include both the balance specifications and the ambient (vibration, fluctuating air current/temperature/humidity, etc.) Operator handling of the balance is also included in the standard deviation.

Unit : g	Range : 220	<input checked="" type="checkbox"/> Before adjustment	<input checked="" type="checkbox"/> After adjustment
<input type="checkbox"/> No adjustment	Nominal value	100	100
<input checked="" type="checkbox"/> Adjustment	Standard weight	100.000022	200.000141
	Average reading of indicator	99.9998	199.9998
	Standard deviation	0.00009	0.00005
			0.00004

Unit : -	Range : -	<input type="checkbox"/> Before adjustment	<input type="checkbox"/> After adjustment
<input type="checkbox"/> No adjustment	Nominal value	-	-
<input type="checkbox"/> Adjustment	Standard weight	-	-
	Average reading of indicator	-	-
	Standard deviation	-	-

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FM-CL-064

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CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH

Effective Date: 15/10/21





Certificate No. : 22-011768  
Sample Code : 22-04498-005

Page 3 of 4

## REPORT OF CALIBRATION

### Result of Calibration

2. Sensitivity or value of a scale division

Change in the output variable of a measuring instrument divided by the associated change in the input variable.

Unit : g

Test Point	Sensitivity, S	Test Point	Sensitivity, S
0	0.7981	-	-
100	0.9976	-	-
200	0.9976	-	-

3. Departure of indication from nominal value, Linearity

Unit : g

Nominal Value	Standard Value	Average Reading of Indicator	Correction Value	Expanded Uncertainty	Coverage Factor (k)
Unload	0.0000000	0.0000	0.0000	0.000094	2.01
0.01	0.0100045	0.0100	0.0000	0.000094	2.01
0.1	0.1000102	0.1000	0.0000	0.000094	2.01
1	1.0000055	1.0000	0.0000	0.000095	2.01
2	2.0000144	1.9999	0.0001	0.000095	2.01
5	5.0000060	5.0000	0.0000	0.000096	2.01
10	10.000017	9.9999	0.0001	0.000097	2.01
20	20.000022	20.0000	0.0000	0.00010	2.01
50	50.000038	50.0000	0.0000	0.00012	2.01
100	100.000022	99.9999	0.0001	0.00016	2.00
200	200.0000141	200.0000	0.0001	0.00027	2.00

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003.



Certificate No. : 22-011768  
Sample Code : 22-04498-005

Page 4 of 4

## REPORT OF CALIBRATION

### Result of Calibration:

4. Eccentric or off-centre loading

Deviation of the measurement value through off - center (eccentric) loading. The corner load increases with the weight of the load and its removal from the center of the pan support.

Weighing pan	Circle	Test weight	Unit : g
<input checked="" type="radio"/> Circle	<input type="radio"/> Triangular	220	
<input type="radio"/> Rectangular			
Range	Position	Reading of indicator	Reading of indicator
1	99.9999	-	-
2	100.0000	-	-
3	99.9999	-	-
4	99.9997	-	-
5	100.0000	-	-
6	99.9999	-	-
Maximum difference	0.0002		

### Condition of Calibration

- Calibration Method : WI-CL-004 base on UKAS LAB 14: 2019
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibration item: Normal
- This certification is traceable to the International System of Unit maintained at : -  
Through the reference standard laboratory of Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (Instrument number 1).
- Reference standard instrument :

Ambient conditions	Min	Max
Temperature (°C)	24.9	26.7
Relative Humidity (%RH)	40.3	55.6
Air pressure (hPa)	1009.3	1010.7

Instrument : STANDARD WEIGHT 1 mg to 1 kg  
Class : E2  
ID No. : LB-WE-57

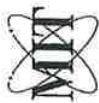
Certificate No. : 21-055/61  
Dua Date : 29 June 2022

- End of Report -

## **BAROMETER**

**Equipment : Analog Barometer**

**ID No. / Tag No. : BM001/41**



MIRACLE INTERNATIONAL TECHNOLOGY CO., LTD.  
214 Bangwaek Rd. Bangpai Bangkok 10160  
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 <http://www.miti.in.th>



## CALIBRATION CERTIFICATE

Certificate No. : AD2106-032-0001

Date Issued : 04-Jun-21

**Customer** : Eastern Thai Consulting 1992 Co., Ltd.  
683 Moo 11 Sukhapibam 8 Rd., Nongkham, Sriracha, Chonburi 20230

**Equipment** : Analog Barometer

**Manufacturer** : Barigo

**Model** : -

**Serial No.** : -

**ID No./Tag No.** : BM001/41

**Date Received** : 02-Jun-21

**Date Calibrated** : 04-Jun-21

**Calibrated by** : Mr. Somjet Onbua

**Calibration Method or Calibration Procedure Used**

In-house method : CP-21 base on DKD-R 6-1: Edition 3 2014.

This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

### Result of Calibration

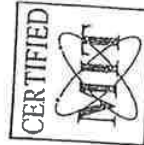
The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level confidence approximately 95 percent.

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Approved by :

(Mr. Tassanai Suksukon )  
Technical Manager

Page 1 of 2



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Certificate No. : AD2106-032-0001

Environment : Ambient Temperature : (25 ± 2)°C

Relative Humidity : (50 ± 15)%RH

STD Reading hPa	UUC Reading (hPa) Before Adjusted	UUC Reading (hPa) After Adjusted	UUC Error hPa	Uncertainty ± hPa
990.00	990.0	*	0.00	0.91
1000.00	1000.0	*	0.00	0.91
1010.00	1010.0	*	0.00	0.91
1020.00	1020.0	*	0.00	0.91
1030.00	1030.0	*	0.00	0.91

STD = Standard

UUC = Unit Under Calibration

Calibrated condition :

Pressure Medium

Mounting Position

Reference Level

Air : Density = 1.19 kg/m<sup>3</sup> @ 20°C, 1 bar

Vertical

at center of its dial

Description of UUC :

Range

955 - 1075 hPa Absolute

Calibration Range

990 - 1030 hPa Absolute

Scale Interval

1 hPa

Resolution

0.5 hPa Absolute

Measurement Standards Used & Traceability :

The International System of Units (SI) through

IRPC Certificate No. CL1-P210029 for Digital Barometer Serial No. 290185, Due 19-Oct-21

End of Certificate

Page 2 of 2

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## **BAROMETER**

**Equipment : Analog Barometer**

**ID No. / Tag No. : BM001/41**



## CALIBRATION CERTIFICATE

Certificate No. : AD2205-163-0001  
 Date Issued : 20-May-22

**Customer** : Eastern Thai Consulting 1992 Co., Ltd.  
 683 Moo 11 Sukhapibam 8 Rd., Nongkham, Sriracha, Chonburi 20230

**Equipment** : Analog Barometer

**Manufacturer** : Barigo  
**Model** : -  
**Serial No.** : -  
**ID No./Tag No.** : BM001/41  
**Date Received** : 12-May-22  
**Date Calibrated** : 20-May-22  
**Calibrated by** : Mr. Suth Srichutikul

### Calibration Method or Calibration Procedure Used

In-house method : CP-21 base on DKD-R 6-1: Edition 3 2014.

This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

### Result of Calibration

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

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Approved by: K. Nonthong  
 (Mr. Nathapong Krudaum)

Page 1 of 2

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Certificate No : AD2205-163-0001

Environment Ambient Temperature : (25 ± 2)°C

Relative Humidity : (50 ± 15)%RH

STD Reading hPa	UUC Reading (hPa) Before Adjusted	UUC Reading (hPa) After Adjusted	UUC Error hPa	Uncertainty ± hPa
990.00	990.0	-	0.00	0.59
1000.00	1000.0	-	0.00	0.59
1010.00	1010.0	-	0.00	0.59
1020.00	1020.0	-	0.00	0.59
1030.00	1030.0	-	0.00	0.59

STD = Standard

UUC = Unit Under Calibration

Calibrated condition :

Pressure Medium Air : Density = 1.19 kg/m<sup>3</sup> @ 20°C, 1 bar  
 Mounting Position Vertical  
 Reference Level at center of its dial

Description of UUC :

Range 955 - 1075 hPa Absolute  
 Calibration Range 990 - 1030 hPa Absolute  
 Scale Interval 1 hPa  
 Resolution 0.5 hPa Absolute

Condition As-Received : Used Item

The measurement results and statements of conformity with specification only relate to the item calibrated.

Measurement Standards Used & Traceability :

The International System of Units (SI) through

IRPC Certificate No. CL1-P210086 for Reference Pressure Monitor Serial No. 1598, Due 08-Nov-22

End of Certificate

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Page 2 of 2

**BOD INCUBATOR**

**ID No. : LABE 19/1**





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NSC-TS1-TIS 17025  
CALIBRATION 0152

Certificate No. : 21-013237

Sample code : 21-05951-001

Page 1 of 4

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapiban 8 Rd., Nongkham,  
Sriracha, Chonburi 20230

Location of calibration : EASTERN THAI CONSULTING 1992 CO., LTD.  
(Laboratory)

Equipment : Temperature controlled enclosures  
(Incubator)

Manufacturer : N/A

Model : E811.0306

Serial No. : N/A

ID No. : LABE 19/1

Date of receipt : 09 February 2021

Date of calibration : 09 February 2021

Calibrated by : Mr. Pattarakorn Panklong  
Scientist

Approved by : ( Mr. Somchai Neampunt )

Signed for Director

Date of issue : 22 February 2021

The uncertainties are for a confidence probability of approximately 95%

This Calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.  
This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has  
assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement  
realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written  
approval of the Asia Medical and Agricultural Laboratory and Research Center Co., Ltd. (AMARC)



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NSC-TS1-TIS 17025  
CALIBRATION 0152

Certificate No. : 21-013237

Sample code : 21-05951-001

Page 2 of 4

## REPORT OF CALIBRATION

Equipment : Temperature controlled enclosures (Incubator)  
Manufacturer : N/A Model : E811.0306  
Serial No. : N/A ID No. : LABE 19/1  
Resolution : 0.1 °C

### Condition of calibration

#### 1 Environment

1.1 Ambient temperature : Maximum 31.8 °C ; Minimum 30.3 °C  
1.2 Relative humidity : Maximum 56.6 % ; Minimum 49.9 %  
1.3 Line voltage supplied : Maximum 225.6 VAC ; Minimum 224.5 VAC

#### 2 Calibration method

- TLAS-G-20 : Guidelines for calibration and checks of temperature controlled enclosures

#### 3 Reference standard instrument

Instrument	Model	ID No.	Certificate No.	Due date
Data Acquisition With Sensor (RTD-P100)	34872A	LB-DA-11 (RTD-136, RTD- 139, RTD-225, RTD-141, RTD-226, RTD-143, RTD- 144, RTD-145, RTD-146)	20-041962	11 May 2021

4 This certificate is traceable to the International system of unit (SI Unit)

- The measurement is traceable to Thailand Institute of Scientific and Technological Research through Asia  
Medical and Agricultural Laboratory and Research Center Co., Ltd.

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

6 Condition of calibration item : Normal

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NSC-TIS-17025  
CALIBRATION 0152

Certificate No. : 21-013237

Sample code : 21-05951-001

Page 3 of 4

## REPORT OF CALIBRATION

Equipment : Temperature controlled enclosures (incubator)  
Manufacturer : N/A Model : E811.0306  
Serial No. : N/A ID No. : LABE 19/1  
Resolution : 0.1 °C

### Results of calibration

#### 1. Reporting of temperature

Calibration point (°C)	Controller Temp.(°C)	Indicating Temp.(°C)	Measured temperature (°C) at spread locations								Uncertainty ± (°C)	Coverage factor k
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
20	20.0	20.0	20.41	19.92	19.48	19.94	20.18	20.40	20.47	20.47	20.19	2.00

#### 2. Characterization result

Calibration point (°C)	Controller temperature (°C)	Indicating temperature (°C)	Temperature stability (°C)	Temperature uniformity (°C)	Overall variation (°C)
20	20.0	20.0	0.11	0.75	1.22

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NSC-TIS-17025  
CALIBRATION 0152

Certificate No. : 21-013237

Sample code : 21-05951-001

Page 4 of 4

## REPORT OF CALIBRATION

### Results of calibration

#### Note

#### 1 Sensor installation locations

- 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.

- 1.2 The reference sensor is preferably located of the geometric center of the chamber.

#### 2 Interior dimensions approx of chamber

W = 60 cm ; D = 70 cm ; H = 124 cm

- 3 Air valve or fresh air level ; N/A

- 4 Fan level ; Open

- 5 The quoted uncertainty exclude \* Overall variation \*

- 6 The quoted uncertainty include \* Stability of chamber and loading effect in chamber at 20% of uniformity \*

- 7 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.

- 8 Temperature stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.

- 9 Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation

- 10 Measured temperature - the average reading of standards at any positions or locations.

- 11 Indicating temperature - the average reading of indicating device that forms the integral part of the enclosure.

- 12 Calibration results without adjustment.

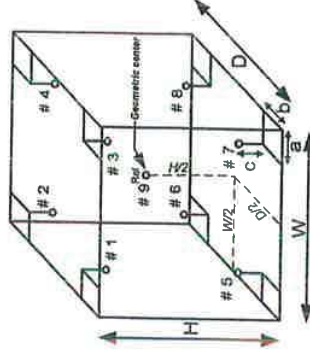


Figure :Example of sensor  
installation locations

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with U<AS M3003

End of report

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**BOD INCUBATOR**

**ID No. : LABE 19/2**



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NSC-TS1-TS 17025  
CALIBRATION 0152

Certificate No. : 21-013238

Sample code : 21-05951-002

Page 1 of 4

## CERTIFICATE OF CALIBRATION

**Customer** : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapiban 8 Rd., Nongkham,  
Sriracha, Chonburi 20230

**Location of calibration** : EASTERN THAI CONSULTING 1992 CO., LTD.  
(Laboratory)

**Equipment** : Temperature controlled enclosures  
(Incubator)

**Manufacturer** : N/A

**Model** : N/A

**Serial No.** : S540040277

**ID No.** : LABE 19/2

**Date of receipt** : 09 February 2021

**Date of calibration** : 09 February 2021

**Calibrated by** Mr. Pattarakorn Panklong  
**Scientist**

**Approved by** ( Mr. Somchai Neampunt )  
**Signed for Director**

**Date of issue** : 22 February 2021

The uncertainties are for a confidence probability of approximately 95%.

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Rev.04

Effective Date: 09/11/15



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NSC-TS1-TS 17025  
CALIBRATION 0152

Certificate No. : 21-013238

Sample code : 21-05951-002

Page 2 of 4

## REPORT OF CALIBRATION

**Equipment** : Temperature controlled enclosures (Incubator)

**Manufacturer** : N/A

**Model** : N/A

**Serial No.** : S540040277

**ID No.** : LABE 19/2

**Resolution** : 0.1 °C

### Condition of calibration

#### 1 Environment

1.1 Ambient temperature : Maximum 31.8 °C ; Minimum 30.3 °C

1.2 Relative humidity : Maximum 56.6 % ; Minimum 49.9 %

1.3 Line voltage supplied : Maximum 225.6 VAC ; Minimum 224.5 VAC

#### 2 Calibration method

- TLAS-G-20 : Guidelines for calibration and checks of temperature controlled enclosures

#### 3 Reference standard instrument

Instrument	Model	ID No.	Certificate No.	Due date
- Data Acquisition With Sensor (RTD-PH00)	34972A	LA-DA-11 (RTD-148, RTD-149, RTD-150, RTD-151, RTD-152, RTD-153, RTD-154, RTD-155, RTD-227)	20-041982	11 May 2021

4 This certificate is traceable to the International system of unit (SI Unit)

- The measurement is traceable to Thailand Institute of Scientific and Technological Research through Asia Medical and Agricultural Laboratory and Research Center Co., Ltd.

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

6 Condition of calibration item : Normal

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FM-CL-018

Rev.07

Effective Date: 09/11/15



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http://www.amarc.co.th Email:cl@amarc.co.th



NSC-TIS-TIS 17025  
CALIBRATION 0152

Certificate No. : 21-013238  
Sample code : 21-05951-002

Page 3 of 4

## REPORT OF CALIBRATION

Equipment : Temperature controlled enclosures (Incubator)  
Manufacturer : N/A Model : N/A  
Serial No. : S540040277 ID No. : LABE 19/2  
Resolution : 0.1 °C

### Results of calibration

#### 1. Reporting of temperature

Calibration point (°C)	Controller Temp.(°C)	Indicating Temp.(°C)	Measured temperature (°C) at spread locations									Uncertainty ± (°C)	Coverage factor k
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 <sup>Rev</sup>		
20	20.0	20.0	19.71	19.44	19.72	19.40	20.19	20.20	20.06	20.42	19.70	0.28	2.00

#### 2. Characterization result

Calibration point (°C)	Controller temperature (°C)	Indicating temperature (°C)	Temperature stability (°C)	Temperature uniformity (°C)	Overall variation (°C)
20	20.0	20.0	0.09	0.83	1.16

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NSC-TIS-TIS 17025  
CALIBRATION 0152

Certificate No. : 21-013238  
Sample code : 21-05951-002

Page 4 of 4

## REPORT OF CALIBRATION

### Results of calibration

#### Note

##### 1. Sensor installation locations

- 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
- 1.2 The reference sensor is preferably located of the geometric center of the chamber.
- 2 Interior dimensions approx of chamber  
W = 60 cm ; D = 70 cm ; H = 124 cm
- 3 Air valve or fresh air level ; Off
- 4 Fan level ; Open

##### 5 The quoted uncertainty excludes " Overall variation ".

##### 6 The quoted uncertainty include " Stability of chamber and loading effect in chamber at 20% of uniformity ".

##### 7 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.

##### 8 Temperature stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.

##### 9 Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation

##### 10 Measured temperature - the average reading of standards at any positions or locations.

##### 11 Indicating temperature - the average reading of indicating device that forms the integral part of the enclosure.

##### 12 Calibration results without adjustment.

The result expanded uncertainty of measurement U is stated as the standard uncertainty multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

End of report

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**BOD INCUBATOR**

**ID No. : LABE 19/1**



## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhaphan 8 Rd., Nongkham,  
Sriacha, Chonburi 20230

Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.  
(Laboratory)

Equipment : Temperature controlled enclosures (Incubator)  
Manufacturer : N/A  
Model : N/A  
Serial No. : SS40040277  
ID No. : LABE 19/2  
Date of Receipt : 24 January 2022  
Date of Calibration : 24 January 2022

## Condition of Calibration

1. Environment : 1.1 Ambient temperature : Maximum 30.4 °C ; Minimum 30.0 °C  
1.2 Relative humidity : Maximum 51.2 % ; Minimum 46.2 %  
1.3 Line voltage supplied : Maximum 225.3 VAC ; Minimum 224.1 VAC

## 2. Calibration method

TLAS-G-20: Guidelines for calibration and checks of temperature controlled enclosures.

## 3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data acquisition with sensor (RTD-PT100)	LB-DA-12 (RTD-158 to RTD-166)	21-038920	10 May 2022

## 4. This certificate is traceable to the international system of unit (SI Unit).

The measurement is traceable to Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.

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

6. Condition of calibration item : Normal

Calibrated by : Mr. Pattarakorn Panklong

Issue date : 28 January 2022  
Scientist

Signed for Director  
(Mr. Somchai Neampunt)

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The uncertainties are for a confidence probability of approximately 95%.

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

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Effective Date: 15/10/21

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FAX 02-516-6949  
Rev.01



## REPORT OF CALIBRATION

Certificate No. : 22-007487  
Page 2 of 3  
Sample Code : 22-02978-006

## Results of Calibration

Resolution : 0.1 °C

## 1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C) reading (°C)	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor k
		#1	#2	#3	#4	#5	#6	#7	#8	# g <sub>ref</sub>	
20	20.0	19.61	19.35	19.81	19.37	20.15	20.34	20.14	20.45	19.61	2.00

## 2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
20	0.08	0.94	1.22

## Notes

- UUC\* = Unit Under Calibration

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361 Soi Ladprao 22, Ladprao Road,  
Phlabphla, Wang Thonglang, Bangkok 10310  
Rev.09  
CONTACT@AMARC.CO.TH  
WWW.AMARC.CO.TH  
Effective Date: 15/10/21



NSC-TS1-TS17025  
CALIBRATION 0152

Page 3 of 3

## REPORT OF CALIBRATION

Certificate No. : 22-007487

Sample Code : 22-02978-006

### Results of Calibration

#### Notes

1. Sensor installation locations
  - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
  - 1.2 The reference sensor is preferably located of the geometric center of the chamber.
2. Interior dimensions approx of chamber :  
 $W = 60 \text{ cm}$  ;  $D = 70 \text{ cm}$  ;  $H = 124 \text{ cm}$
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes "Stability of chamber and loading effect in chamber at 20% of uniformity".

6. 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.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC\* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

The result expanded uncertainty of measurement  $U$  is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003.

- End of Report -

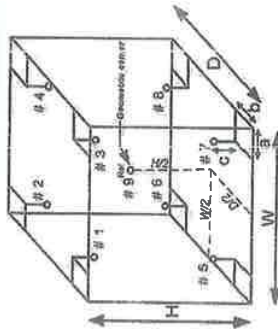


Figure: Example of sensor

Installation Positions

**COPY**

**BOD INCUBATOR**

**ID No. : LABE 19/2**





## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhaphiban 8 Rd., Nongkham,  
Sriacha, Chonburi 20230

Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.  
(Laboratory)

Equipment : Temperature controlled enclosures (incubator)  
Manufacturer : N/A  
Model : N/A  
Serial No. : SS40040277  
ID No. : LABE 19/2  
Date of Receipt : 24 January 2022  
Date of Calibration : 24 January 2022

## Condition of Calibration

1. Environment : 1.1 Ambient temperature : Maximum 30.4 °C ; Minimum 30.0 °C  
1.2 Relative humidity : Maximum 51.2 % ; Minimum 46.2 %  
1.3 Line voltage supplied : Maximum 225.3 VAC ; Minimum 224.1 VAC

## 2. Calibration method

TLAS-G-20: Guidelines for calibration and checks of temperature controlled enclosures.

## 3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data acquisition with sensor (RTD-P100)	LB-DA-12 (RTD-158 to RTD-166)	21-038920	10 May 2022

## 4. This certificate is traceable to the international system of unit (SI Unit).

The measurement is traceable to Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.

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

## 6. Condition of calibration item : Normal

Calibrated by

Mr. Pattarakom Panklong

Approved by

(Mr. Somchai Neampunt)

Issue date

28 January 2022

The uncertainties are for a confidence probability of approximately 95%.  
The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

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WWW.AMARC.CO.TH

Rev.01

Effective Date: 15/10/21



## REPORT OF CALIBRATION

Certificate No. : 22-007487

Sample Code : 22-02978-006

## Results of Calibration

Resolution : 0.1 °C

## 1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C) reading (°C)	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor k
		#1	#2	#3	#4	#5	#6	#7	#8		
20	20.0	19.61	19.35	19.81	19.37	20.15	20.34	20.14	20.45	19.61	2.00

## 2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
20	0.08	0.94	1.22

## Notes

UUC\* = Unit Under Calibration

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## REPORT OF CALIBRATION

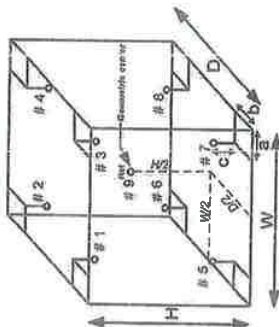
Certificate No. : 22-007487

Sample Code : 22-02978-006

## Results of Calibration

## Notes

1. Sensor installation locations
  - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
  - 1.2 The reference sensor is preferably located of the geometric center of the chamber.
2. Interior dimensions approx of chamber :  
W = 60 cm; D = 70 cm; H = 124 cm
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes "Stability of chamber and loading effect in chamber at 20% of uniformity".
6. 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.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC\* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

Figure: Example of sensor  
Installation Positions

The result expanded uncertainty of measurement  $U$  is stated at the standard uncertainty multiplied by the coverage factor  $k$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003.

- End of Report -

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**CERTIFICATE OF ANALYSIS**

**EPA PROTOCOL GAS**

**Cylinder No. : EB0145030**



Airgas Specialty Gases  
Airgas USA, LLC  
6141 Easton Road  
Bldg 2  
Plumsteadville, PA 18949  
Airgas.com

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E03N199E15AC0U4  
Cylinder Number: EB0145030  
Laboratory: 124 - Plumsteadville - PA  
PGVP Number: A12021  
Gas Code: CH4,PPN,BALN  
Reference Number: 160-402242242-1  
Cylinder Volume: 144.4 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 350  
Certification Date: Oct 15, 2021  
Expiration Date: Oct 15, 2029

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 000R-12-001, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a molar/mole basis unless otherwise noted.

Do Not Use This Cylinder Below 100 psig at 67 megapascals.

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
METHANE	180.0 PPM	177.0 PPM	G1	+/- 1.0% NIST Traceable
PROPANE	185.0 PPM	187.0 PPM	G1	+/- 1.0% NIST Traceable
NITROGEN	Balance			
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	08011503	K002564	246.7 PPM METHANE/AIR	+/- 0.6%
NTRM	200602-06	6162660Y	243.3 PPM PROPANE/AIR	+/- 0.5%
ANALYTICAL EQUIPMENT				
Instrument/Make/Model			Last Multipoint Calibration	
Nicolet ISSO FTIR AUP2110295 CH4			FTIR	Oct 13, 2021
Nicolet ISSO FTIR AUP2110295 C3H8			FTIR	Oct 14, 2021

#### Triad Data Available Upon Request

NOTES:  
Gross Weight: 28.0 Kg  
Net Weight: 4.9 Kg  
PO# 5221004861



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*Mahmud A. Nader*  
Approved for Release

**CERTIFICATE OF ANALYSIS**

**EPA PROTOCOL GAS**

**Cylinder No. : EB0062815**

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E04N199E15ACX9C  
Cylinder Number: EB0062815  
Laboratory: 124 - Riverton (SAP) - NJ  
PGVP Number: B52018  
Gas Code: CO,NO,NOX,SO2,BALN

Reference Number: 82-401135335-1  
Cylinder Volume: 144.4 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 680  
Certification Date: Mar 13, 2018  
Expiration Date: Mar 13, 2026

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)\* document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

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

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
NOX	50.00 PPM	50.55 PPM	G1	+/- 1.4% NIST Traceable
NITRIC OXIDE	50.00 PPM	50.50 PPM	G1	+/- 1.4% NIST Traceable
SULFUR DIOXIDE	50.00 PPM	51.01 PPM	G1	+/- 1.0% NIST Traceable
CARBON MONOXIDE	2000 PPM	1977 PPM	G1	+/- 1.0% NIST Traceable
NITROGEN	Balance			
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NITRM	18060607	CC442564	50.42 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%
PRM	12367	APEX1099237	9.82 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%
GMS	0315201604	CC5003358	4.975 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%
NITRM	16011025	CC473218	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%
NITRM	12060735	CC356192	2488 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%
The SRM, PRM or RGM noted above is only in reference to the GMS used in the assay and not part of the analysis.				
ANALYTICAL EQUIPMENT				
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration		
Nicolet 6700 APWT100391 CO	FTIR	Feb 08, 2018		
Nicolet 6700 APWT100391 NO	FTIR	Feb 15, 2018		
Nicolet 6700 APWT100391 NO2	FTIR	Feb 16, 2018		
Nicolet 6700 APWT100391 SO2	FTIR	Mar 01, 2018		

Triad Data Available Upon Request

NOTES: NET WEIGHT: 10.43lbs

GROSS WEIGHT: 60.93lbs

PC# 5218000763

This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2000 and relate only to items identified on this certificate. All concentrations are certified to be NIST Traceable with total uncertainty as detailed under Analytical Uncertainty. This document shall not be reproduced in full without written approval of the issuer.



TESTING CERT No. 3082.05

*Don Moraw*  
Approved for Release

**DRY GAS METER XC-572-V**

**Serial No. : A2007510**

# METHOD 5 PRE-TEST CONSOLE CALIBRATION USING REFERENCE METER # WET TEST METER W-NK5A No. 540961

5-POINT METRIC UNIT

Meter Console Information	
Console Model Number	XC-572-V
Console Serial Number	A2007510
DGM Model Number	SK25EX
DGM Serial Number	00005115

Calibration Conditions			
Date	Time	11-Aug-21	1:00 PM
Calibration Reference No.	GC64APE0040		
Barometric Pressure	761	mm Hg	
Calibration Meter Gamma	0.9980	unitless	

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K <sub>1</sub>	0.386	

Calibration Data									
Run Time		Metering Console				Calibration Meter			
Elapsed (t)	DGM Orifice ΔH (P <sub>1</sub> )	Volume Initial (V <sub>1</sub> )	Volume Final (V <sub>2</sub> )	Outlet Temp Initial (t <sub>1</sub> )	Outlet Temp Final (t <sub>2</sub> )	Volume Initial (V <sub>1</sub> )	Volume Final (V <sub>2</sub> )	Outlet Temp Initial (t <sub>1</sub> )	Outlet Temp Final (t <sub>2</sub> )
min	mm H <sub>2</sub> O	m <sup>3</sup>	m <sup>3</sup>	°C	°C	m <sup>3</sup>	m <sup>3</sup>	°C	°C
15.00	13.0	192.9377	193.1065	25	25	217.64994	217.82028	25	25
10.00	25.0	193.1438	193.3008	25	25	217.85800	218.01650	25	25
8.00	50.0	193.3330	193.5109	25	25	218.04911	218.22929	25	25
7.00	80.0	193.5431	193.7402	25	25	218.26189	218.46254	25	25
5.00	120.0	193.7826	193.9548	25	25	218.50573	218.68184	25	25

Results								
Standardized Data				Dry Gas Meter				
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate	ΔH @	
(V <sub>meas</sub> )	(Q <sub>meas</sub> )	(V <sub>std</sub> )	(Q <sub>std</sub> )	Value	Variation	Std & Corr	.0212 m <sup>3</sup> /min (ΔH@)	Variation (ΔH@)
m <sup>3</sup>	m <sup>3</sup> /min	m <sup>3</sup>	m <sup>3</sup> /min	(Y)	(ΔY)	m <sup>3</sup> /min	mm H <sub>2</sub> O	
0.166	0.011	0.167	0.011	1.006	-0.001	0.011	46.495	0.632
0.155	0.015	0.156	0.016	1.005	-0.002	0.016	46.005	0.141
0.176	0.022	0.177	0.022	1.006	-0.001	0.022	45.788	-0.076
0.195	0.028	0.197	0.028	1.008	0.001	0.028	45.491	-0.373
0.171	0.034	0.173	0.035	1.009	0.002	0.035	45.540	-0.324
				1.007	Y Average		45.864	ΔH@ Average

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is  $\pm 0.02$

Note: For ΔH<sub>0</sub>, orifice pressure differential that equates to 0.75cm (0.0212m<sup>3</sup>/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is  $\pm 0.2$  inches  $\pm 5.1$  mm H<sub>2</sub>O

Signature: *[Signature]*  
(Sirichok Sansomsup)

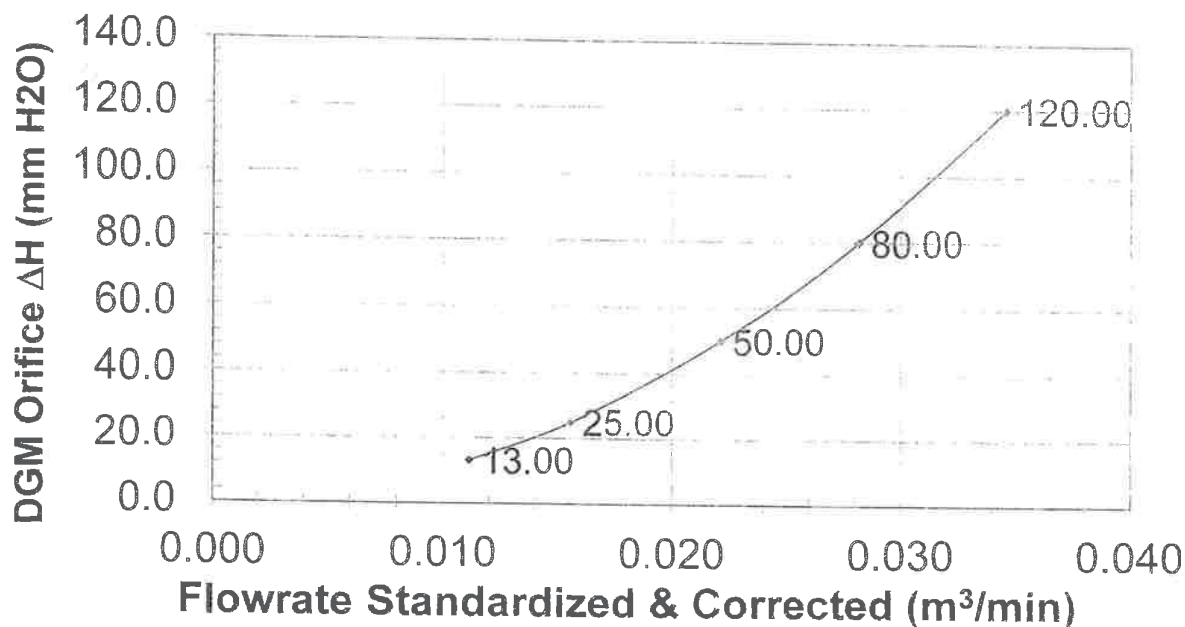
บริษัท สิทธีพรแอสโซซิเอต จำกัด  
SITHIPORN ASSOCIATES COMPANY LIMITED

Date: 11 / 8 / 2021

Calibration Date: 25-2-2014

Calibration Reference No: VO57AP0011

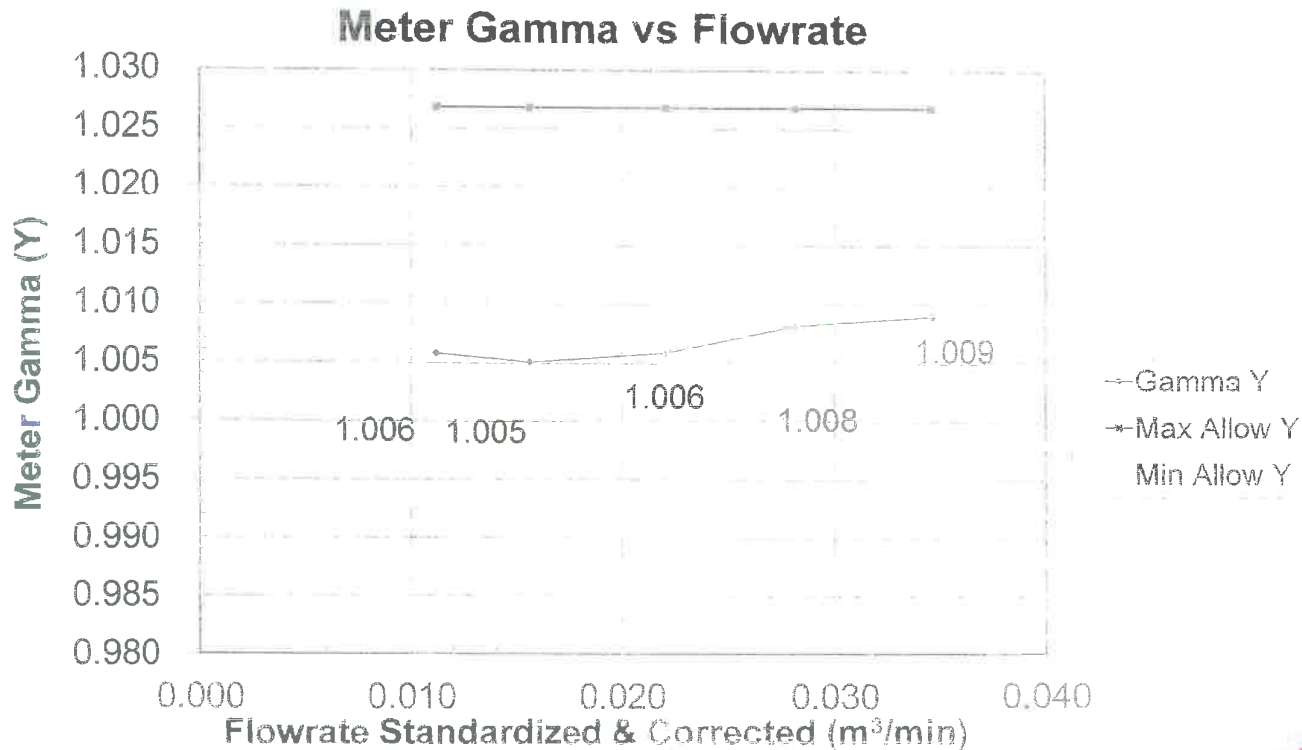
## Meter Pressure vs Flowrate



Console Serial: A2007510

บริษัท สิทธีพรแอสโซซิเอต จำกัด  
SITHIPORN ASSOCIATES COMPANY LIMITED

Console Model: XC-572-V



Console Serial: A2007510

บริษัท สิทธีพร แอสโซซิเอต จำกัด  
SITHIPORN ASSOCIATES COMPANY, LTD.

Console Model: XC-572-V

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THERMOCOUPLES SYSTEM CALIBRATION			
SITHIPORN			
Sithiporn Associate Thermocouples System Calibration Report			
Web site : www.sithiporn.com & Email : sithiporn@www.sithiporn.com			
Sampling System Equipment Information		Calibration Conditions	
Console Model Number	XC-572-V	Date	11-Aug-21
Console Serial Number	A2007510	Calibration Reference No.	GC64APE0040
DGM Model Number	SK25EX	Barometric Pressure	751 mm Hg
DGM Serial Number	00005115	Reference Thermometer	FLUKE 714
Meter Box Model Number	JENCO 765	Serial Number	9033005
Meter Box Serial Number	JC02982		

Results		Console Thermocouple Simulator	
Channel and test point		Meter Box Channel Temperature Reading (°C)	
		-18.0	25.0
Stack		-18	25
Probe		-17	25
Filter		-17	25
Aux		-17	25
Exit		-17	25

Stack  
Probe  
Filter

± 1.50% Absolute  
± 3.0 °C  
± 3.0 °C

Meter  
Exit

± 3.0 °C  
± 2.0 °C

Note: Temperature difference ≤ 1.5%

Signature: Sirichok Sansomsup  
( Sirichok Sansomsup )  
Service Engineerบริษัท สิทธีพร แอสโซซิเอต จำกัด  
SITHIPORN ASSOCIATES COMPANY, LTD.

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 451-451/1 ถนนสีลม แขวงบางนาพรุ เขตบางนา กรุงเทพมหานคร 10700 โทร. 0-2433-8331, 0-2435-8800, 0-2434-9191 แฟกซ์ : 0-2433-679, 0-2434-9511  
 451-451/1 Sirinthorn Road, Bangbunru, Bangkok 10700 Thailand Tel. (662) 433-8331, 435-8800, 434-9191 Fax: (662) 433-1679, 434-951



**DRY GAS METER MC-572**

**Serial No. : 0011024**

METHOD 5 PRE-TEST CONSOLE CALIBRATION  
USING REFERENCE METER # WET TEST METER W-NK5A No. 540961  
5-POINT METRIC UNIT

Meter Console Information	
Console Model Number	MC-572
Console Serial Number	0011024
DGM Model Number	SK25EX
DGM Serial Number	00005437

Calibration Conditions			
Date	Time	07-Jan-22	1:00 PM
Calibration Reference No.	HC65APE0005		
Barometric Pressure	759	mm Hg	
Calibration Meter Gamma	0.9980	unitless	

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K <sub>1</sub>	0.386	

Calibration Data									
Run Time		Metering Console				Calibration Meter			
Elapsed (t)	DGM Orifice ΔH (P <sub>o</sub> )	Volume Initial (V <sub>i</sub> )	Volume Final (V <sub>f</sub> )	Outlet Temp Initial (t <sub>in</sub> )	Outlet Temp Final (t <sub>out</sub> )	Volume Initial (V <sub>i</sub> )	Volume Final (V <sub>f</sub> )	Outlet Temp Initial (t <sub>in</sub> )	Outlet Temp Final (t <sub>out</sub> )
min	mm H <sub>2</sub> O	m <sup>3</sup>	m <sup>3</sup>	°C	°C	m <sup>3</sup>	m <sup>3</sup>	°C	°C
15.00	13.0	519.3522	519.5372	25	25	248.31965	248.50831	25	25
10.00	25.0	519.5505	519.7196	25	25	248.52318	248.69613	25	25
8.00	50.0	519.7505	519.9399	25	25	248.72918	248.92339	25	25
7.00	80.0	519.9562	520.1641	25	25	248.94255	249.15608	25	25
5.00	120.0	520.1817	520.3645	25	25	249.17802	249.36602	25	25

Standardized Data				Results				
Dry Gas Meter		Calibration Meter		Calibration Factor		Dry Gas Meter		
(V <sub>dry</sub> )	(Q <sub>dry</sub> )	(V <sub>wet</sub> )	(Q <sub>wet</sub> )	Value	Variation	Flowrate	ΔH @	
m <sup>3</sup>	m <sup>3</sup> /min	m <sup>3</sup>	m <sup>3</sup> /min	(Y)	(ΔY)	Std & Corr	.0212 m <sup>3</sup> /min	Variation
						(Q <sub>dry</sub> )	(ΔH@)	(ΔΔH@)
						m <sup>3</sup> /min	mm H <sub>2</sub> O	
0.182	0.012	0.185	0.012	1.016	-0.001	0.012	38.004	-1.317
0.166	0.017	0.169	0.017	1.018	0.001	0.017	38.741	-0.580
0.187	0.023	0.190	0.024	1.018	0.001	0.024	39.516	0.195
0.206	0.029	0.209	0.030	1.017	0.000	0.030	40.276	0.955
0.181	0.036	0.184	0.037	1.015	-0.002	0.037	40.070	0.748
				1.017	Y Average		39.321	ΔH@ Average

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is  $\pm 0.02$

Note: For ΔH<sub>dry</sub>, orifice pressure differential that equates to 0.75scfm (0.0212m<sup>3</sup>/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is  $\pm 0.2$  inches (5.1mm) H<sub>2</sub>O.

Signature Sirichok Sansomsup  
(Sirichok Sansomsup)  
Service Engineer

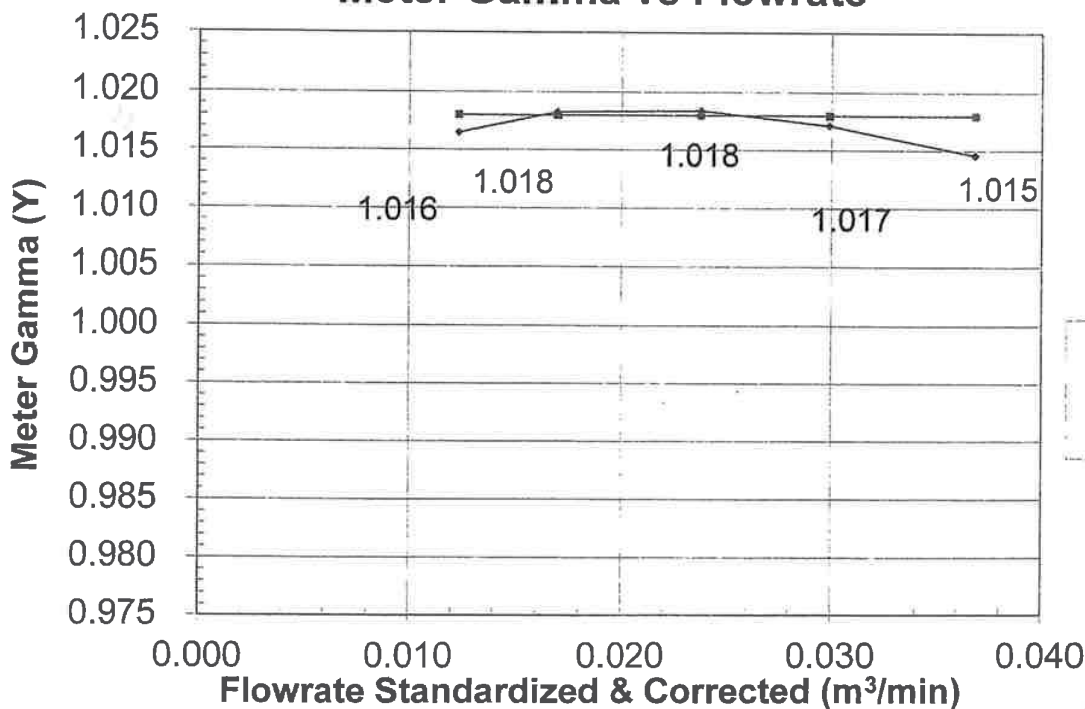
บริษัท สิทธิพรแอตโมสเฟียร์ จำกัด

Date 07/01/2022

Calibration Date: 25-2-2014

Calibration Reference No: VO57AP0011

## Meter Gamma vs Flowrate

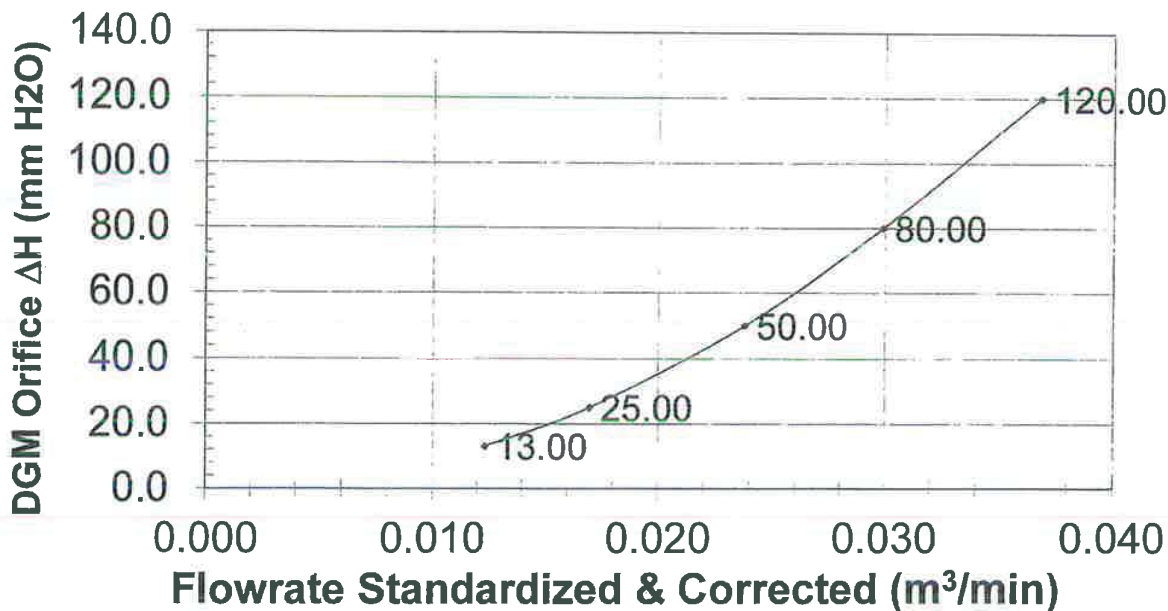


Console Serial: 0011024

บริษัท สิทธิพรแอตโมสเฟียร์ จำกัด

Console Model: MC-572

# Meter Pressure vs Flowrate



Console Serial: 0011024

บริษัท สิทธีพรแอสโซซิเอต จำกัด  
SITHIPORN ASSOCIATES COMPANY LIMITED

Console Model: MC-372

COPY

## THERMOCOUPLES SYSTEM CALIBRATION

SITHIPORN ASSOCIATES

SA Environmental / Hygiene Products Division (EPD)  
Web site : www.sithiporn.com E-mail: service-epd@sithiporn.com

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	MC-372	Date	07-Jan-22
Console Serial Number	0011024	Calibration Reference No.	HC65APE0005
DGM Model Number	SK26EX	Barometric Pressure	759 mm Hg
DGM Serial Number	00005437	Reference Thermometer	FLUKE 714
Meter Box Model Number	JENCO 765	Serial Number	9038005
Meter Box Serial Number	JC02982		

Results	
Console Thermocouple Simulator	
Channel and test point	Meter Box Channel Temperature Reading (°C)
Stack	-18.0 25.0 38.0 94 150 261 372 483 595 817 1040
Probe	-18 25 38 94 150
Filter	-18 25 38 94 150
Aux	-18 25 38 94 150
Exit	-18 25 38

Stack ± 1.50% Absolute  
Probe ± 3.0 °C  
Filter ± 3.0 °C

Tolerance Range

Meter Exit ± 3.0 °C  
± 2.0 °C

Note: Temperature difference ≤ 1.5%

Signature

(Sirichok Sansomsup)  
Service Engineer

บริษัท สิทธีพรแอสโซซิเอต จำกัด  
SITHIPORN ASSOCIATES COMPANY LIMITED

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Sithiporn Associates Co., Ltd.

451-451/1 ถนนศรีนครินทร์ แขวงบางนาพรุ เขตบางนา กรุงเทพมหานคร 10700 โทร. 0-2433-8331, 0-2435-8800, 0-2434-9191 แฟกซ์ : 0-2433-1679, 0-2434-9510  
451-451/1 Sirinthorn Road, Bangbunru, Bangkok 10700 Thailand Tel. (662) 433-8331, 435-8800, 434-9191 Fax: (662) 433-1679, 434-9510

**Flue gas Analyzer**

**Testo 350XL**

**Serial No. 01859560**

**Certificate No:** G 640712  
**Date of issue :** 29-Oct-21



**Instrument description :** Flue gas Analyzer  
**Instrument model :** Testo 350XL  
**Instrument serial no. :** 01859560  
**ID no. or control no. :** -  
**Manufacturer :** testo SE  
**Probe description :** -  
**Probe model :** -  
**Probe serial :** -  
**Customer name :** Eastern Thai Consulting 1992 Company Limited  
**Customer address :** 683 Moo 11, Sukhapibarn 8 Road, Nongkham, Si Racha, Chon Buri 20280

**Total pages of certificate :** 2 Pages  
**Receiving no. :** L-213012  
**Receiving date. :** 28-Oct-21  
**Parameter of calibration :** Gas Calibration (Oxygen 2.501, 10.00, 21.00 %Vol, Carbon Monoxide 80.97, 309.9, 1003 ppm, Nitrogen Dioxide 80.62 ppm, Sulphur Dioxide 100.9 ppm, Nitric Oxide 150.9 ppm)

**Condition of UUC. :** Used  
**Ambient condition :** All of the Measurement were carried out the stabilized laboratory  
**Temperature :** 23 ± 5 °C  
**Humidity :** 55 ± 15 %RH  
**Calibration place :** 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Lakso, Bangkok 10210  
**Calibration procedure no. :** WT-CL-28-C

*The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. This certificate is applied only to item under test Environmental condition.*  
*This Calibration Certificate may not be reproduced other than in full except with the permission of the Issuing laboratory.*  
*Calibration certificates without signature and seal not valid.*  
*This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).*

**Date of calibration :** 29-Oct-21

*Kunmichai K.*  
Mr. Kwanchai Khamdoung  
Calibration Technician

*D. Nongluck*  
Mrs. Nongluck Wongsettee  
Technical Manager

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**Certificate No.:** G 640712



**Standard References (Table 1)**

Standard	Certificate No.	Vendor	Due date
Oxygen ( O <sub>2</sub> ) 2.501 % Vol	2431/19	Linde	16-Jul-23
Oxygen ( O <sub>2</sub> ) 10.00 % Vol	2453/19	Linde	18-Jul-23
Oxygen ( O <sub>2</sub> ) 21.00 % Vol	2426/19	Linde	16-Jul-23
Carbon monoxide ( CO ) 80.97 ppm	2842/21	Linde	24-Jun-23
Carbon monoxide ( CO ) 309.9 ppm	2803/21	Linde	22-Jun-23
Carbon monoxide ( CO ) 1003 ppm	2829/21	Linde	23-Apr-23
Nitrogen Dioxide ( NO <sub>2</sub> ) 80.62 ppm	3240/21	Linde	25-Jul-23
Sulphur Dioxide ( SO <sub>2</sub> ) 100.9 ppm	4942/20	Linde	20-Nov-22
Nitric Oxide ( NO ) 150.9 ppm	2857/21	Linde	27-Jun-23

**Measured room conditions**

**Temperature :** 23.6 °C **Humidity :** 57.8 %RH **Pressure :** 1014.1 mbar  
**Calibration conditions**  
**Gas Temperature :** 23 °C **Flow rate :** 1,100 ml/min **Gas pressure :** 1023.6 mbar

**Calibration Results (without adjustment) (Table 2)**

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O <sub>2</sub> (%Vol)	2.501	2.45	-0.051	0.20
O <sub>2</sub> (%Vol)	10.00	9.86	-0.14	0.40
O <sub>2</sub> (%Vol)	21.00	21.14	0.14	0.80
CO (ppm)	80.97	82	1.03	2.8
CO (ppm)	309.9	314	4.1	11
CO (ppm)	1003	1017	14	34
*NO <sub>2</sub> (ppm)	80.62	80.2	-0.42	5.0
*SO <sub>2</sub> (ppm)	100.9	102	1.1	5.0
*NO (ppm)	150.9	149	-1.9	5.0

**Remark :** 1 cmol/mol = 1 %Vol , 1 umol/mol = 1 ppm.

\* Calibrations marked Not TISI Accredited "in this Certificate have been included for completeness."

**End of Report**

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**GAS CHROMATOGRAPH**

**MODEL : GC-2010 Plus AF**

**S/N : C12095200986**



# Operational Qualification Record

## 3. Operational Qualification Record

If the unit is included in the system to be inspected, place a checkmark in the "Applicable" box. If the unit is not included in the system, place a checkmark in the "Not Applicable" box. Enter a diagonal line in the Pass/Fail checkbox for "Not applicable" items. Here, inspection results are recorded along the procedure of Chapter 4 in Operational Qualification Protocol.

Component ID		Model Name		GC-2010Plus		<input checked="" type="checkbox"/> Applicable <input type="checkbox"/> Not Applicable	
No.	Item	Criteria	Results	Pass	Fail		
1	Display, LED test	Verify the display and LED operation.	LED Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
2	Standard self-diagnostic test	*Good* displayed as the result of the self-diagnostic test.	Good	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
3	Firmware version check	Verify the program version.	Version: 2.1040 Build No.: 264 The version No. and build No. matches the controlled version number.	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
4	Temperature test	Verify that temperature control is normal.	TEMP LED lights green. Displayed actual values agree to the set values within $\pm 1.0^{\circ}\text{C}$ .	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
5	Column inlet pressure test	Verify the accuracy of the column inlet pressure.	Pressure gauge reading: 0.0 kPa Pressure gauge reading: 0.0 kPa Post-correction reading: 0.0 kPa Pressure gauge reading: 0.0 kPa Post-correction reading: 0.0 kPa Pressure gauge reading: 0.0 kPa Post-correction reading: 0.0 kPa	<input checked="" type="checkbox"/>	<input type="checkbox"/>		

Performer (signature): DM Date: 25 / 03 / 2021  
 Reviewer (signature): \_\_\_\_\_ Date: \_\_\_\_\_

# Operational Qualification

No.	Item	Criteria	Results	Pass	Fail
6	Pressure program test	Verify that the pressure program operates normally.	Monitored pressure 6 minutes after start: $250.0 \pm 5.0 \text{ kPa}$ Inspection pressure gauge reading 8 minutes after start: $250.0 \pm 20.0 \text{ kPa}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	Flowrate test	Verify the accuracy of the full-flow and septum purging.	Septum purge vent measured flow rate: $3.0 \pm 1.0 \text{ mL/min}$ Total of septum purge and split vent flow rate values: $10.0 \pm 3.0 \text{ mL/min}$ Total of septum purge and split vent flow rate values: $200 \pm 20 \text{ mL/min}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8	Column oven test	Verify the accuracy of the column oven temperature.	Inspection temperature sensor displayed value: $50.0 \pm 0.3^{\circ}\text{C}$ Inspection temperature sensor displayed value: $50.0 \pm 0.3^{\circ}\text{C}$ Inspection temperature sensor displayed value: $50.0 \pm 0.3^{\circ}\text{C}$ Inspection temperature sensor displayed value: $50.0 \pm 0.3^{\circ}\text{C}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9	Temperature program test	Verify the column temperature program operates normally.	Monitored temperature 6 minutes after start: $200 \pm 1^{\circ}\text{C}$ Inspection temperature reading 8 minutes after start: $200.0 \pm 4.7^{\circ}\text{C}$ Using a temperature sensor with $1^{\circ}\text{C}$ minimum display increment: $200 \pm 3^{\circ}\text{C}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10	Sensitivity test	Verify the detector sensitivity.	Calculated S value: $51.372$ Calculated S value: $1.44 \times 10^{-3} \text{ C/g}$ Calculated S value: $1.44 \times 10^{-3} \text{ C/g}$ Calculated S value: $1.44 \times 10^{-3} \text{ C/g}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Performer (signature): DM Date: 25 / 03 / 2021  
 Reviewer (signature): \_\_\_\_\_ Date: \_\_\_\_\_

# Operational Qualification

## Operational Qualification Record

### 3-2 AOC-20i Auto Injector

☒ Applicable ☐ Not Applicable

☒ Single ☐ Dual system, main injector

Component ID		Model Name		AOC-20i	
Serial No. (S/N)		C 1 2 1 2 5 4 1 0 8 0 4			
No.	Item	Criteria		Results	Pass/Fail
1	Display, LED test	Verify the display and LED All LEDs light, except decimal point.		Display: 000	Pass
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.		Display: 000	Pass
3	Firmware version check	Verify the program version.		Version No. 3.4	Pass
4	Basic operation test	Verify that the auto injector basic operation is correct.		Version No. 3.4	Pass

☒ Not Applicable ☐ Dual system, sub injector

Component ID		Model Name		AOC-20i	
Serial No. (S/N)					
No.	Item	Criteria		Results	Pass/Fail
1	Display, LED test	Verify the display and LED All LEDs light, except decimal point.		Display: 000	Pass
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.		Display: 000	Pass
3	Firmware version check	Verify the program version.		Version No. 3.4	Pass
4	Basic operation test	Verify that the auto injector basic operation is correct.		Version No. 3.4	Pass

Performer (signature):

Date: 25 / 08 / 2021

Reviewer (signature):

Date: / /

# Operational Qualification

## Operational Qualification Record

### 3-3 AOC-20s Auto Sampler

☒ Applicable ☐ Not Applicable

Component ID		Model Name		AOC-20s	
Serial No. (S/N)		C 1 2 1 3 5 4 0 5 9 1 0			
No.	Item	Criteria		Results	Pass/Fail
1	Initial operation test	Verify that the auto sampler basic operation is correct.		LED lights green, not red.	Pass
2	Firmware version check	Verify the program version.		Version number is displayed. The version number matches the controlled version number.	Pass

Performer (signature):

Date: 25 / 08 / 2021

Reviewer (signature):

Date: / /

**Hot Air Oven**

**Model : UM 400**

**Serial No. : 900982**



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NSC-TIS-TIS 17025  
CALIBRATION 0152

Certificate No. : 21-049716  
Sample code : 21-19686-006  
Page 2 of 3

## REPORT OF CALIBRATION

### Results of calibration

Resolution : 0.1 °C  
1. Reporting of temperature

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Measured temperature at Each Positions (°C)										Uncertainty ± (°C)	Coverage factor k
			#1	#2	#3	#4	#5	#6	#7	#8	#9	#10		
85	85.0	85.0	84.98	84.92	84.61	84.66	84.93	84.88	84.93	84.82	84.92	84.92	0.27	2.00

### 2. Characterization result

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
85	0.16	0.32	0.67

### Note

UUC\* = Unit Under Calibration

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NSC-TIS-TIS 17025  
CALIBRATION 0152

Certificate No. : 21-049716  
Sample code : 21-19686-006  
Page 1 of 3

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapiban 8 Rd., Nongkham,  
Sriacha, Chonburi 20230

Location of calibration : EASTERN THAI CONSULTING 1992 CO., LTD.  
(Hot Lab)

Equipment : Temperature controlled enclosures (Hot air oven)

Manufacturer : Memmert

Model : UM 400

Serial No. : 900982

Date of receipt : 09 June 2021

Date of calibration : 09 June 2021

### Condition of calibration

1 Environment Ambient temperature : Maximum 32.7 °C ; Minimum 30.1 °C

Relative humidity : Maximum 60.3 % ; Minimum 44.1 %

Line voltage supplied : Maximum 228.5 VAC ; Minimum 221.3 VAC

2 Calibration method : TLAS-G-20 : Guidelines for calibration and checks of temperature controlled enclosures

3 Reference standard instrument

Instrument ID No. Certificate No. Due date

Data Acquisition With Sensor LB-DA-12 (RTD-178 to RTD-186) 21-038924 06 May 2022

4 This certificate is traceable to the international system of unit (SI Unit)

The measurement is traceable to Thailand Institute of Scientific and Technological Research through Asia Medical and

Agricultural Laboratory and Research Center Co., Ltd.

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

6 Condition of calibration item : Normal

Calibrated by : Mr. Sarawoot Thamro

Scientist : 14 June 2021

Date of issue : 14 June 2021

Approved by : ( Mr. Somchai Neampunt )

Signed for Director

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The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the

measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding

national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and

Agricultural Laboratory and Research Center Co., Ltd. (AMARC)

Rev.00

Effective Date 04/05/21

Rev.08

Effective Date 04/05/21



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NSC-THT-TIS 17025  
CALIBRATION 0152

Certificate No. : 21-049716  
Sample code : 21-19686-006

Page 3 of 3

## REPORT OF CALIBRATION

### Results of calibration

#### Note

- Sensor installation locations
  - All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
  - The reference sensor is preferably located of the geometric center of the chamber.
- Interior dimensions approx of chamber ;  
W = 40 cm ; D = 28 cm ; H = 39 cm
- Air valve or fresh air level ; Off
- Fan level ; Open
- The quoted uncertainty include " Stability of chamber and loading effect in chamber at 20% of uniformity ".

6 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.

7 Temperature stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.

8 Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.

9 UUC\* Reading - the average reading of indicating device that forms the integral part of the enclosure.

10 Calibration results without adjustment.

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

End of report

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**Hot Air Oven**

**Model : UM 400**

**Serial No. : 900982**





## CERTIFICATE OF CALIBRATION

Page 1 of 3  
Certificate No. : 22-025399  
Sample Code : 22-09604-002

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapiban 8 Rd., Nongkham,  
Sriacha, Chonburi 20230

Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.  
(Hot Lab)

Equipment : Temperature controlled enclosures (Hot air oven)  
Manufacturer : Memmert Model : UM 400  
Serial No. : 900982 ID No. : LABE 17/1  
Date of Receipt : 11 March 2022 Date of Calibration : 11 March 2022

## Condition of Calibration

1. Environment  
1.1 Ambient temperature : Maximum 28.7 °C ; Minimum 27.4 °C  
1.2 Relative humidity : Maximum 61.5 % ; Minimum 55.8 %  
1.3 Line voltage supplied : Maximum 226.5 VAC ; Minimum 224.7 VAC

## 2. Calibration method

TLAS-G-20: Guidelines for calibration and checks of temperature controlled enclosures.

## 3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-PH100)	LB-DA-11	RTD-138 to RTD-146	21-035792
			18 May 2022

## 4. This certificate is traceable to the international system of unit (SI Unit).

The measurement is traceable to Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.

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

## 6. Condition of calibration item : Normal

Calibrated by

Mr. Natthan Phosri  
Scientist

Approved by

(Mr. Sornchai Neampunt)

Issue date

14 March 2022

The uncertainties are for a confidence probability of approximately 95%.  
The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

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Effective Date: 15/10/21



## REPORT OF CALIBRATION

Page 2 of 3  
Certificate No. : 22-025399  
Sample Code : 22-09604-002

## Results of Calibration

Resolution : 0.1 °C

## 1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor <i>k</i>	
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8			# g <sup>ref</sup>
85	85.0	85.0	85.05	84.99	84.66	84.71	84.85	84.92	84.96	84.86	84.98	0.25	2.00

## 2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
85	0.08	0.35	0.54

## Notes

UUC\* = Unit Under Calibration  
*Sornchai*

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## REPORT OF CALIBRATION

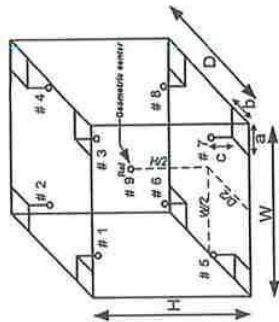
Certificate No. : 22-025399

Sample Code : 22-09504-002

## Results of Calibration

## Notes

1. Sensor installation locations
  - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
  - 1.2 The reference sensor is preferably located of the geometric center of the chamber.
2. Interior dimensions approx of chamber :  
W = 40 cm ; D = 28 cm ; H = 39 cm
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes "Stability of chamber and loading effect in chamber at 20% of uniformity".
6. 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.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC\* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

Figure: Example of sensor  
Installation Positions

- End of Report -

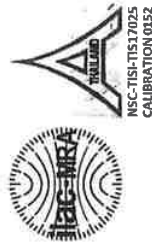
The result expanded uncertainty of measurement  $U$  is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with ISO 9000.

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**Hot Air Oven**

**Model : UFE 500**

**Serial No. : G511.0182**



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## CERTIFICATE OF CALIBRATION

Page 1 of 3

Certificate No. : 22-011766  
Sample Code : 22-04498-003

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhaphan 8 Rd., Nongkham,  
Sriracha, Chonburi 20230

Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.  
(Laboratory)

Equipment : Temperature controlled enclosures (Hot air oven)  
Manufacturer : Memmert  
Serial No. : G511.0182  
Date of Receipt : 03 February 2022  
Model : UFE 500  
ID No. : LABE 17/4  
Date of Calibration : 03 February 2022

### Condition of Calibration

1. Environment  
1.1 Ambient temperature : Maximum 27.5 °C ; Minimum 26.4 °C  
1.2 Relative humidity : Maximum 59.5 % ; Minimum 50.8 %  
1.3 Line voltage supplied : Maximum 225.1 VAC ; Minimum 223.2 VAC

### 2. Calibration method

TLAS-G-20: Guidelines for calibration and checks of temperature controlled enclosures.

### 3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-Pt100)	LB-DA-11 (RTD-148 to RTD-155, RTD-227)	21-041213	09 May 2022

### 4. This certificate is traceable to the international system of unit (SI Unit).

The measurement is traceable to Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.

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

6. Condition of calibration item : Normal

Calibrated by

Mr. Pattarakorn Panklong

(Mr. Somchai Neampunt)

Scientist

Signed for Director

Issue date

11 February 2022

The uncertainties are for a confidence probability of approximately 65%.

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

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## REPORT OF CALIBRATION

Page 2 of 3

Certificate No. : 22-011766  
Sample Code : 22-04498-003

### Results of Calibration

Resolution : 0.5 °C

### 1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor k	
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 <sup>Rev</sup>		
104	103.5	103.5	104.46	104.45	#####	104.07	104.46	104.42	104.34	104.07	104.30	0.53	2.00

### 2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
104	0.12	0.80	1.13

### Notes

- UUC\* = Unit Under Calibration

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WWW.AMARC.CO.TH  
Effective Date: 15/01/21



## REPORT OF CALIBRATION

Certificate No. : 22-011766

Sample Code : 22-0498-003

## Results of Calibration

## Notes

1. Sensor installation locations
  - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
  - 1.2 The reference sensor is preferably located of the geometric center of the chamber.
2. Interior dimensions approx of chamber :  
W = 56 cm; D = 40 cm; H = 48 cm
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes "Stability of chamber and loading effect in chamber at 20% of uniformity".
6. 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.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC\* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

The result expanded uncertainty of measurement  $U$  is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003.

- End of Report -

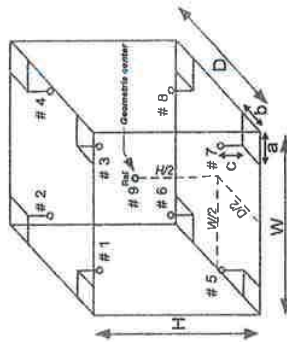


Figure: Example of sensor  
Installation Positions

COPY

**LIQUID IN GLASS THERMOMETER**

**Model : Total Immersion**

**Serial No. : 43560**





QUALITY CALIBRATION CO., LTD.  
235 Petchkasem 63/2 Road, Laksong, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584  
www.qcalibration.com



CERTIFICATE No : 21T10802  
REFERENCE No : 62916-1

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : LIQUID IN GLASS THERMOMETER  
MANUFACTURER :  
MODEL : PRECISION  
ID No : 0 °C TO 100 °C  
SERIAL No : 43560  
Labe 16/1  
RESOLUTION : 0.1 °C  
TYPE : TOTAL IMMERSION  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : EASTERN THAI CONSULTING 1992 COMPANY LIMITED  
999 MOO.11 NONGKHAM, SRIRACHA, CHONBURI  
20230

CALIBRATED BY : CHARUKIT L.  
CALIBRATION DATE : 27-Oct-21  
APPROVED BY : PONGSAK J.  
ISSUED DATE : 27-Oct-21  
RECEIVED DATE : 21-Oct-21

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF  
QUALITY CALIBRATION CO., LTD.

F-G010 REV 02

COPY



QUALITY CALIBRATION CO., LTD.  
235 Petchkasem 63/2 Road, Laksong, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584  
www.qcalibration.com

CERTIFICATE No : 21T10802

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : LIQUID IN GLASS THERMOMETER  
MANUFACTURER :  
MODEL : PRECISION  
ID No : 0 °C TO 100 °C  
SERIAL No : 43560  
Labe 16/1  
RESOLUTION : 0.1 °C  
TYPE : TOTAL IMMERSION  
RECEIVED DATE : 21-Oct-21  
AMBIENT TEMPERATURE : 23 °C ± 3 °C  
RELATIVE HUMIDITY : 50 %RH ± 20 %RH

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BASED ON ASTM E77:1992 BY COMPARISON WITH STANDARD PLATINUM RESISTANCE THERMOMETER (SPRT) INTO LIQUID BATH TEMPERATURE CONTROLLER. THE TEMPERATURE SCALE USED WAS BASED ON ITS-90.

2. REFERENCE STANDARD INSTRUMENTS :

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD THERMOMETER	1502	77964	21T3033	08-Mar-22
2) SPRT PROBE	5614	636626	21T3033	08-Mar-22
3) PRECISION BATH	7320	A21105	20T12163	16-Dec-21
4) PRECISION BATH	CTR-40	A68155	20T12164	22-Dec-21

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT-

- NATIONAL INSTITUTE OF METROLOGY (THAILAND).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	EMERGENT STEM TEMPERATURE (°C)	UNCERTAINTY OF MEASUREMENT (±°C)
0.004	0.0	60	0.004	N/A	0.090
25.009	25.0	160	0.009	N/A	0.090
50.012	50.0	270	0.012	N/A	0.090

UUC\* : UNIT UNDER CALIBRATION

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k = 2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

COPY

F-G010 REV 02

**ORIFICE TRANSFER STANDARD CERTIFICATION**

**WORKSHEET TE-5025A**

**ROOTSMETER S/N 0438320**



TISCH ENVIRONMENTAL, INC.  
145 SOUTH MIAMI AVE  
VILLAGE OF CLEVELAND, OH  
45002  
513.467.9000  
877.263.7810 TOLL FREE  
513.467.9009 FAX

# ORIPICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date - Mar 24, 2016 Rootmeter S/N 0438320 Ta (K) - 295  
Operator Tisch Office I.D. - 0136 Pa (mm) - 742.95

PLATE OR Run #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORIFICE DIFF H2O (in.)
1	NA	NA	1.00	1.3400	3.2	2.00
2	NA	NA	1.00	0.9510	6.3	4.00
3	NA	NA	1.00	0.8510	7.8	5.00
4	NA	NA	1.00	0.8130	8.6	5.50
5	NA	NA	1.00	0.6690	12.6	8.00

## DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
0.9832	0.7337	1.4054	0.9957	0.7430	0.8911
0.9791	1.0296	1.9875	0.9915	1.0426	1.2603
0.9770	1.1481	2.2221	0.9894	1.1626	1.4090
0.9760	1.2006	2.3305	0.9884	1.2157	1.4778
0.9707	1.4510	2.8107	0.9830	1.4694	1.7823
Qstd slope (m) =	1.96262		Qa slope (m) =	1.22896	
intercept (b) =	-0.03249		intercept (b) =	-0.02060	
coefficient (r) =	0.99993		coefficient (r) =	0.99993	
y axis = SQRT [H2O (Pa/760) (298/Ta)]			y axis = SQRT [H2O (Ta/Pa)]		

## CALCULATIONS

$$Vstd = Diff. Vol [(Pa-Diff. Hg)/760] (298/Ta)$$

$$Qstd = Vstd/Time$$

$$Va = Diff Vol [(Pa-Diff Hg)/Pa]$$

$$Qa = Va/Time$$

For subsequent flow rate calculations:

$$Qstd = 1/m \{ [SQRT (H2O (Pa/760) (298/Ta))] - b \}$$

$$Qa = 1/m \{ [SQRT H2O (Ta/Pa)] - b \}$$

COPY

**pH Meter**

**Model : SevenCompact<sup>TM</sup> pH/Ion Meter S220**

**Serial No. : B448305208**

Certificate Number CCP-0443-21

## Calibration Certificate SevenCompact™ pH/Ion Meter S220

<b>Customer</b>	<b>Company</b>	EASTERN THAI CONSULTING 1992 CO., LTD.
	<b>Address</b>	683 Moo 11, Sukhaphum 8 Rd., Nong Kham, Sriracha Chonburi 20230
	<b>Customer ID number</b>	301608441
	<b>Customer representative</b>	K Sasiporn Nakhin
	<b>Order Number</b>	083331128350

### Instrument

<b>Type</b>	SevenCompact™ S220	<b>Instrument Serial Number</b>	B446305208
<b>Internal Identification</b>	LABE 11/4	<b>Firmware version</b>	1.20.06

### Technical specifications

Measuring Range -1999.9 ... 1999.9 mV  
Resolution 0.1 mV  
Limit of Error ±0.2 mV

Measuring Range -2.000 ... 20.000 pH  
Resolution 0.001 pH  
Limit of Error ±0.002 pH

Temperature range MTC -30.0 ... 130.0 °C  
Temperature range ATC -5.0 ... 130.0 °C  
Resolution 0.1 °C  
Limit of Error ±0.1 °C

### Procedure Statement

METTLER TOLEDO Calibration SOP (Doc. No. 30027577) will be used as referring documentation to adjust and certify the instrument indicated in the "Type" and "Serial number" fields. The measurement results of this certification were obtained at ambient conditions.

COPY

Certificate Number CCP-0443-21

### Certification Tools

<b>Certified digital voltmeter</b>	<b>Manufacturer</b>	GOSSEN METRAWATT	<b>Serial number</b>	ZD1740
	<b>Control No.</b>	ANAT7	<b>Certificate number</b>	E1U202338
			<b>Due date</b>	July 14, 2021

### Certified Temperature Resistors

<b>Manufacturer</b>	METTLER TOLEDO / ME-S130241	<b>Serial number</b>	A116
<b>Control No.</b>	IN46	<b>Certificate number</b>	S2542
		<b>Due date</b>	December 3, 2021

COPY

Certificate Number CCP-0443-21

Certification Measurements

pH/mV Sensor Input				
Designation	Certified value	Measured value	Max. Tolerance	Passed / Failed
NTC 30 kΩ, 0 °C	-1900.0 mV	-1899.9 mV	0.2 mV	Passed
-1000 mV	-1000.0 mV	-999.9 mV	0.2 mV	Passed
-500 mV	-500.0 mV	-500.0 mV	0.2 mV	Passed
-180 mV	-180.0 mV	-180.0 mV	0.2 mV	Passed
0 mV	0.0 mV	0.0 mV	0.2 mV	Passed
180 mV	180.0 mV	180.0 mV	0.2 mV	Passed
500 mV	500.0 mV	500.0 mV	0.2 mV	Passed
1000 mV	1000.0 mV	999.9 mV	0.2 mV	Passed
1900 mV	1900.0 mV	1899.9 mV	0.2 mV	Passed

pH/mV Sensor Input at high Impedance				
Designation	Measured low-imp.	Measured high-imp.	Max. Tolerance	Passed / Failed
-1900 mV	1899.9 mV	1899.9 mV	0.5 mV	Passed

Temperature Sensor Input				
Designation	Nominal value	Measured value	Max. Tolerance	Passed / Failed
NTC 30 kΩ, 25 °C	25.0 °C	25.0 °C	0.1 °C	Passed
NTC 30 kΩ, 50 °C	50.0 °C	49.9 °C	0.1 °C	Passed
NTC 30 kΩ, 75 °C	75.0 °C	75.0 °C	0.1 °C	Passed
NTC 30 kΩ, 100 °C	100.0 °C	100.0 °C	0.1 °C	Passed
PT1000, 0 °C	0.0 °C	0.0 °C	0.1 °C	Passed
PT1000, 25 °C	25.0 °C	25.0 °C	0.1 °C	Passed
PT1000, 50 °C	50.0 °C	50.0 °C	0.1 °C	Passed
PT1000, 75 °C	75.0 °C	75.0 °C	0.1 °C	Passed
PT1000, 100 °C	100.0 °C	100.0 °C	0.1 °C	Passed

Summary of Certification

Certification of instrument **Passed**

The instrument referred to in this certificate has fulfilled the criteria of the certification. This is indicated by the notation Passed in the column above.

Remarks

Certification of the instrument was performed by

Name Panchanakit Rujlprapal

Place Laboratory

Function Service Engineer

Calibration Date: April 21, 2021

Signature ELECTRONIC SIGNATURE

COPY

Mettler-Toledo (Thailand) Limited

Performance Test

Control No. CCE-6443-21/1

Company:

EASTERN THAI CONSULTING 1902 CC., LTD.

Address:

683 Moo 11, Sukhaphiban 8 Rd., Nong Kham, Sriracha

Order Number:

0332112835

pH Electrode

Type:

InLab Expert Pro-ISM

S/N:

0373618

Certified standards used

Standard 1:	Type:	pH Buffer	Manufacturer:	METTLER TOLEDO	Exp. date:	Aug-22
	Nominal value:	pH ( 25.00 °C )	4.01		Lot No.:	15217A

Standard 2:	Type:	pH Buffer	Manufacturer:	METTLER TOLEDO	Exp. date:	Jul-22
	Nominal value:	pH ( 25.00 °C )	7.00		Lot No.:	15160D

Standard 3:	Type:	pH Buffer	Manufacturer:	METTLER TOLEDO	Exp. date:	Nov-21
	Nominal value:	pH ( 25.00 °C )	9.21		Lot No.:	15312C

Test equipment:	Type:	pH Meter	Manufacturer:	METTLER TOLEDO	Cal date:	21-Apr-21
	S/N:	B448305208	No. of certificate:	CCP-0443-21	Model:	S520

Adjustment

Set Calibration Buffer					
B2: (25 °C) 7.00, 4.01, 9.21					
Select Calibration Mode					
3-Point Calibration					
Cal 1	°C	pH	°C	pH	°C
ATC	25.8	7.00	ATC	---	ATC
Cal 2	ATC	26.0	4.01	ATC	---
Offset (mV)	2.4				
Slope % (or mV/pH)	97.7				
Cal 3	ATC	25.7	9.20	---	---
Slope % (or mV/pH)	97.7				

Measurements

Before adjustment					
After adjustment					
Buffer Values	Measured	Difference	Buffer Values	Measured	Difference
pH	°C	pH	pH	°C	pH
4.01	26.0	ATC	4.02	0.01	ATC
7.00	25.8	ATC	7.01	0.01	ATC
9.20	25.7	ATC	9.21	0.01	ATC

Remarks: The difference result of calibrated electrode should be within  $\pm 0.05$  pH

Place:

Laboratory

Calibration Date:

April 21, 2021

Service Specialist:

Punchanakit Rujlprapal

Signature:

Electronic Signature

COPY



**pH Meter**

**Model : SevenCompact<sup>TM</sup> pH/Ion Meter S220**

**Serial No. : B448305208**

METTLER TOLEDO

Certificate Number CCP-1416-22

## Calibration Certificate SevenCompact™ pH/Ion Meter S220

### Customer

Company EASTERN THAI CONSULTING 1992 CO., LTD.  
Address 653 Moo 11, Sukhaphan 8 Rd., Nong Khai

Srinacha

Chonburi 20230

30160441

Susiporn Nakin

Assignment ID

00332664387

### Instrument

Type SevenCompact™ S220  
Internal Identification LABE 114  
Instrument Serial Number B44303288  
Firmware version 1.20.05

### Technical specifications

Measuring Range -1999.9 ... 1999.9 mV  
Resolution 0.1 mV  
Limit of Error  $\pm 0.2$  mV

Temperature range ATC -30.0 ... 130.0 °C  
Temperature range ATC -5.0 ... 130.0 °C  
Resolution 0.1 °C  
Limit of Error  $\pm 0.1$  °C

### Procedure Statement

METTLER TOLEDO Calibration SOP (Doc. No. ME-30027578) will be used as relating documentation to adjust and certify the instrument indicated in the "Type" and "Serial number" section. The measurement results of this certification were obtained in ambient conditions.

COPY

METTLER TOLEDO

Certificate Number CCP-1416-22

### Certification Tools

Certified digital voltmeter  
Manufacturer GOSSEN METRAWATT  
Control No. ANA77

Serial number ZD1740  
Certificate number E110213186  
Due date August 8, 2022

Certified Temperature  
Resistors

Manufacturer METTLER TOLEDO / ME-S182410  
Control No. ANA137

Serial number A424  
Certificate number 31344  
Due date August 25, 2023

Designation	Nominal value	Certified value
NTC 30 kΩ, 0 °C	94.880 kΩ	94.8550 kΩ
NTC 30 kΩ, 25 °C	30.000 kΩ	30.0137 kΩ
NTC 30 kΩ, 50 °C	10.869 kΩ	10.9640 kΩ
NTC 30 kΩ, 75 °C	4.528 kΩ	4.5257 kΩ
NTC 30 kΩ, 100 °C	2.070 kΩ	2.06849 kΩ
PT1000, 0 °C	1.000 kΩ	1.000158 kΩ
PT1000, 25 °C	1.0974 kΩ	1.097404 kΩ
PT1000, 50 °C	1.1940 kΩ	1.194202 kΩ
PT1000, 75 °C	1.2899 kΩ	1.290138 kΩ
PT1000, 100 °C	1.3851 kΩ	1.385061 kΩ

COPY

**Certificate Number** CCP-1416-22

Control No. CCE-1416-22/1

## Performance Test

**Company:**

EASTERN THAI CONSULTING 1892 CO., LTD.

**Address:**

683 Moo 11, Sukhaphibani 8 Rd., Nong Kham Srirachha

## Certification Measurements

Designation	Certified value	Measured value	Max. Tolerance	Passed / Failed
-1500 mV	-1500.0 mV	-1500.0 mV	0.2 mV	Passed
-1000 mV	-1000.0 mV	-999.9 mV	0.2 mV	Passed
-500 mV	-500.0 mV	-499.9 mV	0.2 mV	Passed
0 mV	0.0 mV	0.0 mV	0.2 mV	Passed
500 mV	500.0 mV	500.0 mV	0.2 mV	Passed
1000 mV	1000.0 mV	999.9 mV	0.2 mV	Passed
1500 mV	1500.0 mV	1499.9 mV	0.2 mV	Passed

pH/mV Sensor Input  
at high impedance

Designation	Measured low Imp.	Measured high Imp.	Max. Tolerance	Passed / Failed
1900 mV	1900.0 mV	1889.6 mV	0.6 mV	Passed

### Temperature Sensor Input

Occupation	Nominal value	Measured value	Max. tolerance	Passed / Failed
NTC 30 kΩ, 0 °C	0.0 °C	0.0 °C	0.1 °C	Passed
NTC 30 kΩ, 25 °C	25.0 °C	25.0 °C	0.1 °C	Passed
NTC 30 kΩ, 50 °C	50.0 °C	60.0 °C	0.1 °C	Passed
NTC 30 kΩ, 75 °C	75.0 °C	74.8 °C	0.1 °C	Passed
NTC 30 kΩ, 100 °C	100.0 °C	99.9 °C	0.1 °C	Passed
PH1000, 0 °C	0.0 °C	0.1 °C	0.1 °C	Passed
PH1000, 25 °C	25.0 °C	25.0 °C	0.1 °C	Passed
PH1000, 50 °C	50.0 °C	50.0 °C	0.1 °C	Passed
PH1000, 75 °C	75.0 °C	75.1 °C	0.1 °C	Passed
PH1000, 100 °C	100.0 °C	100.1 °C	0.1 °C	Passed

### Digital sensor input with pH Sensor

Sensor recognition	The sensor was recognized correctly by the meter	Passed
<p>1. The sensor was recognized correctly by the meter</p> <p>2. The sensor was not recognized by the meter</p>	<p>1. The sensor was recognized correctly by the meter</p> <p>2. The sensor was not recognized by the meter</p>	<p>1. The sensor was recognized correctly by the meter</p> <p>2. The sensor was not recognized by the meter</p>

### Summary of Certification

### Certification of instrument

Passed

1

The instrument referred to in this certificate has fulfilled the criteria of the certification. This is indicated by the notation Passed in the column above.

Remarks

Certification of the Instrument was performed by

Name: Pailloat Swealpanuwat

Service Engineer

Laboratory room

23

Calibration Date:

**Signature** **ELECTRONIC SIGNATURE**

**Signature** **ELECTRONIC SIGNATURE**

Remarks: The difference result of calibrated electrode should be within  $\pm 0.05$  pH

**Place:**

Laboratory room

## Calibration

February 7, 2022

Electronic Signature

Electronic Signature

[illegible]

COPI

**Primary Flow Calibrator**

**Serial No. : 110619**

## Certificate of Calibration

Customer : Eastern Thai Consulting 1992 Co., Ltd.  
Name : 683 Moo 11, Sukhaphum 8 Rd., Nongkham, Sriracha, Chonburi 20230  
Address : 683 Moo 11, Sukhaphum 8 Rd., Nongkham, Sriracha, Chonburi 20230

Certificate No : 22-AFM-016 Rev.1  
Request No : Req-2022-0122

Unit Under Calibration Details  
Measurement Item : Primary Flow Calibrator  
Manufacturer : BIOS  
Model : Defender 510-L  
Serial Number : 110619  
ID : -

Sensor Model : -  
Sensor Serial Number : -

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 21 January 2022  
Calibration Date : 27 January 2022

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	21 May 2022
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	20 May 2022

Traceability :

Units (SI)

Note :

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

This Certificate was issued to replace to Calibration Certificate No. 22-AFM-016

Calibration By : Mr. Noppadon Luangart  
Service Calibration Engineer  
Approved By : Mr. Pacht Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 11 February 2022

COPY

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

FM-708-AFM-01 Rev.00 Issue date 01/07/19

Result of Calibration :

Flow Setting (cc/min)	STD Flow Reading (cc/min)	UUC Flow Reading (cc/min)	Correction Flow (cc/min)	Uncertainty (cc/min)
20	20.73	20.697	0.03	0.69
50	49.66	49.541	0.12	0.99
100	102.7	102.93	-0.2	1.9
250	249.0	248.45	0.5	4.8
500	502.0	500.51	1.4	7.9

Note

STD : Standard

UUC : Unit Under Calibration

End of Certificate

COPY

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

FM-708-AFM-01 Rev.00 Issue date 01/07/19

**STANDARD WEIGHT 50 g**





Certificate No. : 22-052238  
Sample Code : 22-19150-003

Page 1 of 3

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapiban 8 Rd., Nongkham,  
Siracha, Chonburi 20230

Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited  
(Calibration Laboratory)

Equipment : Standard Weight 50 g

Manufacturer : METTLER TOLEDO

Class : F1

Serial No. : N/A

ID No. : LABE 10/1

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee  
Scientist  
Issue date : 31 May 2022

Approved by : ( Mr. Somchai Neampunt )

Signed for Director

The uncertainties are for a confidence probability of approximately 95%.

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

361 Soi Ladprao 122, Ladprao Road,  
Phlabphla, Wang Thonglang, Bangkok 10310  
FM-CL-007

CONTACT@AMARC.CO.TH  
WWW.AMARC.CO.TH  
Effective Date: 15/10/21

TEL 02-516-2422  
FAX 02-516-6949  
Rev.05



Certificate No. : 22-052238

Sample Code : 22-19150-003

Page 2 of 3

## REPORT OF CALIBRATION

Equipment : Standard Weight 50 g

Manufacturer : METTLER TOLEDO

Class : F1

Serial No. : N/A

ID No. : LABE 10/1

### Result of Calibration :

☒ Without adjustment

☐ Adjustment

Conventional value of the result of weighing in air. For a weight taken at a reference temperature ( $t_{ref}$ ) of 20°C, the conventional mass is the mass of a reference weight of a density ( $\rho_{ref}$ ) of 8000 kg.m<sup>-3</sup> which it balances in air of a reference density ( $\rho_0$ ) of 1.2 kg.m<sup>-3</sup>

Description	Deviation	Conventional	Expanded	Maximum	ID No.
		Mass	Uncertainty	Permissible Error	
	(mg)		(mg)	± (mg)	
50 g	-0.324	49.999676 g	0.10	0.30	LABE 10/1

The result expanded uncertainty of measurement  $U$  is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2.0$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

*[Signature]*

**COPY**

CONTACT@AMARC.CO.TH  
WWW.AMARC.CO.TH  
Effective Date: 15/10/21

TEL 02-516-2422  
FAX 02-516-6949  
Rev.03

361 Soi Ladprao 122, Ladprao Road,  
Phlabphla, Wang Thonglang, Bangkok 10310  
FM-CL-064



Certificate No. : 22-052238

Sample Code : 22-19150-003

Page 3 of 3

## REPORT OF CALIBRATION

### Condition of Calibration

1. Ambient Conditions : Temperature 20 °C ± 1.5°C, Relative humidity 50% ± 10% and air density 1.20 kg/m³

2. Calibration Method : Direct comparison weighing according to OIML R111-1 : 2004(E)

3. Reference standard Instrument

Instrument	Class	ID No.	Certificate No.	Due Date
1) Standard Weight 1 mg to 1 kg	E2	LB-WE-79	21-078366	22 September 2022

4. This certification is traceable to the International System of Unit maintained at : -

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

### 6. Description of Calibrated Item :

Type and Nominal Value :	Standard Weight 50 g
Shape :	Cylindrical weight with knob
Material :	Stainless steel
Case :	Wooden Box
Comments :	Recalibration

• End of Report •

**COPY**

**STANDARD WEIGHT 100 g**

Certificate No. : 22-052239  
Sample Code : 22-19150-004

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapiban 8 Rd., Nongkham,  
Sriracha, Chonburi 20230

Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited  
(Calibration Laboratory)

Equipment : Standard Weight 100 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/2

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee

Scientist

Issue date : 31 May 2022

The uncertainties are for a confidence probability of approximately 95%.

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

351 Soi Ladprao 122, Ladprao Road,  
Phlabphla, Wang Thonglang, Bangkok 10310  
FM-CL-007

CONTACT@AMARC.CO.TH  
WWW.AMARC.CO.TH  
Effective Date: 15/10/21

TEL 02-516-2422  
FAX 02-516-6949  
Rev.05

Certificate No. : 22-052239  
Sample Code : 22-19150-004

## REPORT OF CALIBRATION

Equipment : Standard Weight 100 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/2

### Result of Calibration :

☒ Without adjustment

☐ Adjustment

Conventional value of the result of weighing in air. For a weight taken at a reference temperature ( $t_{ref}$ ) of 20°C, the conventional mass is the mass of a reference weight of a density ( $\rho_{ref}$ ) of 8000 kg.m<sup>-3</sup> which it balances in air of a reference density ( $\rho_0$ ) of 1.2 kg.m<sup>-3</sup>

Description	Deviation	Conventional	Expanded	Maximum	ID No.
		Mass	Uncertainty	Permissible Error	
	(mg)		(mg)	± (mg)	
100 g	-0.171	99.999829 g	0.16	0.50	LABE 10/2

The result expanded uncertainty of measurement  $U$  is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2.0$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

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Effective Date: 15/10/21

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FAX 02-516-6949  
Rev.03

351 Soi Ladprao 122, Ladprao Road,  
Phlabphla, Wang Thonglang, Bangkok 10310  
FM-CL-064



Certificate No. : 22-052239

Sample Code : 22-19150-004

## REPORT OF CALIBRATION

### Condition of Calibration

1. Ambient Conditions : Temperature 20 °C ± 1.5°C, Relative humidity 50% ± 10% and air density 1.18 kg/m³

2. Calibration Method : WI-CL-007 base on OIML R 111-1 : 2004(E)

3. Reference standard instrument

Instrument	Class	ID No.	Certificate No.	Due Date
1) Standard Weight 1 mg to 1 kg	E2	LB-WE-79	21-078366	22 September 2022

4. This certification is traceable to the International System of Unit maintained at :-

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited  
(Instrument number 1).

5. Condition of Calibration item: Normal

### 6. Description of Calibrated Item :

Type and Nominal Value :	Standard Weight 100 g
Shape :	Cylindrical weight with knob
Material :	Stainless steel
Case :	Wooden Box
Comments :	Recalibration

- End of Report -

*Signature*

**COPY**

**STANDARD WEIGHT 50 g**





Certificate No. : 22-052237

Sample Code : 22-19150-002

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapiban 8 Rd., Nongkham,  
Sriracha, Chonburi 20230

Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited  
(Calibration Laboratory)

Equipment : Standard Weight 50 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/4

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee  
Scientist

Issue date : 31 May 2022

The uncertainties are for a confidence probability of approximately 95%.

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

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FM-CL-017

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Rev.05

CONTACT@AMARC.CO.TH  
WWW.AMARC.CO.TH  
Effective Date: 15/01/21

Certificate No. : 22-052237

Sample Code : 22-19150-002

## REPORT OF CALIBRATION

Equipment : Standard Weight 50 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/4

## Result of Calibration :

☒ Without adjustment

☐ Adjustment

Conventional value of the result of weighing in air. For a weight taken at a reference temperature ( $t_{ref}$ ) of 20°C, the conventional mass is the mass of a reference weight of a density ( $\rho_{ref}$ ) of 8000 kg.m<sup>-3</sup> which it balances in air of a reference density ( $\rho_a$ ) of 1.2 kg.m<sup>-3</sup>

Description	Deviation	Conventional	Expanded	Maximum	ID No.
		Mass	Uncertainty	Permissible Error	
	(mg)		(mg)	± (mg)	
50 g	-0.111	49.999889 g	0.10	0.30	LABE 10/4

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2.0, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

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FM-CL-064

CONTACT@AMARC.CO.TH  
WWW.AMARC.CO.TH  
Effective Date: 15/01/21



Certificate No. : 22-052237  
Sample Code : 22-19150-002

## REPORT OF CALIBRATION

### Condition of Calibration

1. Ambient Conditions : Temperature  $20^{\circ}\text{C} \pm 1.5^{\circ}\text{C}$ , Relative humidity  $50\% \pm 10\%$  and air density  $1.18 \text{ kg/m}^3$

2. Calibration Method : WI-CL-007 base on OIML R 111-1 : 2004(E)

3. Reference standard instrument

Instrument	Class	ID No.	Certificate No.	Due Date
1) Standard Weight 1 mg to 1 kg	E2	LB-WE-79	21-079366	22 September 2022

4. This certification is traceable to the International System of Unit maintained at : -

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

### 6. Description of Calibrated Item :

Type and Nominal Value :	Standard Weight 50 g
Shape :	Cylindrical weight with knob
Material :	Stainless steel
Case :	Wooden Box
Comments :	Recalibration

- End of Report -

**COPY**

**THERMO-HYGROMETER**

**Model : 608-H1**

**Serial No. : 45106737**



ASIA MEDICAL AND AGRICULTURAL LABORATORY  
AND RESEARCH CENTER CO., LTD.

361,361/1-4 Soi Ladprao 122, (Mahadithi 1), Ladprao Road, Phaisabha,  
Wangthonglang, Bangkok, Thailand 10310, Head Office  
Tel:(66) 2-934-2381-3 Fax:(66) 2-934-0661  
http://www.amarc.co.th Email: d@amarc.co.th



NSC-TSI-TS 17025  
CALIBRATION 0152

Certificate No. : 21-062722

Sample code : 21-24788-002

Page 1 of 2

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO.,LTD

683 Moo 11, Sukhapiban 8 Rd, Nongkham,

Sriacha, Chonburi 20230

Location of calibration : Asia Medical and Agricultural Laboratory and Research Center Co., Ltd.  
(Calibration laboratory)

Equipment : Digital thermo-hygrometer

Manufacturer : Testo

Model : 608-H1

Serial No. : 45106737

ID No. : LABE 09/7

Date of receipt : 23 July 2021

Date of calibration : 29 July 2021

Condition of calibration

1 Environment Ambient temperature : 23.0 °C ± 3.0 °C

Relative humidity : 55.0 % ± 15.0 %

2 Calibration method

2.1 In-house method : WI-CI-045 By comparison with thermometer standard / chilled mirror hygrometer in controlled chamber.

2.2 The calibration by comparison unit under calibration (UUC) to the thermometer standard / chilled mirror hygrometer

3 Reference standard instrument

In controlled chamber in a chamber at the controlled temperature/ relative humidity.

4 This certificate is traceable to the international system of unit (SI Unit)

4.1 Instrument No.3.1 through : National Institute of Metrology (Thailand)

4.2 Instrument No.3.2 and 3.3 through : Asia Medical and Agricultural Laboratory and Research Center Co., Ltd.

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

6 Condition of calibration item : Normal

Calibrated by

Miss Pornsuda Lohabai

Scientist

Date of issue

11 August 2021

Approved by

( Mr. Somchai Neampunt )

Signed for Director

The uncertainties are for a confidence probability of approximately 95%.

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Co., Ltd. (AMARC)

FM-CL-114

Rev.00

Effective Date: 04/05/21



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NSC-TSI-TS 17025  
CALIBRATION 0152

Certificate No. : 21-062722

Sample code : 21-24788-002

Page 2 of 2

## REPORT OF CALIBRATION

Results of calibration

- Temperature measurement

Resolution of unit under calibration : 0.1 °C

Range : 0 °C to 50 °C

Calibration point °C	Average of standard reading		Unit under calibration		Expanded uncertainty °C
	Controlled humidity %RH	Temperature °C	Average reading °C	Correction value °C	
20	50	20.02	20.1	- 0.08	± 0.40
25	50	25.02	25.0	+ 0.02	± 0.40
30	50	30.00	29.7	+ 0.30	± 0.40

- Humidity measurement

Resolution of unit under calibration : 0.1 %RH

Range : 10 %RH to 95 %RH

Calibration point %RH	Average of standard reading		Unit under calibration		Expanded uncertainty %RH
	Air temperature °C	Calculated humidity %RH	Average reading %RH	Correction value %RH	
45	25.00	45.13	52.4	- 7.27	± 1.3
60	25.00	60.03	67.5	- 7.47	± 1.5
75	25.00	75.20	82.5	- 7.30	± 1.7

Note

- Calibration results without adjustment

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2.00, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003.

End of report

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FM-CL-018

Rev.08

Effective Date: 04/05/21

UV/VIS SPECTROPHOTOMETER

Model : UV – 1800

Serial No. : A11635101643CD



**Bara Scientific Co., Ltd.**  
968 U Chu Liang Building Floor 7 Rama4 Road  
Silom Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barascientific.com

# Certificate of Calibration

Number of Page(s) 1 of 3

**Certificate No.** BS00-UV-152/21  
**Equipment** UV/Vis Spectrophotometer  
**Model** UV-1800  
**Manufacturer** Shimadzu  
**Serial No.** A11635101643CD  
**ID No.** LABE 03/2  
**Date of receipt** 24 May 2021  
**Date of calibration** 24 May 2021  
**Date of issue** 1 June 2021

**Customer name** Eastern Thai Consulting 1992 Co., Ltd.  
**Address** 683 Moo 11, Sukkaphapharn 8 Rd., Nongkham, Sistracha, Chonburi 20230

**Temperature** (20.1-22.2) °C (On site)  
**Humidity** (43.9-49.2) %RH (On site)

**Equipment condition** Good Operation

**Calibration Location** Analysis Department.

**Calibration Procedure** In-house method WI-UV-702-01 based on ASTM E275-01

**Traceability** Wavelength Accuracy is traceable to certificate No. 87839 and 87844  
Photometric Accuracy is traceable to certificate No. 87846 and 87877  
Stray Light is traceable to certificate No. 87825  
The above certificate are traceable to SI unit through Stama Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)

**Calibrated by** Mr. Kanchit Choothep

Approved by

**Mr. Kanchit Choothep**  
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / Certificate  
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# Certificate of Calibration

Number of Page(s) 2 of 3

**Certificate No.** BS00-UV-152/21

**Calibration Results:**

**1. Wavelength Accuracy**

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (nm)
287.71	287.70	-0.01	0.18
445.82	445.85	0.03	0.18
536.52	536.45	-0.07	0.18
741.02	741.05	0.03	0.18
879.41	879.35	-0.06	0.18

**2. Photometric Accuracy (UV)**

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (A)
235	0.0000	0.0000	0.0000	0.0075
257	0.7174	0.7178	0.0004	0.0075
313	CNR	CNR	CNR	CNR
350	CNR	CNR	CNR	CNR

\*CNR = Customer not request

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# Certificate of Calibration

Certificate No.

BSCC-UV-152/21

Number of Page(s)

3 of 3

Calibration Results:

## 3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5631	0.5616	-0.0016	0.0042
	0.7390	0.7376	-0.0014	0.0042
440.0	1.0863	1.0846	-0.0017	0.0042
	0.0000	0.0000	0.0000	0.0042
	0.5524	0.5501	-0.0023	0.0042
465.0	0.7217	0.7199	-0.0018	0.0042
	1.0606	1.0587	-0.0019	0.0042
	CNR	CNR	CNR	CNR
546.1	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
590.0	0.0000	0.0000	0.0000	0.0042
	0.5147	0.5124	-0.0023	0.0042
	0.6743	0.6720	-0.0023	0.0042
635.0	0.9909	0.9882	-0.0027	0.0042
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
635.0	0.0000	0.0000	0.0000	0.0042
	0.5268	0.5271	0.0003	0.0042
	0.6720	0.6708	-0.0012	0.0042
0.9864		0.9854	-0.0010	0.0042

\*CNR = Customer not request

## 4. Stray Light\*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)	
	Wavelength (nm)	Absorbance (A)
200.86±0.11nm	201.05	2.0123

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A

\*Stray Light not NSC-ONSC Accredited.

The measurement uncertainty is base on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

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

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate. Adversing the report / Certificate and publicity of the results are prohibited and also that not be responsible except in full, without written approval of the Bara Scientific Co., Ltd.

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**UV/VIS SPECTROPHOTOMETER**

**Model : UV – 1800**

**Serial No. : A11635101643CD**



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Silom Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375486-7  
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## Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-167722  
Equipment UVVis Spectrophotometer  
Model UV-1800  
Manufacturer Shimadzu  
Serial No. A11635101643 CD  
ID No. LABE 032  
Date of receipt 18 May 2022  
Date of calibration 18 May 2022  
Date of issue 25 May 2022

Customer name Eastern Thai Consulting 1992 Co., Ltd.  
Address 683 Moo 11, Sukkaphibarn 8 Rd., Nongkham, Sistracha, Chonburi 20230.

Temperature (23.8-24.5) °C (On site)  
Humidity (47.6-48.3) %RH (On site)

Equipment condition Good Operation  
Calibration Location Analysis Department  
Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01  
Traceability Wavelength Accuracy is traceable to certificate No. 96387 and 96386  
Photometric Accuracy is traceable to certificate No. 99825 and 100147  
Stray Light is traceable to certificate No. 96346  
The above certificate are traceable to SI unit through Sianna Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Kandhit Choothep  
Approved by   
Mr.Kanchit Choothep  
Technical Manager

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FM-UV-708-02 Rev.01 (230763)



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Tel : 02-6324300 Fax : 02-6375486-7  
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## Certificate of Calibration

Number of Page(s) 2 of 3

Certificate No. BSCC-UV-167722  
Calibration Results :  
1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
287.71	287.80	0.09	0.18
445.82	445.95	0.13	0.18
536.52	536.60	0.08	0.18
741.02	741.00	-0.02	0.18
879.41	879.40	-0.01	0.18

### 2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000	0.0000	0.0000	0.0075
	0.7311	0.7321	0.0010	0.0075
257	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
313	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
350	0.0000	0.0000	0.0000	0.0075
	0.6306	0.6314	0.0008	0.0075

\*CNR = Customer not request

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FM-UV-708-02 Rev.01 (230763)



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Silom Bangkok Bangkok 10500  
Tel : 02-6324300 Fax : 02-6375486-7  
www.barascientific.com



# Certificate of Calibration

3 of 3

Number of Page(s)

Certificate No. BSCC-UV-16722

Calibration Results:

## 3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5472	0.5461	0.0009	0.0042
	0.7637	0.7636	-0.0001	0.0042
	1.0480	1.0497	0.0017	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5371	0.5377	0.0006	0.0042
	0.7451	0.7451	-0.0006	0.0042
	1.0233	1.0240	0.0016	0.0042
465.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
546.1	0.0000	0.0000	0.0000	0.0042
	0.5006	0.5006	0.0000	0.0042
	0.6961	0.6944	-0.0017	0.0042
	0.9563	0.9550	-0.0013	0.0042
590.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
635.0	0.0000	0.0000	0.0000	0.0042
	0.5137	0.5137	0.0000	0.0042
	0.6907	0.6891	-0.0016	0.0042
	0.9533	0.9519	-0.0014	0.0042

\*CNR = Customer not request

## 4. Stray Light\*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)	
	Wavelength (nm)	Absorbance (A)
200.91±0.11nm	201.10	0.9543
		2.0204

The Stray light transmission reference is less than 1.0% and Stray light absorbance reference is greater than 2.00A

\*Stray Light not NSC-ONSC Accredited.

The measurement uncertainty is base on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

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

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The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate. Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced except in full, without written approval of the Bara Scientific Co., Ltd.

FM-UV-708-02 Rev.01 (2300163)

**SOUND LEVEL CALIBRATOR**

**MODEL : NC-75**

**SERIAL No. : 34802645**



TISTR



TISTR

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0018

MTC No. EEL. BP. 24/1064

## CALIBRATION CERTIFICATE

Submitted by : Eastern Thai Consulting 1992 Co., Ltd.

Address : 683 Moo 11 Sukaphibal 8 Rd., Nongkham, Sriracha, Chonburi 20230.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : Rion

Model : NC-75

Serial No. : 34802645

## Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

Standards used :

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.

2. Measuring Amplifier Bruel&amp;Kjaer 2636 S/N 1537484.

3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.

4. Digital Multimeter Agilent 34401A S/N MY44005560.

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Keithley 2015-P S/N 4106495.

7. Condenser Microphone B&amp;K 4180 S/N 2889871.

**Calibration Procedure:** CP-102-04 based on IEC 60942-2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 11 Oct. 2021

Date of Calibration : 21 Oct. 2021

The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Office

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FM.BLMTC.002 Rev.4



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Request No. 21-65/0018

MTC No. EEL. BP. 24/1064

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%.

Nominal Output of Unit Under Test = 94 dB re 20μPa at 1000 Hz

Acoustic Output in dB re 20μPa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

## 1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit
1/2 inch B&K 4180	93.97	-0.03	± 0.10	±0.40 dB

## 2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit
1/2 inch B&K 4180	1000.0	0.0	± 1.5	±1.0%

## 3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit
1/2 inch B&K 4180	0.50	± 0.50	±3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Deechaiyae)

Approved by :



(Mr. Prawat Khuyap)  
Acting Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref: 201.1264.101.104.187003

End of Certificate

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**SOUND LEVEL METER**

**MODEL : CR:172A**

**SERIAL No. : G300957**



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0101

MTC No. EEL. BP. 62/1164

## CALIBRATION CERTIFICATE

**Submitted by** : Eastern Thai Consulting 1992 Co., Ltd.  
**Address** : 683 Moo 11 Sukaphibal 8 Rd., Nongkham, Siracha, Chonburi 20230.  
**Calibrated at** : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

### Instrument Calibrated :

Description	Sound Level Meter	Ambient Environment
Manufacturer	Cirrus	Temperature : $(23 \pm 3) ^\circ\text{C}$ Relative Humidity : $(50 \pm 15) \%$
Model	CR:172A	Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$
Serial No.	G300957 (No.28)	
Microphone	Cirrus MK216 No.412415B	
Preamplifier	No.9371F	

### Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2995571.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 17 Nov. 2021

Date of Calibration : 13-14 Dec. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0101

MTC No. EEL. BP. 62/1164

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tamoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

### Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a level of confidence of approximately 95%.

Date of Calibration : 13-14 Dec. 2021

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### 1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test			Tolerance Limit Class 2 (±dB)
	Measured Value (dB)	Deviation (dB)	Uncertainty (±dB)	
93.75	Before adjust 95.1	After adjust 93.7	0.0	0.50
			0.0	1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 93.7 dB.

### 2. Self-generated noise

#### 2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
16.4	0.10

#### 2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	under-range	-
C-Weighting	20.0	0.10
Flat	29.5	0.10

Note: The under-range means the indicator cannot display the value because it is under the setting range 20-140 dB.

Date of Calibration : 13-14 Dec. 2021

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### 3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)	
125	0.1	0.0	-0.2	0.40
1 000	-0.6	-0.6	-0.6	0.40
4 000	0.2	0.4	0.3	0.40
				2.0
				1.4
				3.6

### 4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)	
63	0.4	0.2	0.2	0.20
125	0.3	0.1	0.1	0.20
250	0.2	0.1	0.1	0.20
500	0.1	0.0	0.0	0.20
1 000	0.0	0.0	0.0	0.20
2 000	-0.2	0.0	0.0	0.20
4 000	-0.3	-0.1	0.0	0.20
8 000	-0.5	-0.3	-0.1	0.20
				2.5
				2.0
				1.9
				1.9
				1.4
				2.6
				3.6
				5.6

Date of Calibration : 13-14 Dec. 2021

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
A-weighting	114.0	0.0	0.20	0.4
C-weighting	114.0	0.0	0.20	0.4
Flat	114.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Fast	114.0	0.0	0.20	0.3
Slow	114.0	0.0	0.20	0.3
Leq	114.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
139	139.0	0.0	0.30	1.4
134	134.0	0.0	0.30	1.4
129	129.0	0.0	0.30	1.4
124	124.0	0.0	0.30	1.4

Date of Calibration : 13-14 Dec. 2021

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6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
119	119.0	0.0	0.30	1.4
114	114.0	0.0	0.30	1.4
109	109.0	0.0	0.30	1.4
104	104.0	0.0	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	83.9	-0.1	0.30	1.4
79	79.0	0.0	0.30	1.4
74	74.0	0.0	0.30	1.4
69	69.0	0.0	0.30	1.4
64	64.0	0.0	0.30	1.4
59	59.0	0.0	0.30	1.4
54	53.9	-0.1	0.30	1.4
49	49.0	0.0	0.30	1.4
44	44.0	0.0	0.30	1.4
39	39.1	0.1	0.30	1.4
34	34.0	0.0	0.30	1.4
29	29.1	0.1	0.30	1.4
24	24.1	0.1	0.30	1.4

Date of Calibration : 13-14 Dec. 2021

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7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
20-140	135	135.0	0.0	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (dB)
Fast	200	136.0	0.0	0.20	±1.3
	2	118.9	-0.1	0.20	+1.3; -2.8
	0.25	109.9	-0.1	0.20	+1.8; -5.3
Slow	200	129.6	0.0	0.20	±1.3
	2	110.0	0.0	0.20	+1.3; -5.3
	200	129.6	-0.4	0.20	±1.3
SEL	2	110.0	0.0	0.20	+1.3; -2.8
	0.25	100.9	-0.1	0.20	+1.8; -5.3

Date of Calibration : 13-14 Dec. 2021

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9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Complete cycle	135.4	135.6	0.2	0.20	2.4
Positive half cycle	134.4	134.2	-0.2	0.20	1.4
Negative half cycle	134.4	134.2	-0.2	0.20	1.4

10. Overload indication

Measured value (dB)	Deviated value (dB)		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	Positive	Negative		
one-half cycle	139.2	139.1	0.1	1.8

Calibrated by :

*Paanya Phasingiri*  
(Mr. Paanya Phasingiri)

(Mr. Tawikiat Iamsamran)

Date of Calibration : 13-14 Dec. 2021

Date of Issue : 15 Dec. 2021

Approved by :

*Paanya Phasingiri*  
(Mr. Paanya Phasingiri)

Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Ref: 2011264111704770004

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**SOUND LEVEL METER**

**MODEL : NL-21**

**SERIAL No. : 00209079**





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0485

MTC No. EEL BP. 34/0464

## CALIBRATION CERTIFICATE

Submitted by : Eastern Thai Consulting 1992 Co., Ltd.

Address : 683 Moo 11 Sukaphibal 8 Rd., Nongkham, Sriracha, Chonburi, 20230.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A Muang, Samutprakan 10280.

### Instrument Calibrated :

Description : Sound Level Meter  
Manufacturer : Rion  
Model : NL-21  
Serial No. : 00209079 (No.17)  
Microphone : Type UC-52 No.147767  
Preamplifier : Type NH-21 No.34626

### Standards used :

1. Band Pass Filter Stamford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 19 Apr. 2021

Date of Calibration : 5-13 May 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0485

MTC No. EEL BP. 34/0464

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.

10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.

11. Digital Multimeter Agilent 34401A S/N MY44005560.

12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

### Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a level of confidence of approximately 95%.

Date of Calibration : 5-13 May 2021

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### 1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test		Tolerance Limit Class 2 (±dB)
	Measured Value (dB)	Deviation (dB)	
113.91	Before adjust 113.6	After adjust 113.9	0.0 0.30 1.4

**Note:** The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 115.7 dB.

### 2. Self-generated noise

#### 2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
19.8	0.10

#### 2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	14.3	0.10
C-Weighting	18.5	0.10
Flat	25.0	0.10

Date of Calibration : 5-13 May 2021

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FM.BLMTC.002 Rev.4

### 3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.0	0.1	0.1	2.0
1 000	-0.1	-0.1	0.1	1.4
4 000	-0.7	-0.7	0.40	3.6

### 4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)		
63	-0.1	-0.2	0.20	2.5
125	-0.1	-0.1	0.0	2.0
250	-0.1	0.0	0.0	1.9
500	0.0	0.0	0.0	1.9
1 000	0.0	0.0	0.0	1.4
2 000	0.0	0.1	0.1	2.6
4 000	0.0	0.1	0.1	3.6
8 000	0.2	0.3	0.1	5.6

Date of Calibration : 5-13 May 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0485

MTC No. EEL. BP. 34/0464

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
125	125.0	0.0	0.30	1.4
124	124.0	0.0	0.30	1.4
123	123.0	0.0	0.30	1.4
122	122.0	0.0	0.30	1.4
121	121.0	0.0	0.30	1.4
120	120.0	0.0	0.30	1.4
119	119.0	0.0	0.30	1.4
114	114.0	0.0	0.30	1.4
109	109.0	0.0	0.30	1.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0485

MTC No. EEL. BP. 34/0464

6. Level linearity on the reference level range (con.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
104	104.0	0.0	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	84.1	0.1	0.30	1.4
79	79.1	0.1	0.30	1.4
74	74.0	0.0	0.30	1.4
69	69.0	0.0	0.30	1.4
64	64.0	0.0	0.30	1.4
59	59.0	0.0	0.30	1.4
54	54.0	0.0	0.30	1.4
49	49.0	0.0	0.30	1.4
44	44.0	0.0	0.30	1.4
39	38.9	-0.1	0.30	1.4
34	33.9	-0.1	0.30	1.4
33	32.9	-0.1	0.30	1.4
32	31.9	-0.1	0.30	1.4
31	30.9	-0.1	0.30	1.4
30	29.9	-0.1	0.30	1.4
29	28.8	-0.2	0.30	1.4
28	27.8	-0.2	0.30	1.4

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Request No. 21-64/0485

MTC No. EEL BP. 34/0464

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
		Value	Deviated Value		
40-130	125	124.9	-0.1	0.30	1.4
30-120	115	115.0	0.0	0.30	1.4
20-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4
20-90	85	85.1	0.1	0.30	1.4
20-80	75	75.1	0.1	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration (ms)	Measured Value (dB)		Uncertainty (±dB)	Tolerance Limits Class 2 (dB)
		Value	Deviated Value		
Fast	200	116.0	0.0	0.20	±1.3
	2	99.0	0.0	0.20	+1.3; -2.8
	0.25	89.9	-0.1	0.20	+1.8; -5.3
Slow	200	109.6	0.0	0.20	±1.3
	2	90.0	0.0	0.20	+1.3; -5.3
SEL	200	110.0	0.0	0.20	±1.3
	2	90.0	0.0	0.20	+1.3; -2.8
	0.25	80.9	-0.1	0.20	+1.8; -5.3

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Request No. 21-64/0485

MTC No. EEL BP. 34/0464

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance limits Class 2 (±dB)
Complete cycle	125.4	125.0	-0.4	0.20	2.4
Positive half cycle	124.4	124.1	-0.3	0.20	1.4
Negative half cycle	124.4	124.1	-0.3	0.20	1.4

10. Overload indication

Measured value (dB)	Deviated value (dB)		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	Positive one-half cycle	Negative one-half cycle		
135.7		135.7	0.0	0.30
				1.8

Calibrated by :

*Yongkiet Laohasiri*  
(Mr. Komkrit Laohasiri)

Approved by :



(Mr. Komkrit Laohasiri)

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 5-13 May 2021

Date of Issue : 14 May 2021

Ref : 2011264041901629003

End of Certificate

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FM.BLMTC.002 Rev.4

**SOUND LEVEL METER**

**MODEL : NL-21**

**SERIAL No. : 00310455**



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0842

MTC No. EEL BP. 48/0964

## CALIBRATION CERTIFICATE

Submitted by : Eastern Thai Consulting 1992 Co.,Ltd.

Address : 683 Moo 11 Sukaphibal 8 Rd., Nongkham, Sriracha, Chonburi, 20230.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

### Instrument Calibrated :

Description : Sound Level Meter

Manufacturer : Rion

Model : NL-21

Serial No. : 00310455 (No.9)

Microphone : Type UC-52 No.186082

Preamplifier : Type NH-21 No.34622

### Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

**Ambient Environment**  
Temperature :  $(23 \pm 3) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 15) \%$   
Ambient Pressure :  $(101.325 \pm 1.5) \text{ kPa}$

Date of Receipt : 14 Sep. 2021

Date of Calibration : 20-22 Sep. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0842

MTC No. EEL BP. 48/0964

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.

10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.

11. Digital Multimeter Agilent 34401A S/N MY44005560.

12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

### Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a level of confidence of approximately 95%.

Date of Calibration : 20-22 Sep. 2021

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FM.BL.MTC.002 Rev

### 1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance Limit Class 2 (±dB)
	Measured Value (dB)		Deviation (dB)	Uncertainty (+dB)	
	Before adjust	After adjust			
	113.94	114.4			

**Note:** The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 115.9 dB.

### 2. Self-generated noise

#### 2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
17.5	0.10

#### 2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	14.1	0.10
C-Weighting	19.2	0.10
Flat	26.3	0.10

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### 3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.4	0.5	0.4	0.40	2.0
1 000	-0.4	-0.4	-0.4	0.40	1.4
4 000	0.1	0.1	0.1	0.40	3.6

### 4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.0	0.0	-0.1	0.20	2.5
125	-0.1	0.0	-0.1	0.20	2.0
250	-0.1	0.0	0.0	0.20	1.9
500	0.0	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	0.1	0.1	0.2	0.20	2.6
4 000	0.1	0.2	0.1	0.20	3.6
8 000	0.3	0.3	0.1	0.20	5.6

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
125	125.0	0.0	0.30	1.4
124	124.1	0.1	0.30	1.4
123	123.1	0.1	0.30	1.4
122	122.1	0.1	0.30	1.4
121	121.0	0.0	0.30	1.4
120	120.0	0.0	0.30	1.4
119	119.0	0.0	0.30	1.4
114	114.0	0.0	0.30	1.4
109	109.0	0.0	0.30	1.4

Date of Calibration : 20-22 Sep. 2021

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FMBL-MTC.002 Re

6. Level linearity on the reference level range (continue)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
104	104.0	0.0	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	84.1	0.1	0.30	1.4
79	79.0	0.0	0.30	1.4
74	74.1	0.1	0.30	1.4
69	69.1	0.1	0.30	1.4
64	64.0	0.0	0.30	1.4
59	59.0	0.0	0.30	1.4
54	54.0	0.0	0.30	1.4
49	49.0	0.0	0.30	1.4
44	44.0	0.0	0.30	1.4
39	38.9	-0.1	0.30	1.4
34	34.0	0.0	0.30	1.4
33	33.0	0.0	0.30	1.4
32	32.0	0.0	0.30	1.4
31	31.0	0.0	0.30	1.4
30	30.0	0.0	0.30	1.4
29	28.9	-0.1	0.30	1.4
28	27.9	-0.1	0.30	1.4

Date of Calibration : 20-22 Sep. 2021

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FMBL-MTC.002 Re

Request No. 21-64/0842

MTC No. EEL. BP. 48/0964

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
40-130	125	125.0	0.0	0.30	1.4
30-120	115	115.0	0.0	0.30	1.4
20-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4
20-90	85	85.0	0.0	0.30	1.4
20-80	75	75.1	0.1	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (dB)
Fast	200	116.0	0.0	0.20	±1.3
	2	98.9	-0.1	0.20	+1.3; -2.8
	0.25	89.9	-0.1	0.20	+1.8; -5.3
Slow	200	109.6	0.0	0.20	±1.3
	2	90.0	0.0	0.20	+1.3; -5.3
	200	110.0	0.0	0.20	±1.3
SEL	2	90.0	0.0	0.20	+1.3; -2.8
	0.25	80.8	-0.2	0.20	+1.8; -5.3

Date of Calibration : 20-22 Sep. 2021

The results relate only to the items tested/calibrated or value assigned.

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FM.BL.MTC.002 Re

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Request No. 21-64/0842

MTC No. EEL. BP. 48/0964

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance limits Class 2 (±dB)
Complete cycle	125.4	125.0	-0.4	0.20	2.4
Positive half cycle	124.4	124.1	-0.3	0.20	1.4
Negative half cycle	124.4	124.1	-0.3	0.20	1.4

10. Overload indication

Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Positive one-half cycle	135.6	0.1	0.30
135.7			1.8

Calibrated by :

*Panya Phasing Sri*  
(Mr. Panya Phasing Sri)

Approved by :

*T. K. S.*  
(Mr. Tawakiat Iamsamran)

(Mr. Panya Phasing Sri)

(Mr. Tawakiat Iamsamran)

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Center

Date of Calibration : 20-22 Sep. 2021

Date of Issue : 6 Oct. 2021

Ref : 2011264091403815002

End of Certificate

8 / 8

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FM.BL.MTC.002 Re

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**NOISE DOSIMETER**

**MODEL : NP-DLX**

**SERIAL No. : NXQ070006**



## Certificate of Calibration

### Customer

Name : Eastern Thai Consulting 1992 Co., Ltd. Certificate No : 21-ACT-359  
Address : 683 Moo 11, Sukkapibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230 Request No : Req-2021-1237

### Unit Under Calibration Details

Measurement item : Noise dosimeter Microphone Class : 2

Manufacturer : 3M Microphone Model : -

Model : NP-DLX Microphone S/N : -

Serial Number : NXQ070006 Preamplifier Model : -

ID : - Preamplifier S/N : -

Resolution : 0.1 dB Instrument Status : Used

### Calibration Environment and Details

Temperature : 23 °C ± 2 °C

Humidity : 50 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 14 September 2021

Calibrated Date : 14 September 2021

Calibration Procedure : In-house method CP-NDM4-01 based on IEC 61252 : 2017

Location of Calibration : Lab Acoustic

### Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	188272	14 June 2022	TSI
Standard Microphone	GRAS	40AN	188273	29 October 2021	GRAS
Sine Generator	Svanlek	Svan401	131	30 September 2021	WIK Electric
Timer	EXTECH	-	05-ACT	29 March 2022	TPA

### Note

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

Calibrated By :

Mr. Noppadon Luangart  
Calibration Officer

Approved By :

Mr. Pacit Mahavorn  
Calibration Engineer Supervisor

Issue Date :

14 September 2021

**COPY**

### 1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement		UNCERTAINTY (%)	Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (Pa <sup>2</sup> h)	UUC (Pa <sup>2</sup> h)		
FAST / A / 70-140	120.00	120	3.63	3.65	3.0	-21, +26
Calibrator Setting						
1000 Hz 114 dB						

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

### 2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY (± dB)	Tolerances Limit (± dB)
	A	C		
FAST / 70-140				
STD Setting				
*63 Hz	-0.4	-0.2	0.40	2.0
125 Hz	0.1	0.3	0.40	1.5
250 Hz	0.3	0.4	0.40	1.5
500 Hz	0.2	0.3	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	-0.3	-0.3	0.40	2.0
4000 Hz	-1.4	-1.4	0.40	3.0
8000 Hz	-1.4	-1.5	0.40	5.0

**COPY**

Certificate No : 21-ACT-359  
Request No : Req-2021-1237

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting	Ref	(dB)	FAST / A / High									
			70.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0	
1000 Hz	Level A	(dB)	70.5	80.2	90.1	100.1	110.0	114.0	120.0	130.0	140.2	
	Error	(dB)	0.5	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.2	
	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9	
8000 Hz	Level A	(dB)			89.1	99.1	109.0	112.9	118.9	128.9	138.9	
	Error	(dB)			0.2	0.2	0.1	0.0	0.0	0.0	0.0	
	Ref	(dB)						87.8	93.8	103.8	113.8	
63 Hz	Level A	(dB)						87.8	93.7	103.7	113.7	
	Error	(dB)						0.0	-0.1	-0.1	-0.1	
	Tolerances Limit	(±dB)						1.0				
UNCERTAINTY		(±dB)						0.27				

b. Sound exposure meter linearity of error

UUC Setting	Ref	(s)	Time		UUC	(s)	Exposure Measurement				UNCERTAINTY	Tolerances Limit (%)
			Ref	(s)			Ref	(Pa <sup>2</sup> h)	UUC	(Pa <sup>2</sup> h)		
FAST / A / 70-140	Calibrator Setting	1000 Hz 110 dB	27	27	27	27	0.30	0.30	0.30	0.00	4.3	-21, +26
			45	45	45	45	0.50	0.50	0.50	0.00		
1000 Hz 110 dB		1000 Hz 110 dB	90	90	90	90	1.00	1.00	1.00	0.00	3.8	
			180	180	180	180	2.00	1.99	1.99	-0.50		
1000 Hz 120 dB		1000 Hz 120 dB	36	36	36	36	4.00	3.99	3.99	-0.25		
			72	72	72	72	8.00	7.98	7.98	-0.25		
1000 Hz 120 dB		1000 Hz 120 dB	90	90	90	90	10.00	9.97	9.97	-0.30		
			180	180	180	180	20.00	19.95	19.95	-0.25		
1000 Hz 120 dB		1000 Hz 120 dB	360	360	360	360	40.00	39.89	39.89	-0.27		
			720	720	720	720	80.00	79.78	79.78	-0.27		

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FM-708-NDM-01 Rev 0 Issue date 01/07/19

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Certificate No : 21-ACT-359  
Request No : Req-2021-1237

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
	Ref	UUC	Ref	UUC	Error		
FAST / A / 70-140	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>3</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	Limit
Calibrator Setting							(Pa <sup>2</sup> h)
4000 Hz 95 dB	2846	2846	00	0.99	-0.01	0.31	-0.29 - 0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (Pa <sup>2</sup> ·h)	UUC (Pa <sup>2</sup> ·h)	Error (%)		
FAST / A / 70-140	Calibrator Setting	2846	2846	1.00	-1.00	3.0	-21 - +26
Burst 1 ms, 95 dB				0.99			
Burst 1 ms, 100 dB		900	900	1.00	-1.00		
Burst 1 ms, 108 dB		143	143	1.00	0.00		

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement		UNCERTAINTY	Tolerances Limit (%)
	UUC		UUC	Different (%)		
FAST / A / 70-140						
Calibrator Setting		(s)		(Pa <sup>2</sup> h)		
Continuous Rectangle +	6		10.12		2.4	-21 - +26
Continuous Rectangle -			10.10			

End of Certificate

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FM-708-NDM-01 Rev 0 Issue date 01/07/19

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**NOISE DOSI METER**

**MODEL : NP-DLX**

**SERIAL No. : NXL060045**

Certificate No	21-ACT-420 Rev.1
Request No	Reg-2021-1437

Name : Eastern Thai Consulting 1992 Co., Ltd.  
 Request No : 21-ACT-420 Rev1  
 Request No : Rec-2021-1437  
 2021 May 11 Sukhothai 8 Rd. Nonthaburi Sriracha Chonburi 20730

Measurement item :	Noise Dosimeter	Microphone Class :	2
Manufacturer	3M	Microphone Model :	-
Model	NF-DLX	Microphone S/N :	-
Serial Number	NXL060045	Preamplifier Model :	-
ID	-	Preamplifier S/N :	-
		Instrument Status :	Used

Calibration Environment and Details  
Temperature :  $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$

Cellulose Derivatives, In-house method CP-NDM-01 based on IEC 61252:2017

Reference Standard		Brand	Model	SN	Due calibration	Traceability
Instrument	Multifrequency Calibrator	Quest	Quest-cal	188272	14 June 2022	TSI
	Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
	Signal Generator	Svantek	Svan401	131	18 October 2022	WK Electric
Tuner		EXTECH	-	05-ACT	29 March 2022	TPA

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

Approved By: Mr. Pacit Mathavorn  
Calibration Engineer Supervisor  
Issue Date: 23 November 2021

Mr. Pacit Mathavorn  
Calibration Engineer Supervisor  
23 November 2021

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.  
EIM-705-NTM-01

Certificate No : 21-ACT-420 Rev.1  
Request No : Req-2021-1437

### 3. Linearity of response to steady signals

#### a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting	FAST / A / High									
	Ref	(dB)	70.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0 140.0
1000 Hz	Level A	(dB)	70.0	79.9	90.0	100.0	110.0	114.0	120.0	130.0 140.0
	Error	(dB)	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9 138.9
8000 Hz	Level A	(dB)			89.0	99.0	109.0	112.9	118.9	128.9 138.8
	Error	(dB)			0.1	0.1	0.1	0.0	0.0	0.0 -0.1
	Ref	(dB)						87.8	93.8	103.8 113.8
63 Hz	Level A	(dB)						87.8	93.8	103.8 113.8
	Error	(dB)						0.0	0.0	0.0 0.0
Tolerances Limit	(±dB)							1.0		
UNCERTAINTY	(±dB)							0.27		

#### b. Sound exposure meter linearity of error

UUC Setting	Time				Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (Pa h)	UUC (Pa h)	Error (%)				
FAST / A / 70-140									
Calibrator Setting									
1000 Hz 110 dB	27	27	0.30	0.30	0.00				
1000 Hz 110 dB	45	45	0.50	0.50	0.00				
1000 Hz 110 dB	90	90	1.00	0.99	-1.00		4.3		
1000 Hz 110 dB	180	180	2.00	1.99	-0.50				
1000 Hz 120 dB	36	36	4.00	3.99	-0.25				-21, +26
1000 Hz 120 dB	72	72	8.00	7.98	-0.25				
1000 Hz 120 dB	90	90	10.00	9.98	-0.20				
1000 Hz 120 dB	180	180	20.00	19.96	-0.20		3.8		
1000 Hz 120 dB	360	360	40.00	39.90	-0.25				
1000 Hz 120 dB	720	720	80.00	79.80	-0.25				

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FN-108-NDA-01 Rev.0 Issue date 01/07/19

Certificate No : 21-ACT-420 Rev.1  
Request No : Req-2021-1437

### 4. Response to short duration

#### a. Response for sinusoidal signals - reference level

UUC Setting	Time			Exposure Measurement			Tolerances Limit (Pa h)
	Ref (s)	UUC (s)	Ref (Pa h)	UUC (Pa h)	Error (Pa h)	UNCERTAINTY (Pa h)	
FAST / A / 70-140							
Calibrator Setting							
4000 Hz 95 dB	2846	2846	1.00	0.93	-0.02	0.0	-0.25 - +0.41

#### b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time			Exposure Measurement			Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (Pa h)	UUC (Pa h)	Error (%)	UNCERTAINTY (%)	
FAST / A / 70-140							
Calibrator Setting							
Burst 1 ms, 95 dB	2846	2846	1.00	0.98	-2.00		-21 - +26
Burst 1 ms, 100 dB	900	900	1.00	0.98	-2.00	3.0	-21 - +41
Burst 1 ms, 108 dB	143	143	1.00	0.99	-1.00		-21 - +41

#### 5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement		UNCERTAINTY (%)	Tolerances Limit (%)
	Ref (s)	UUC (s)	UUC (Pa h)	Different (%)		
FAST / A / 70-140						
Calibrator Setting						
Continuous Rectangle +		6	10.35	+0.01	2.4	-21 - +26
Continuous Rectangle -			10.36			

End of Certificate

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FN-108-NDA-01 Rev.0 Issue date 01/07/19

**NOISE DOSI METER**

**MODEL : TES-1355**

**SERIAL No. : 070204292**





## Certificate of Calibration

### Customer

Name : Eastern Thai Consulting 1992 Co., Ltd.  
Address : 683 Moo 11, Sukhaphibam 8 Rd., Nongkham, Sriracha,  
Chonburi 20230  
Certificate No : 21-ACT-222  
Request No : Req-2021-0681

### Unit Under Calibration Details

Calibration Parameter : Noise Dosimeter  
Manufacturer : TES  
Model : TES-1355  
Serial Number : 70204292  
ID : -  
Microphone Class : 2  
Microphone model : -  
Microphone S/N : -  
Instrument Status : Used  
Resolution : 0.1 dB

### Calibration Environment and Details

Temperature : 23°C ±3°C  
Humidity : 55 %RH ±15 %RH  
Barometric Pressure : 1010 hPa ±10 hPa  
Received Date : 1 June 2021  
Calibrated Date : 28 June 2021  
Calibration Procedure : In-house method CP-ACT-01 based on BS EN 61672-3:2013  
Location of Calibration : LAB 1 Acoustic

Reference Standard : Multi frequency sound calibrator, Manufacturer: Quest Technologies, Model: Quest-cal, S/N: EFA000234  
Which was calibrated on 14 June 2021, Calibration Certificate No. : 948321 EFA000234

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the International System of Units (SI). TSI, USA, A2LA Accreditation No. 1326.01, TPA, Thailand, TISI Accreditation No. 0008  
Timer, Manufacturer: EXTECH, Model: -, S/N: 05-ACT Which was calibrated on 31 Mar 2021, Calibration Certificate No. : 21E1063

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

Calibrated By : *mpc*

Mr. Noppadon Luangrat  
Service Calibration Engineer

Approved By : *WJ*

Mr. Paet Mathavorn  
Calibration Engineer Supervisor

Issue Date : 28 June 2021



Certificate No : 21-ACT-222  
Request No : Req-2021-0681

### Range and Linearity Test

UUC Setting	STD REF	Without Adjustment		Adjustment		Uncertainty	Acceptance limit
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)	(+ dB)	(+ dB)
FAST / A / 70 - 140							
Calibrator Setting							
1000 Hz 74 dB	74.00	74.4	+0.40	-	-	± 0.3	
1000 Hz 84 dB	84.00	83.8	-0.20	-	-	± 0.3	
1000 Hz 94 dB	94.00	93.5	-0.50	-	-	± 0.3	
1000 Hz 104 dB	104.00	103.4	-0.60	-	-	± 0.3	
1000 Hz 114 dB	114.00	113.2	-0.80	-	-	± 0.3	
1000 Hz 120 dB	120.00	119.2	-0.80	-	-	± 0.3	
							1.1

### Weighting Test

UUC Setting	STD REF	Without Adjustment		Adjustment		Uncertainty	Acceptance limit
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)	(+ dB)	(+ dB)
FAST / 70 - 140 / A							
Calibrator Setting							
125 Hz, 114 dB	97.90	96.6	-1.30	-	-	± 0.3	1.5
250 Hz, 114 dB	105.40	104.0	-1.40	-	-	± 0.3	1.5
500 Hz, 114 dB	110.80	109.6	-1.20	-	-	± 0.3	1.5
1000 Hz, 114 dB	114.00	113.2	-0.80	-	-	± 0.3	1.0
2000 Hz, 114 dB	115.20	115.1	-0.10	-	-	± 0.3	2.0
4000 Hz, 114 dB	115.00	117.2	+2.20	-	-	± 0.3	3.0

### Time Response Test

UUC Setting	STD REF	Without Adjustment		Adjustment		Uncertainty
		UUC (Sec)	ERR (Sec)	UUC (Sec)	ERR (Sec)	(+ dB)
A / 70 - 140						
114 dB Drop to 74 dB Test						
FAST	1.0 - 3.0	2.23	-	-	-	± 1.0
SLOW	7.0 - 15.0	7.74	-	-	-	± 1.0

Note :

- The STD REF, UUC values are average of 4 value.
- NA - Not Available, UR - Under Range, OL - Over Load, OR - Over Range

End of Certificate

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**NOISE DOSI METER**

**MODEL : NP-DLX**

**SERIAL No. : NXL060044**

# Certificate of Calibration

**Customer**  
 Name : Eastern Thai Consulting 1992 Co., Ltd.  
 Address : 683 Moo 11, Sukhaphan 8 Rd., Nongkham, Srinach, Chonburi 20230

Certificate No : 21-ACT-220 Rev.1  
 Request No : Req-2021-0682


**Unit Under Calibration Details**  
 Measurement item : Noise Dosimeter  
 Manufacturer : 3M  
 Model : NP-DLX  
 Serial Number : NXL060044  
 ID : -  
 Resolution : 0.1 dB  
 Calibration Environment and Details  
 Temperature : 23 °C ± 2 °C  
 Humidity : 50 %RH ± 20 %RH  
 Barometric Pressure : 1013 hPa ± 10 hPa  
 Received Date : 1 June 2021  
 Calibrated Date : 28 June 2021  
 Calibration Procedure : In-house method CP-NDM-01 based on IEC 61357 : 2017  
 Location of Calibration : Lab Acoustic

Instrument	Brand	Model	SN.	Due calibration	Traceability
Multi-frequency Calibrator	Quest	Quest-cal	188272	14 June 2022	TSI
Standard Microphone	GRAS	40AN	188273	29 October 2021	GRAS
Sine Generator	Svante	Svax401	131	30 September 2021	WIK Electric
Timer	EXTECH	-	05-ACT	29 March 2022	TPA

Note

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

This Certificate was issued to replace to Calibration Certificate No. 21-ACT-220

Calibrated By :   
 Mr. Noppolun Luangrit  
 Calibration Officer

Approved By :   
 Mr. Pait Mallavorn  
 Calibration Engineer Supervisor  
 Issue Date : 16 July 2021

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 FM-708-NDM-01 Rev.0 Issue date 01/07/21

## 1. Absolute acoustical sensitivity

UUC Setting	Time	Exposure Measurement	UNCERTAINTY	Tolerances Limit
FAST / A / 70-140	Ref	UUC	Error	(%)
Calibrator Setting	(b)	(Pa h)	(%)	(%)
1000 Hz 114 dB	120.00	120	3.63	-0.28

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand Svaniek, Model AC-100, SN. AC-300001087

## 2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting	UNCERTAINTY	Tolerances Limit
FAST / 70-140	A	(± dB)	(± dB)
STD Setting	(dB)	(± dB)	(± dB)
*63 Hz	0.8	0.8	2.0
125 Hz	0.7	0.7	1.5
250 Hz	0.2	0.4	1.5
500 Hz	0.0	0.2	1.5
1000 Hz	0.0	0.0	-
2000 Hz	-1.4	-1.2	2.0
4000 Hz	-2.4	-2.3	3.0
8000 Hz	-2.6	-2.8	5.0

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 FM-708-NDM-01 Rev.0 Issue date 01/07/21

Certificate No : 21-ACT-220 Rev.1  
Request No : Req-2021-0682

4. Response to short duration  
a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			Tolerances Limit
	Ref	UUC	Ref	UUC	Error	
FAST / A / 70-140	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)
Calibrator Setting						
4000 Hz 95 dB	2846	2846	1.00	0.99	-0.01	-0.29 - 0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			Tolerances Limit
	Ref	UUC	Ref	UUC	Error	
FAST / A / 70-140	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)
Calibrator Setting						
Burst 1 ms, 95 dB	2846	2846	1.00	0.99	-1.00	-21 - +26
Burst 1 ms, 100 dB	900	900	1.00	0.99	-1.00	-21 - +41
Burst 1 ms, 108 dB	143	143	1.00	0.99	-1.00	-21 - +41

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement			Tolerances Limit
	UUC	(s)	UUC	(Pa <sup>2</sup> h)	Different (%)	
FAST / A / 70-140						
Calibrator Setting						
Continuous Rectangle +		6		10.20		
Continuous Rectangle -				10.21	+0.10	-21 - +26

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FM-108-NDM-01 Rev.0 Issue date 8/09/21

Certificate No : 21-ACT-220 Rev.1  
Request No : Req-2021-0682

3. Linearity of response to steady signals  
a. Sound exposure meter linearity of response for changes of input sinusoidal signal level

UUC Setting	FAST / A / High									
	Ref	(dB)	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0
1000 Hz	Level A	(dB)	70.1	80.0	90.0	99.9	110.0	114.0	120.0	130.0
	Error	(dB)	0.1	0.0	0.0	-0.1	0.0	0.0	0.0	0.2
	Ref	(dB)	88.9	98.9	108.9	117.9	118.9	128.9	138.9	138.9
8000 Hz	Level A	(dB)	89.1	99.1	109.0	112.9	118.9	128.9	138.9	138.9
	Error	(dB)	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0
	Ref	(dB)	87.8	97.8	107.8	113.8	118.8	128.8	138.8	138.8
63 Hz	Level A	(dB)	87.8	93.7	103.7	113.7	113.7	113.7	113.7	113.7
	Error	(dB)	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
	Ref	(dB)	1.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Tolerances Limit	(dB)									
UNCERTAINTY	(dB)									

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			Tolerances Limit
	Ref	UUC	Ref	UUC	Error	
FAST / A / 70-140	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)
Calibrator Setting						
1000 Hz 110 dB	27	27	0.30	0.30	0.00	
1000 Hz 110 dB	45	45	0.50	0.50	0.00	
1000 Hz 110 dB	90	90	1.00	0.99	-1.00	
1000 Hz 110 dB	180	180	2.00	1.98	-1.00	
1000 Hz 120 dB	36	36	4.00	3.99	-0.25	-21, +26
1000 Hz 120 dB	72	72	8.00	7.99	-0.12	
1000 Hz 120 dB	90	90	10.00	9.99	-0.10	
1000 Hz 120 dB	180	180	20.00	19.97	-0.15	
1000 Hz 120 dB	360	360	40.00	39.94	-0.15	
1000 Hz 120 dB	720	720	80.00	79.89	-0.14	

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FM-108-NDM-01 Rev.0 Issue date 8/09/21

**NOISE DOSI METER**

**MODEL : NP-DLX**

**SERIAL No. : NXL060048**



### Certificate of Calibration

**Customer**  
 Name : Eastern Thai Consulting 1992 Co., Ltd.  
 Address : 683 Moo 11, Sukhaphum 8 Rd., Nongkham, Sriracha,  
 Chonburi 20230

Certificate No : 21-ACT-072  
 Request No : Req-2021-0183

#### Unit Under Calibration Details

Measurement Item : Noise Dosimeter  
 Manufacturer : 3M  
 Model : NP-DLX  
 Serial Number : NXL060048  
 ID : -  
 Microphone Class : 2  
 Microphone model : -  
 Microphone S/N : -  
 Instrument Status : Used  
 Resolution : 0.1 dB

#### Calibration Environment and Details

Temperature : 23°C ±3°C  
 Humidity : 55 %RH ±15 %RH  
 Barometric Pressure : 1010 hPa ±10 hPa  
 Received Date : 8 February 2021  
 Calibrated Date : 24 February 2021  
 Calibration Procedure : In-house method CP-ACT-01 based on BS EN 61672-3:2013  
 Location of Calibration : LAB 1 Acoustic

**Reference Standard** : Multifunction Acoustic Calibrator, Manufacturer: Quest Technologies, Model: Quest-Cal, S/N: EFA000234 Which was calibrated on 12 June 2020, Calibration Certificate No. : 874611

**Traceability** : This Certificate is traceable to SI Unit through TSI INCORPORATED, A2LA Accreditation No.: CERT# 1326.01

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

**Calibrated By :** Mr. Noppadon Luangart  
 Service Calibration Engineer  
**Approved By :** Mr. Pacit Mahavorn  
 Calibration Engineer Supervisor  
 Issue Date : 24 February 2021



Certificate No : 21-ACT-072  
 Request No : Req-2021-0183

#### Range and Linearity Test

Calibration Results : Without Adjustment

UUC Setting	STD REF (dB)	Without Adjustment		Adjustment		Uncertainty (+ dB)	Acceptance limit (+ dB)
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
FAST / A / 40 - 110							
Calibrator Setting							
1000 Hz 74 dB	74.00	74.0	0.00	-	-	± 0.3	
1000 Hz 84 dB	84.00	84.0	0.00	-	-	± 0.3	
1000 Hz 94 dB	94.00	93.9	-0.10	-	-	± 0.3	
1000 Hz 104 dB	104.00	103.9	-0.10	-	-	± 0.3	1.1
1000 Hz 114 dB	114.00	OL	NA	-	-	± 0.3	
1000 Hz 120 dB	120.00	OL	NA	-	-	± 0.3	

UUC Setting	STD REF (dB)	Without Adjustment		Adjustment		Uncertainty (+ dB)	Acceptance limit (+ dB)
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
FAST / A / 70 - 140							
Calibrator Setting							
1000 Hz 74 dB	74.00	74.0	0.00	-	-	± 0.3	
1000 Hz 84 dB	84.00	84.0	0.00	-	-	± 0.3	
1000 Hz 94 dB	94.00	93.9	-0.10	-	-	± 0.3	
1000 Hz 104 dB	104.00	103.9	-0.10	-	-	± 0.3	1.1
1000 Hz 114 dB	114.00	113.8	-0.20	-	-	± 0.3	
1000 Hz 120 dB	120.00	119.8	-0.20	-	-	± 0.3	





Certificate No : 21-ACT-072  
 Request No : Req-2021-0183

Calibration Results : Without Adjustment

UUC Setting	STD REF	Without Adjustment		Adjustment		Uncertainty	Acceptance limit
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
FAST / 70 - 140 / A							
Calibrator Setting							
125 Hz, 114 dB	97.90	97.9	0.00	-	-	± 0.3	1.5
250 Hz, 114 dB	105.40	105.5	+0.10	-	-	± 0.3	1.5
500 Hz, 114 dB	110.80	110.9	+0.10	-	-	± 0.3	1.5
1000 Hz, 114 dB	114.00	113.8	-0.20	-	-	± 0.3	1.0
2000 Hz, 114 dB	115.20	114.7	-0.50	-	-	± 0.3	2.0
4000 Hz, 114 dB	115.00	114.3	-0.70	-	-	± 0.3	3.0

UUC Setting	STD REF	Without Adjustment		Adjustment		Uncertainty	Acceptance limit
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
FAST / 70 - 140 / C							
Calibrator Setting							
125 Hz, 114 dB	113.80	114.3	+0.50	-	-	± 0.3	1.5
250 Hz, 114 dB	114.00	114.6	+0.60	-	-	± 0.3	1.5
500 Hz, 114 dB	114.00	114.6	+0.60	-	-	± 0.3	1.5
1000 Hz, 114 dB	114.00	114.1	+0.10	-	-	± 0.3	1.0
2000 Hz, 114 dB	113.80	113.6	-0.20	-	-	± 0.3	2.0
4000 Hz, 114 dB	113.20	112.5	-0.70	-	-	± 0.3	3.0

Time Response Test

UUC Setting	STD REF	Without Adjustment		Adjustment		Uncertainty
		UUC (Sec)	ERR (Sec)	UUC (Sec)	ERR (Sec)	
A / 70 - 140						
114 dB Drop to 74 dB Test						
FAST	1.0 - 3.0	1.82	-	-	-	± 1.0
SLOW	7.0 - 15.0	9.97	-	-	-	± 1.0
IMPULSE	12.0 - 16.0	15.78	-	-	-	± 1.0

Note :

- The STD REF, UUC values are average of 4 value.
- NA = Not Available, UR = Under Range, OL = Over Load, OR = Over Range

End of Certificate

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 PNC-708-ACT Rev.0 Issue date 13/02/20

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**NOISE DOSI METER**

**MODEL : NP-DLX**

**SERIAL No. : NXL060048**



## Certificate of Calibration

### Customer

Name : Eastern Thai Consulting 1992 Co., Ltd.  
Address : 683 Moo 11, Sukthapibam 8 Rd., Nongkham, Sriracha, Chonburi 20230

Certificate No : 22-ACT-221

Request No : Req-2022-0593

### Unit Under Calibration Details

Measurement item : Noise Dosimeter  
Manufacturer : 3M  
Model : NP-DLX  
Serial Number : NX1060048  
ID : -  
Resolution : 0.1 dB  
Calibration Environment and Details  
Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 16 March 2022  
Calibrated Date : 23 March 2022  
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017  
Location of Calibration : Lab Acoustic

Instrument Status : Used

Microphone Class : 2

Microphone Model : -

Microphone S/N : -

Preamplifier Model : -

Preamplifier S/N : -

### 1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement		Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (Pa <sup>2</sup> h)	Error (Pa <sup>2</sup> h)	
FAST / A / 70-140					
Calibrator Setting					
1000 Hz 114 dB	120.00	120	3.63	3.65	-21, +26

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand 3M, Model AC-300, SN. AC-100001087

### 2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting			UNCERTAINTY (± dB)	Tolerances Limit (± dB)
	A (dB)	C (dB)			
FAST / 70-140					
STD Setting					
*63 Hz	-0.4	-0.7		0.40	2.0
125 Hz	-0.1	0.2		0.40	1.5
250 Hz	0.1	0.3		0.40	1.5
500 Hz	0.1	0.2		0.40	1.5
1000 Hz	0.0	0.0		0.40	2.0
2000 Hz	-1.0	-0.0		0.40	3.0
4000 Hz	-1.7	-1.7		0.40	5.0
8000 Hz	-2.8	-2.9		0.40	

Instrument	Brand	Model	SN.	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	188272	14 June 2022	TSI
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Sine Generator	Svante	Svm401	131	18 October 2022	WK Electric
Timer	EXTECH	*	05-ACT	29 March 2022	TPA

### Note

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

Calibrated By : *MC*

Mr. Noppadon Luangart  
Calibration Officer

Approved By : *MC*

Mr. Pasit Madaavorn  
Calibration Engineer Supervisor  
Issue Date : 23 March 2022

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Certificate No 22-ACT-221  
Request No Req-2022-0593

#### 4. Response to short duration

##### a. Response for sinusoidal signals - reference level

UUC Setting	Time				Exposure Measurement			Tolerances
	Ref	UUC	Ref	UUC	UUC	Error	UNCERTAINTY	
FAST / A / 70-140	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(Pa <sup>2</sup> h)	Limit (Pa <sup>2</sup> h)
Calibrator Setting	2846	2846	1.00	0.99	-1.00		0.01	0.71 - 1.41
4000 Hz 95 dB								

##### b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time				Exposure Measurement			Tolerances
	Ref	UUC	Ref	UUC	UUC	Error	UNCERTAINTY	
FAST / A / 70-140	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(Pa <sup>2</sup> h)	Limit (%)
Calibrator Setting	2846	2846	1.00	0.99	-1.00		3.0	-21 - +26
Burst 1 ms, 95 dB	900	500	1.00	0.99	-1.00			-21 - +41
Burst 1 ms, 100 dB	143	143	1.00	1.00	0.00			-21 - +41

#### 5. Response to unipolar pulse

UUC Setting	Time				Exposure Measurement			Tolerances
	Ref	UUC	Ref	UUC	UUC	Different	UNCERTAINTY	
FAST / A / 70-140	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(Pa <sup>2</sup> h)	Limit (%)
Calibrator Setting	6	6	10.36	10.35	+0.01		2.4	-21 - +26
Continuous Rectangle +								
Continuous Rectangle -								

\* Indicates non accredited

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#### 3. Linearity of response to steady signals

##### a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting	FAST / A / High														UNCERTAINTY
	Ref	(dB)	70.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0	140.0	140.0	140.0	
1000 Hz	Level A	(dB)	70.0	79.9	90.0	100.0	110.0	114.0	120.0	130.0	140.0	140.0	140.0	140.0	
	Error	(dB)	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9	138.9	138.9	138.9	
	Level A	(dB)			89.1	99.1	109.1	113.1	119.1	129.1	139.1	139.1	139.1	139.1	
	Error	(dB)			0.2	0.2	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8	113.8	113.8	113.8	
	Level A	(dB)						87.8	93.8	103.8	113.8	113.8	113.8	113.8	
	Error	(dB)						0.0	0.0	0.0	0.1	0.1	0.1	0.1	
Tolerances Limit	(±dB)							1.0							
UNCERTAINTY	(±dB)							0.27							

##### b. Sound exposure meter linearity of error

UUC Setting	Time				Exposure Measurement			Tolerances
	Ref	UUC	Ref	UUC	UUC	Error	UNCERTAINTY	
FAST / A / 70-140	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(Pa <sup>2</sup> h)	Limit (%)
Calibrator Setting	27	27	0.30	0.30	0.30	0.00	4.3	-21 - +26
1000 Hz 110 dB	45	45	0.50	0.50	0.50	0.00		
1000 Hz 120 dB	90	90	1.00	1.00	1.00	0.00		
1000 Hz 110 dB	180	180	2.00	1.99	-0.50			
1000 Hz 120 dB	36	36	4.00	4.00	0.00			
1000 Hz 120 dB	72	72	8.00	8.00	0.00			
1000 Hz 120 dB	90	90	10.00	9.99	-0.10			
1000 Hz 120 dB	180	180	20.00	19.98	-0.10			
1000 Hz 120 dB	360	360	40.00	39.97	-0.08			
1000 Hz 120 dB	720	720	80.00	79.94	-0.08			

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