

ภาคผนวก ง

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เอกสารสอบเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์

**ANALYTICAL BALANCE**

**Model : MS204TS/00**

**Serial No. : B904136539**

Mettler-Toledo (Thailand) Ltd.  
846/4 - 846/5 Lasealle Rd., Bangna Tai Sub-District  
Bangna District, Bangkok 10260  
+662 723 0382  
MT-TH.ServiceSupport@mt.com

Accuracy Calibration Certificate

Customer

Company: EASTERN THAI CONSULTING 1992 CO., LTD.  
Address: 683 Moo 11, Sukhaphiban 8 Rd., Nong Kham  
City: Sriacha  
Zip / Postal: 20230  
State / Province: Chonburi  
Order Number: 0312330077

Contact: Sasipom Nakin

Weighing Device

Manufacturer: Mettler Toledo  
Model: MS204TS/00  
Serial No.: B904136539  
Building: Laboratory  
Floor: 1  
Room: Balance

Instrument Type: Weighing Instrument  
Asset Number: LABE 05/4  
Terminal Model: N/A  
Terminal Serial No.: N/A  
Terminal Asset No.: N/A

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

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)  
CP/M002/20

Calibration TOLEDO Work Instruction: METTLER TOLEDO

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	Start: 25.6 °C	End: 25.2 °C	Start: 50.5 %	End: 44.6 %
Temperature				
Humidity				

As Found Calibration Date: 06-Feb-2023  
As Left Calibration Date: N/A  
Issue Date: 07-Feb-2023

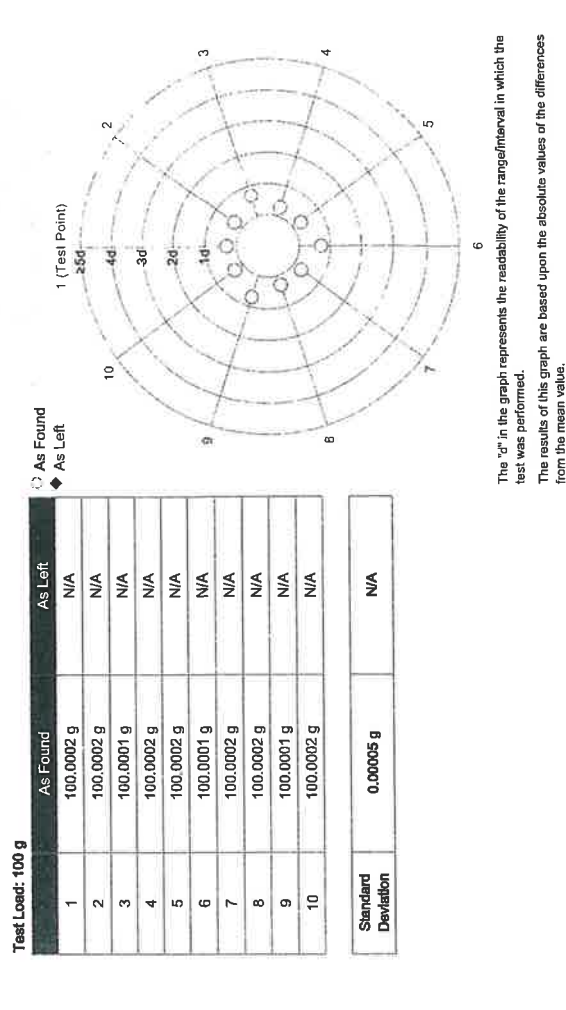
Calibrator: Thiraphong Salanoi

Approved Signatory: [Signature]

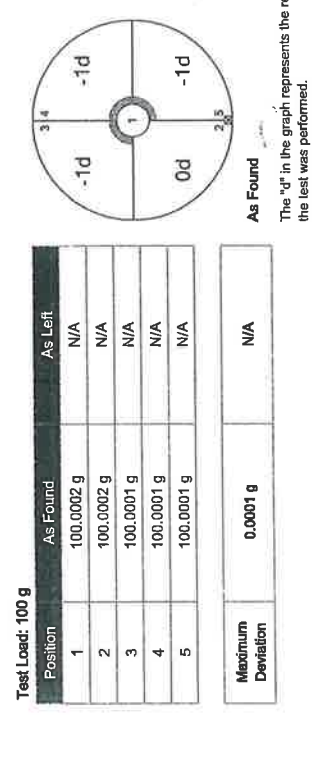
Technical Manager / Head of Calibration Center

Measurement Results

Repeatability



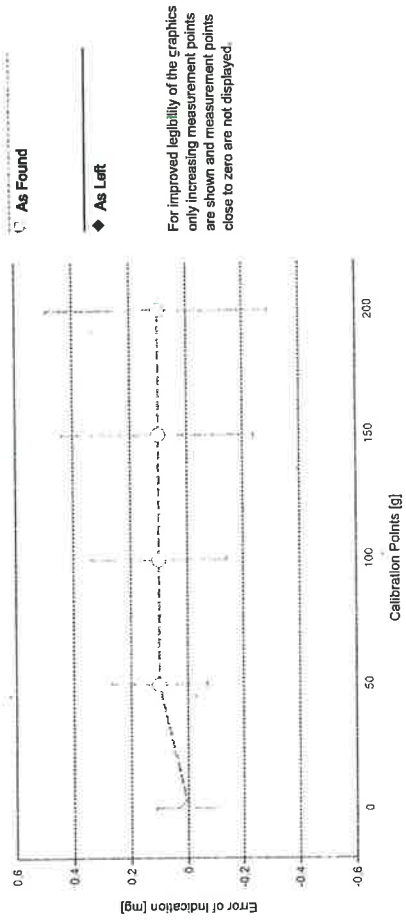
Eccentricity



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Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.11 mg	2
2	0.0100 g	0.0100 g	0.0000 g	0.13 mg	2
3	0.0500 g	0.0500 g	0.0000 g	0.13 mg	2
4	0.1000 g	0.0999 g	-0.0001 g	0.13 mg	2
5	1.0000 g	0.9999 g	-0.0001 g	0.13 mg	2
6	5.0000 g	4.9999 g	-0.0001 g	0.13 mg	2
7	10.0000 g	9.9999 g	-0.0001 g	0.14 mg	2
8	50.0000 g	50.0001 g	0.0001 g	0.17 mg	2
9	100.0001 g	100.0002 g	0.0001 g	0.24 mg	2
10	150.0001 g	150.0002 g	0.0001 g	0.34 mg	2
11	200.0001 g	200.0002 g	0.0001 g	0.39 mg	2



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

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

Test Equipment

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

Weight Set 1: OIML E2			
Weight Set No.:	WS28	Date of Issue:	01-Apr-2022
Certificate Number:	178498	Calibration Due Date:	17-Sep-2023
Thermo Hygrometer			
Equipment No.:	IN306	Date of Issue:	10-Jan-2023
Certificate Number:	23H4	Calibration Due Date:	03-Jan-2024







# GWP® Certificate

As Found ✓

As Left ✓

The weighing device meets the given process requirements.

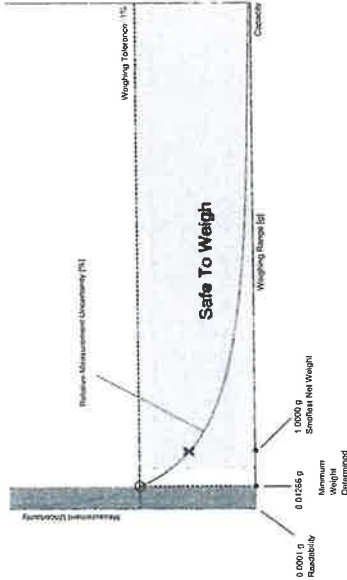
The weighing device meets the given process requirements.

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: 1.0000 g | Safety Factor: 2

Safe Weighing Range



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

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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

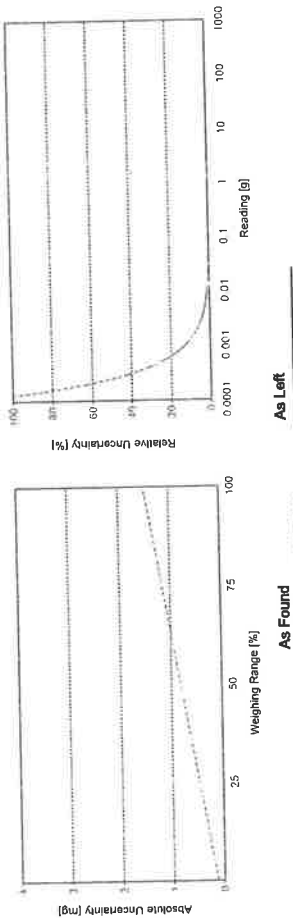
### Linearization of Uncertainty Equation

Range	d	As Found		As Left	
		Max			
1	0.0001 g	220 g	$U_1 = 0.13 \text{ mg} + 0.00625 \text{ mg/g} \cdot R$		N/A

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

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

Net Indication	As Found		As Left	
0.0220 g	0.13 mg	0.59%	N/A	N/A
0.2200 g	0.13 mg	0.060%	N/A	N/A
2.2000 g	0.14 mg	0.0065%	N/A	N/A
22.0000 g	0.27 mg	0.0012%	N/A	N/A
220.0000 g	1.5 mg	0.00068%	N/A	N/A



As Found

As Left

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# Measurement Results

## Results Summary

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

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

### Repeatability

Test Load: 100 g

Tolerance		Control Limit		As Found		As Left	
Std. Deviation	Result	Std. Deviation	Result	Std. Deviation	Result	Std. Deviation	Result
0.1%	0.00050 g	0.00050 g	✓	0.00005 g	✓	0.00005 g	✓
0.2%	0.00100 g	0.00100 g	✓				✓
0.5%	0.00250 g	0.00250 g	✓				✓
1%	0.00500 g	0.00500 g	✓				✓
2%	0.01000 g	0.01000 g	✓				✓
5%	0.02500 g	0.02500 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	
Std. Deviation	Result	Std. Deviation	Result	Std. Deviation	Result	Std. Deviation	Result
0.1%	0.0500 g	0.0500 g	✓	0.0001 g	✓	0.0001 g	✓
0.2%	0.1000 g	0.1000 g	✓				✓
0.5%	0.2500 g	0.2500 g	✓				✓
1%	0.5000 g	0.5000 g	✓				✓
2%	1.0000 g	1.0000 g	✓				✓
5%	2.5000 g	2.5000 g	✓				✓

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

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# Minimum Weight

## As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Safety Factor					
	1	2	3	5	10
Tolerance	0.12729 g	0.25618 g	0.38672 g	0.65284 g	1.34917 g
0.1%	0.06344 g	0.12729 g	0.19153 g	0.32124 g	0.65284 g
0.2%	0.02533 g	0.05072 g	0.07618 g	0.12729 g	0.25618 g
0.5%	0.01266 g	0.02533 g	0.03802 g	0.06344 g	0.12729 g
1%	0.00633 g	0.01266 g	0.01899 g	0.03167 g	0.06344 g
2%	0.00317 g	0.00633 g	0.00949 g	0.01583 g	0.03167 g
5%	0.00158 g	0.00317 g	0.00474 g	0.00792 g	0.01583 g

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

### As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Safety Factor					
	1	2	3	5	10
Tolerance	0.12729 g	0.25618 g	0.38672 g	0.65284 g	1.34917 g
0.1%	0.06344 g	0.12729 g	0.19153 g	0.32124 g	0.65284 g
0.2%	0.02533 g	0.05072 g	0.07618 g	0.12729 g	0.25618 g
0.5%	0.01266 g	0.02533 g	0.03802 g	0.06344 g	0.12729 g
1%	0.00633 g	0.01266 g	0.01899 g	0.03167 g	0.06344 g
2%	0.00317 g	0.00633 g	0.00949 g	0.01583 g	0.03167 g
5%	0.00158 g	0.00317 g	0.00474 g	0.00792 g	0.01583 g

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

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

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

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

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

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Error of Indication

As Found

Reference Value	Error	Control limits for various weighing tolerances				
		0.1%	0.2%	0.5%	1%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A
50.0000 g	0.0001 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	1.2500 g
100.0001 g	0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	2.5000 g
150.0001 g	0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	3.7500 g
200.0001 g	0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓

As Left

Reference Value	Error	Control limits for various weighing tolerances				
		0.1%	0.2%	0.5%	1%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A
50.0000 g	0.0001 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	1.2500 g
100.0001 g	0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	2.5000 g
150.0001 g	0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	3.7500 g
200.0001 g	0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓

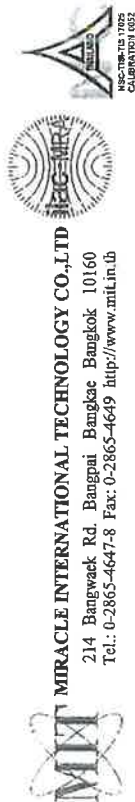
The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.

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## **BAROMETER**

**Equipment : Analog Barometer**

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



MIRACLE INTERNATIONAL TECHNOLOGY CO., LTD

214 Bangwak Rd. Bangpai Bangkok 10160  
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 <http://www.mit.in.th>



## CALIBRATION CERTIFICATE

Certificate No. : L202305085-002  
Date Issued : 16-May-23

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

**Equipment** : Analog Barometer

**Manufacturer** : Barigo  
**Model** : -  
**Serial No.** : -  
**ID No./Tag No.** : BM001/41  
**Date Received** : 11-May-23  
**Date Calibrated** : 15-May-23

**Calibrated by** : Mr. Jame Khaothong

**Calibration Method or Calibration Procedure Used**

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

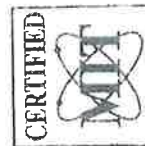
This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

### 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.

This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

Approved by: *Saranyuth T.*  
(Mr. Saranyuth Tochua)



Page 1 of 2

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Certificate No : L202305085-002  
Environment : Ambient Temperature : (25 ± 2)°C  
Relative Humidity : (50 ± 15)%RH

STD Reading	UUC Reading (mbar)	UUC Reading (mbar)	UUC Error	Uncertainty
mbar	Before Adjusted	After Adjusted	mbar	± mbar
990.00	990.0	*	0.00	0.61
1000.00	1000.0	*	0.00	0.61
1010.00	1010.0	*	0.00	0.61
1020.00	1020.0	*	0.00	0.61
1030.00	1030.0	*	0.00	0.61

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  
Conversion Factor Multiply by 1.0 E+02 - Pa unit

**Description of UUC :**  
Range 990 - 1030 mbar Absolute  
Calibration Range 990 - 1030 mbar Absolute  
Scale Interval 1 mbar  
Resolution 0.5 mbar 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-P220104 for Reference Pressure Monitor Serial No. 1598, Due 11-Nov-23

End of Certificate

Page 2 of 2

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**Hot Air Oven**

**Model : UFE 500**

**Serial No. : G511.0182**



NSC-TSI-TSI7025  
CALIBRATION 0152

Page 1 of 3

Certificate No. : 23-006679

Sample Code : 23-02820-002

## CERTIFICATE OF CALIBRATION

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

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

Equipment : Temperature controlled enclosures (Hot air oven)  
Model : UFE 500  
Manufacturer : Memmert  
ID No. : LABE 17/4  
Serial No. : GS11.0182  
Date of Receipt : 20 January 2023  
Date of Calibration : 20 January 2023

## Condition of Calibration

1. Environment : 1.1 Ambient temperature : Maximum 27.9 °C : Minimum 25.3 °C  
: 1.2 Relative humidity : Maximum 50.9 % : Minimum 38.5 %  
: 1.3 Line voltage supplied : Maximum 221.9 VAC : Minimum 218.5 VAC

## 2. Calibration method

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

## 3. Reference standard instrument

Instrument : Data Acquisition With Sensor  
ID No. : LB-DA-11 (RTD-138 to RTD-146)  
Certificate No. : 22-040309  
Due Date : 21 April 2023

## 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. Sarawoot Thammo  
Scientist  
Approved by : (Mr. Somchai Neampunt)  
Signed for Director

Issue date : 24 January 2023

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

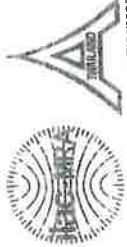
The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

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  
CONTACT@AMARC.CO.TH  
WWW.AMARC.CO.TH  
Effective Date 15/10/21  
Rev 01

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## REPORT OF CALIBRATION

Certificate No. : 23-006679  
Sample Code : 23-02820-002

Results of Calibration  
Resolution : 0.5 °C

## 1. Reporting of Temperature

Calibration point (°C)	UUC*	UUC* reading (°C)	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor k	
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8			# 9 <sup>Ref</sup>
104	103.5	103.5	104.10	104.08	103.87	103.99	104.08	104.08	103.96	104.01	103.84	0.47	2.00

## 2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
104.0	0.09	0.32	0.39

## Notes

\* UUC\* = Unit Under Calibration

NSC-TS1517025  
CALIBRATION 0152

Page 3 of 3

## REPORT OF CALIBRATION

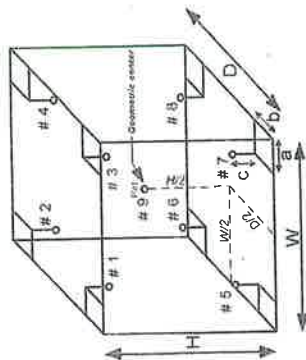
Certificate No. : 23-006679

Sample Code : 23-02820-002

## 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 = 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.

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 UKAS M3003

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**ORIFICE TRANSFER STANDARD CERTIFICATION**

**WORKSHEET TE-5025A**

**ROOTSMETER S/N 0438320**



TISCH ENVIRONMENTAL, INC.  
145 SOUTH MIAMI AVE  
VILLAGE OF CLEVELAND, OH  
44102  
513.467.3000  
877.263.7610 TOLL FREE  
513.467.3009 FAX

# ORIFICE 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	1.4096
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}

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**THERMO-HYGROMETER**

**Model : 608-H1**

**Serial No. : 45106737**



## CERTIFICATE OF CALIBRATION

Page 1 of 2

Certificate No. : 23-055203  
Sample Code : 23-21440-001

## Customer

EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapiarn 8 Rd., Nongkham,  
Sriracha, Chonburi 20230Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited  
(Calibration laboratory)

Equipment : Digital thermo-hygrometer

Manufacturer : testo Model : 608-H1

Serial No. : 45106737 ID No. : LABE 09/7

Date of Receipt : 25 May 2023 Date of Calibration : 29 May 2023

## Condition of Calibration

1. Environment : 23.0 °C ± 3.0 °C  
: 55.0 % ± 15.0 %

## 2. Calibration method

2.1 In-house method: WI-CL-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 in a chamber at the controlled temperature / relative humidity.

## 3. Reference standard instrument

Instrument	Model	ID No.	Certificate No.	Due Date
3.1 Chilled Mirror	Optidew Vision	LB-DP-02 & LB-DP-02 (DP)	TH-0157-22	05 December 2023
3.2 Digital Thermometer	Optidew Vision	LB-DP-02 & LB-DP-02 (Temp.)	23-014916	12 February 2024
3.3 Digital Thermometer	34972A	LB-DA-07 with RTD-89	22-095535	06 September 2023

## 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 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

Miss Pornsuda Lohabal  
Scientist

Approved by

(Mr. Somchai Neampunt)  
Signed for Director

Issue date

31 May 2023

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

TEL 02-516-2422

FAX 02-516-6949

CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH



## REPORT OF CALIBRATION

Page 2 of 2

Certificate No. : 23-055203  
Sample Code : 23-21440-001

## Results of Calibration

## Temperature measurement

Resolution : 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	20.00	20.0	0.00	± 0.39
25	50	25.02	25.1	- 0.08	± 0.39
30	50	30.00	30.0	0.00	± 0.39

## Humidity measurement

Resolution : 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	45.18	53.5	- 8.32	± 1.3
60	25.00	60.03	68.3	- 8.27	± 1.5
75	25.00	75.20	83.2	- 8.00	± 1.7

## Notes

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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**ANALYTICAL BALANCE (DU)**

**Model. : XS205DU**

**Serial No. : 1126323724**



Certificate No. : 23-006683

Sample Code : 23-02820-006

## 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 : METTLER TOLEDO

Model : XS205DU

Serial No. : 1126323724

ID No. : LABE 05/1

Date of Receipt : 20 January 2023

Date of Calibration : 20 January 2023

Calibrated by : Mr. Thanadol Pholthep

Scientist

25 January 2023

(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)



Certificate No. : 23-006683

Sample Code : 23-02820-006

## REPORT OF CALIBRATION

Equipment : ELECTRONIC BALANCE

Manufacturer : METTLER TOLEDO

Model : XS205DU

Capacity : Max 81 g / 220 g

Resolution : 0.01 mg / 0.1 mg

Serial No. : 1126323724

ID No. : LABE 05/1

## 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 : 80

☐ Before adjustment ☐ After adjustment

Nominal value 40 80

Standard weight 40.000042 80.000045

Average reading of indicator 40.000015 80.000019

Standard deviation 0.000004 0.000007

Unit : g Range : 200

☐ Before adjustment ☐ After adjustment

Nominal value 100 200

Standard weight 100.000022 200.000199

Average reading of indicator 100.00001 200.00004

Standard deviation 0.000004 0.000008

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Certificate No. : 23-006683

Sample Code : 23-02820-006

## 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 :		Range :	
80		200	
Test Point	Sensitivity, S	Test Point	Sensitivity, S
0	0.99800	0	0.9980
40	0.99800	100	0.9980
80	0.99800	200	0.9980

## 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	0.00000	0.00000	0.0000090	2.01
0.01	0.0100036	0.01000	0.00000	0.0000093	2.01
0.1	0.1000062	0.10000	0.00001	0.000012	2.00
1	1.0000036	1.00001	-0.00001	0.000014	2.00
5	5.0000044	5.00003	-0.00003	0.000020	2.00
10	10.0000000	10.00007	-0.00007	0.000032	2.00
20	20.0000016	20.00011	-0.00009	0.000036	2.00
50	50.0000029	50.00013	-0.00010	0.000067	2.00
100	100.0000022	100.00001	-0.00001	0.00016	2.00
150	150.0000051	150.00001	0.00000	0.00023	2.00
200	200.0000199	200.00003	-0.00001	0.00028	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.

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Certificate No. : 23-006683

Sample Code : 23-02820-006

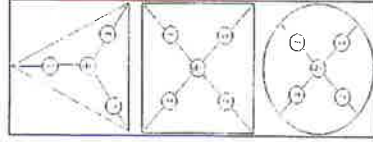
## REPORT OF CALIBRATION

## 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 : 50 and 100	
<input type="radio"/> Circle		Unit : g	
<input type="radio"/> Triangular			
<input checked="" type="radio"/> Rectangular			
Range	Position	Reading of indicator	Reading of indicator
		50.00014	100.00001
1		50.00014	99.99998
2		50.00006	100.00000
3		50.00010	100.00001
4		50.00017	100.00001
5		50.00014	100.00001
6		0.00008	0.00003
Maximum difference			



## Condition of Calibration

1. Calibration Method : WICL-004 base on UKAS LAB 14: 2019
2. This result of calibration was found accurate as shown on date and place of calibration on y.
3. Condition of Calibration item: Normal
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 Public Company Limited (Instrument number 1).

## 5. Reference standard instrument :

Instrument	Class	ID No.	Certificate No.	Due Date
1) STANDARD WEIGHT 1 mg to 1 kg	E2	LB WE-57	22-060639	27 June 2023

6. Ambient conditions		Min	Max
Temperature (°C)		21.3	22.4
Relative Humidity (%Rh)		38.2	40.4
Air pressure (hPa)		1008.4	1010.1

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- End of Report -

**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 800/R-12/021. Assay was performed using a gravimetric method. The cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. The analysis was performed on a gas mixture which is a blend of the following gases: CH4, PPN, BALN. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 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	6162860Y	243.3 PPM PROPANE/AIR	+/- 0.5%
ANALYTICAL EQUIPMENT				
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration		
Nicolet IS50 FTIR AUP2110295 CH4	FTIR	Oct 13, 2021		
Nicolet IS50 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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*Michael A. Markes*  
Approved for Release

**DRY GAS METER MC-572V**

**Serial No. : 0504003**

## Certificate Of Calibration

Method 5 Pre-Test Console Calibration - Cubic meter (m3)

## Meter Console Information

Console Model : MC572V  
 Console Serial : 0504003  
 DGM Model #: SK25EX  
 DGM Serial #: 0009854

## Calibration Condition

Calibration Date: 3-Apr-23  
 Issue Date: 3-Apr-23  
 Cal. Report No.: WDS-SV660039  
 Ambient Temp (°C): 25  
 Pressure (mm Hg): 758  
 Relative Humidity (%): 60

## Factors/Conversion

Std. Temp (°K): 298  
 Std. Pressure (mm Hg): 760  
 K<sub>1</sub> (K/mm Hg): 0.3857

## Reference Equipment

WTM Model: W-NK0Da-5B WTM Cal. Due Date: Nov. 2022  
 WTM Serial: 600245 Gamma: 1.0000

## UUT Meter (DGM)

## Reference Meter (WTM)

Run Time (minutes)	DGM Orifice (mm H <sub>2</sub> O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
15.00	13.0	2.1249	2.2873	26	26	11.24924	11.40853	25	25
10.00	25.0	1.9384	2.0964	26	26	11.06645	11.22136	25	25
8.00	50.0	1.7294	1.9105	26	26	10.86093	11.03905	25	25
7.00	80.0	1.4887	1.6921	26	26	10.62322	10.82407	25	25
5.00	120.0	1.1950	1.3736	26	26	10.33100	10.50914	25	25

## Standardized Data

## Calibration Results

Test Meter		Reference Meter		Correction Factor		Flow Rate		
Std. Volume V <sub>std</sub> (m <sup>3</sup> )	Std. Flow Rate Q <sub>std</sub> m <sup>3</sup> /min	Std. Volume V <sub>ref</sub> (m <sup>3</sup> )	Std. Flow Rate Q <sub>ref</sub> m <sup>3</sup> /min	"Gamma" (Y)	Variation (ΔY)	Std & Corr Q <sub>std</sub> (m <sup>3</sup> /min)	0.0212 SCMM ΔH <sub>0</sub>	Variation ΔΔH <sub>0</sub>
0.159	0.011	0.156	0.010	0.983	-0.001	0.010	52.990	5.531
0.155	0.015	0.152	0.015	0.981	-0.002	0.015	47.999	0.540
0.178	0.022	0.175	0.022	0.982	-0.002	0.022	46.696	-0.763
0.200	0.029	0.197	0.028	0.983	-0.001	0.028	45.249	-2.210
0.177	0.035	0.175	0.035	0.989	0.006	0.035	44.361	-3.098
				0.984	= Y Avg			ΔH@ Avg

Pass/Fail Result: **Pass**

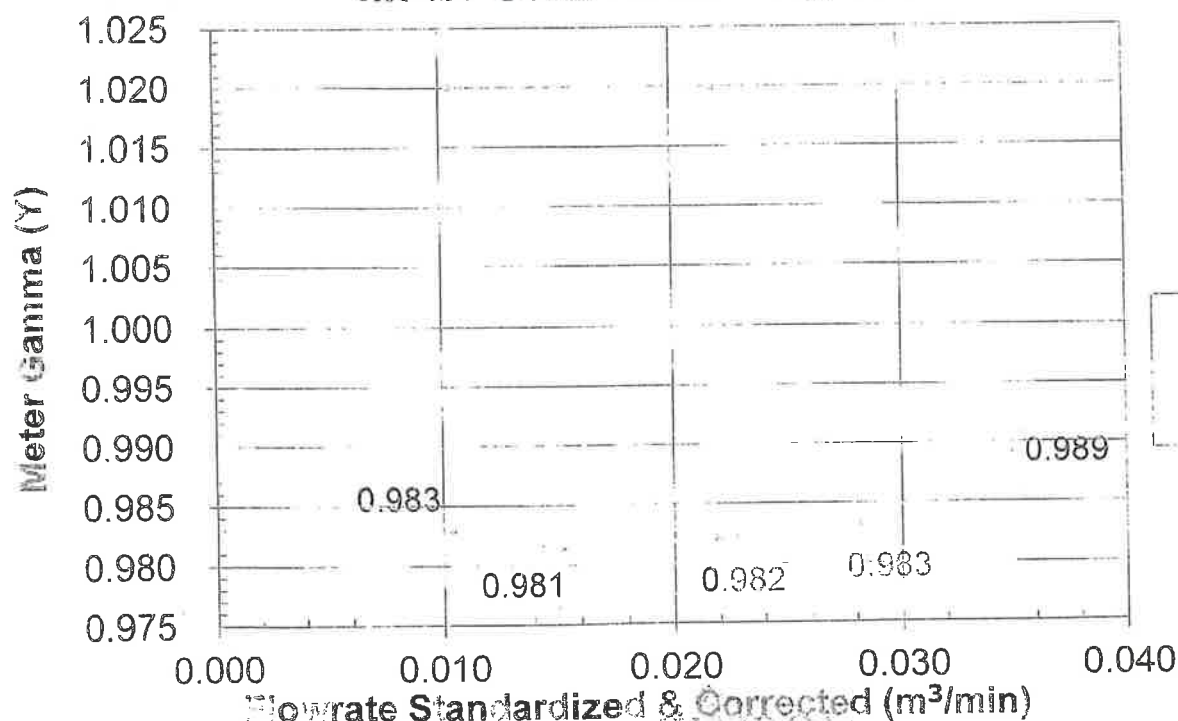
Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02  
 Note: For ΔH<sub>0</sub>, orifice pressure differential that equates to 0.75cfm (0.0212m<sup>3</sup>/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm) H<sub>2</sub>O

Approved By:

(Palpasu Chaisana)  
 Service Manager

Date: 3-Apr-23

## Meter Gamma vs Flowrate



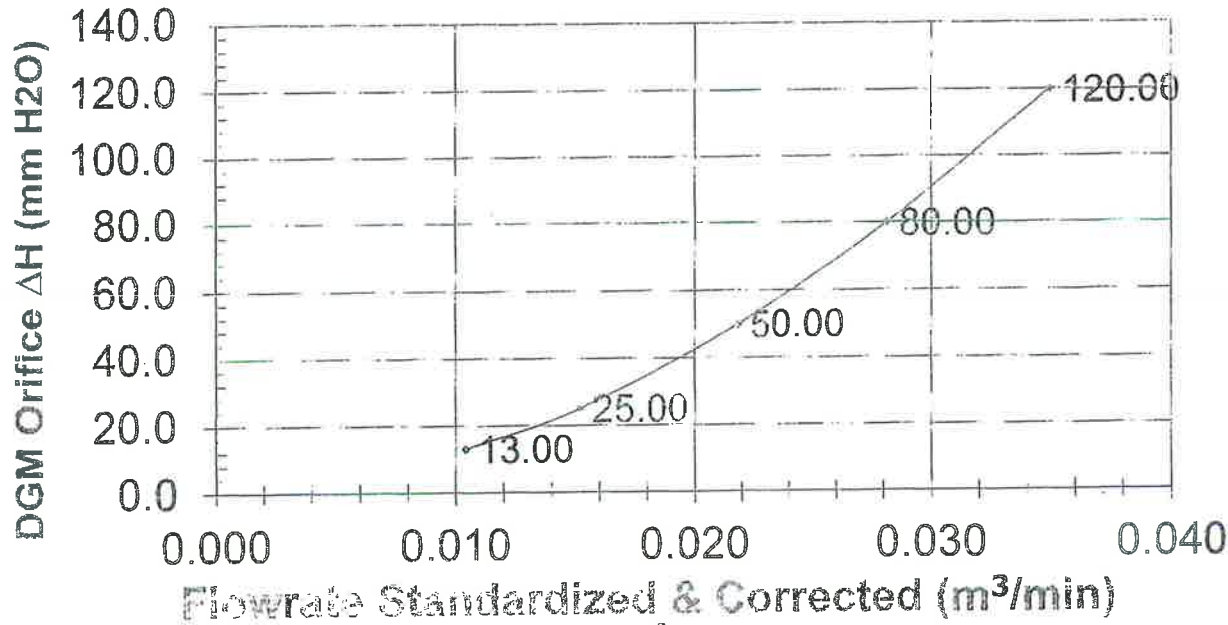
Console Serial

0504003

Console Model

MC572V

## Meter Pressure vs Flowrate



Console Serial:

0504003

Console Model:

MC572V

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### TEMPERATURE DISPLAY CALIBRATION

Meter Console Information		Reference Equipment	
Console Model :	MC572V	Temp. Simulator Model :	FLUKE 714B
Console serial :	0504003	Serial No	60590035
Temp Indicator Model :	765-KF		
Temp Indicator Serial :	JC17862		

Calibration Conditions	
Cal. Date :	3-Apr-23
Issue Date :	3-Apr-23
Cal. Report No. :	WDS-SV60039
Ambient Temp. (°C) :	25
Pressure (mm Hg) :	758
Humidity (%) :	60

#### Temperature Sensor Calibration

Reference Point	Ref. Thermometer Temperature	Thermometer Display	Ref. Thermometer Temperature
#	°C	°C	°C
1	-18.0	-17.0	1.0
2	38.0	37.0	1.0
3	93.0	92.0	1.0
4	149.0	148.0	1.0
5	260.0	259.0	1.0
6	371.0	372.0	-1.0
7	482.0	482.0	0.0
8	593.0	594.0	-1.0
9	816.0	816.0	0.0
10	1038.0	1038.0	0.0
		Maximum	1.0

PASS

#### Note

For valid test results, the maximum difference between temperature readings should  $\leq 1.0^{\circ}\text{C}$  (EPA Method 5, Section 6.1.1.8).  
perform all TC Channel calibrations. Except meter (DGM) channel

#### DGM Out Temperature Sensor Calibration

Temperature point	Ref. Thermometer Temperature	Thermometer Display	Thermometer Temperature
#	°C	°C	°C
Ambient	26.5	26.0	0.5
Heat	100.5	102.0	-1.5

DGM Out Temp. Diff.  $\pm 3^{\circ}\text{C}$

PASS

Approved By :

(Patrasai Chaisena)

Service Manager

Signature of Service Manager

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**DRY GAS METER XC-572-OV**

**Serial No. : A2204323**



**WISDOM SCIENCE**  
SALE AND SERVICE GROUP COMPANY LIMITED

## Certificate Of Calibration

Method 5 Pre-Test Console Calibration - Cubic meter (m<sup>3</sup>)

### Meter Console Information

Console Model : XC-572-OV  
Console serial : A2204323  
DGM Model #: SK25EX  
DGM Serial #: 00008294

### Calibration Condition

Calibration Date: 2-May-2023  
Due Date: 1-May-2024  
Cal. Report No.: WDS-SV660066  
Ambient Temp (°C): 25  
Pressure (mm Hg): 756  
Relative Humidity (%): 55

### Factors/Conversion

Std. Temp. (°K): 298  
Std. Pressure (mm Hg): 760  
K<sub>1</sub> (K/mm Hg): 0.3857

### Reference Equipment

WTM Model: W-NKoDa-5B  
WTM Serial: 600245  
WTM Cal. Date: 22-Nov-2022  
Gamma: 1.0000

### UUT Meter (DGM)

Run Time (minutes)	DGM Orifice (mm H <sub>2</sub> O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
s	P <sub>std</sub>	V <sub>ini</sub>	V <sub>fin</sub>	t <sub>ini</sub>	t <sub>fin</sub>	V <sub>ini</sub>	V <sub>fin</sub>	t <sub>ini</sub>	t <sub>fin</sub>
15.00	13.0	18.0685	18.2252	25	26	17.55844	17.71573	25	25
10.00	25.0	18.2477	18.3984	25	26	17.73837	17.88948	25	25
8.00	50.0	18.4339	18.6056	25	26	17.92517	18.09730	25	25
7.00	80.0	18.6458	18.8344	25	27	18.13775	18.32707	25	25
5.00	120.0	18.8839	19.0510	25	27	18.37705	18.54528	25	25

### Reference Meter (WTM)

### Standardized Data

Test Meter		Reference Meter		Correction Factor		Calibration Results		
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Flow Rate	0.0212 SCMM	
V <sub>std</sub> (m <sup>3</sup> )	Q <sub>std</sub> (m <sup>3</sup> /min)	V <sub>ref</sub> (m <sup>3</sup> )	Q <sub>ref</sub> (m <sup>3</sup> /min)	(Y)	(ΔY)	Q <sub>m</sub> (std/corr)	ΔH <sub>g</sub>	Variation
0.154	0.010	0.154	0.010	1.004	0.003	0.010	54.437	3.293
0.148	0.015	0.148	0.015	1.002	0.001	0.015	50.528	-0.616
0.169	0.021	0.169	0.021	0.999	-0.001	0.021	50.086	-1.058
0.186	0.027	0.186	0.027	0.999	-0.001	0.027	50.928	-0.216
0.165	0.033	0.165	0.033	0.999	-0.002	0.033	49.741	-1.403
				1.001	= Y Avg.		51.144	= ΔH <sub>g</sub> Avg.

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 ±0.02

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

Pass/Fail Result: **PASS**

Approved By:

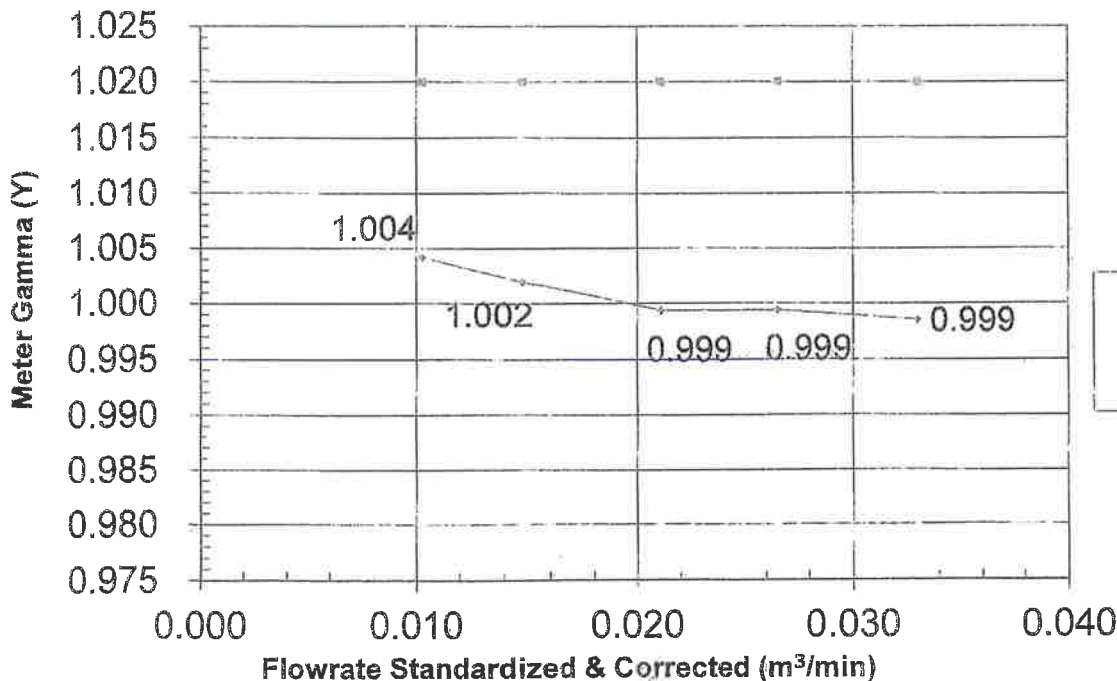
(Palpasu Chaisana)  
Service Manager

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WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Date:

2-May-2023

## Meter Gamma vs Flowrate



→ Gamma Y  
→ Max Allow Y  
→ Min Allow Y

Console Serial: A2204323

Console Model: XC-572-OV

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TEMPERATURE DISPLAY CALIBRATION

Meter Console Information

Console Model: XC-572-OV  
Console Serial: A2204323  
Temp. Indicator Model: 765-KF  
Temp. Indicator Serial: JC19022

Calibration Conditions

Cal. Date: 2-May-2023  
Due Date: 1-May-2024  
Cal. Report No.: WDS-SV660066  
Ambient Temp. (°C): 25  
Pressure (mm Hg): 758  
Humidity (%): 55

Reference Equipment

Temp. Simulator Model: FLUKE 714B  
Serial No.: 60690035  
Calibration Date: 14-Feb-2023

Temperature Sensor Calibration

Reference Point	Bar Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
#	°C	°C	°C
1	-18.0	-17.0	1.0
2	25.0	25.0	0.0
3	90.0	90.0	0.0
4	120.0	120.0	0.0
5	250.0	249.0	1.0
6	380.0	380.0	0.0
7	500.0	500.0	0.0
8	620.0	620.0	0.0
9	740.0	739.0	1.0
10	860.0	860.0	0.0
Maximum <sup>1</sup>			1.0

Note

<sup>1</sup> For valid test results, the maximum difference between temperature readings should  $\leq 1.0^{\circ}\text{C}$  (EPA Method 5, Section 6.1.1.8). Perform AUX, STACK, PROBE, OVEN, FILTER, EXIT. Except meter (DGM) channel

DGM Out Temperature Sensor Calibration

Temperature point	Bar Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
#	°C	°C	°C
Ambient	28.8	29.0	-0.2
Heat	100.0	101.3	-1.3

Difference Range

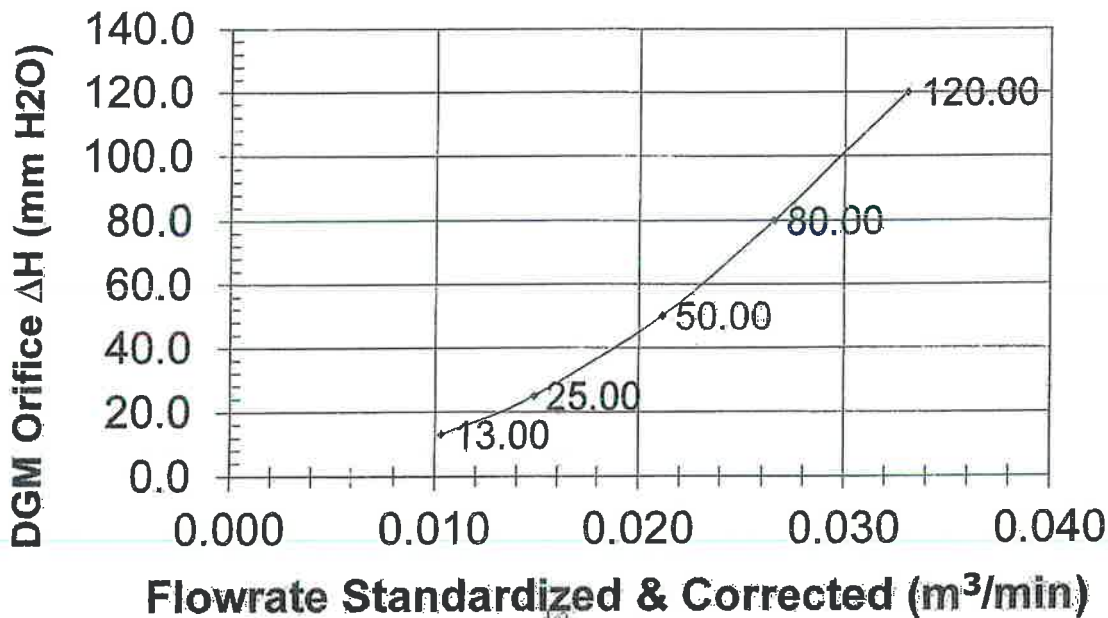
DGM Out Temp. Diff.  $\pm 3^{\circ}\text{C}$

Approved By:

WISDOM SCIENCE  
Service Manager

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WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Meter Pressure vs Flowrate



Console Serial:

A2204323

Console Model:

XC-572-OV

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WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

**DRY GAS METER XC572V**

**Serial No. : 1110070**



## Certificate Of Calibration

Method 5 Pre-Test Console Calibration - Cubic meter (m3)

## Meter Console Information

Console Model : XC572V  
 Console serial : 1110070  
 DGM Model #: SK25EX  
 DGM Serial #: 0005413

## Calibration Condition

Calibration Date: 3-Jul-23  
 Due Date: 2-Jul-24  
 Cal. Report No.: WDS-SV660107  
 Ambient Temp (°C): 25  
 Pressure (mm Hg): 758  
 Relative Humidity (%): 60

## Factors/Conversion

Std. Temp. (°K): 298  
 Std. Pressure (mm Hg): 760  
 K<sub>1</sub> (K/mm Hg): 0.3857

## Reference Equipment

WTM Model: W-NKoDa-SB WTM Cal. Due Date: Nov. 2022  
 WTM Serial: 600245 Gamma: 1.0000

## UUT Meter (DGM)

Run Time (minutes)	DGM Orifice (mm H <sub>2</sub> O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
15.00	13.0	599.3828	599.5462	27	27	20.05690	20.22163	28	27
10.00	25.0	599.5689	599.7246	27	26	20.24425	20.39999	27	27
8.00	50.0	599.7405	599.9176	26	26	20.41592	20.59344	27	27
7.00	80.0	599.9333	600.1337	26	26	20.60920	20.81034	27	27
5.00	120.0	600.1559	600.3319	26	26	20.83271	21.00950	27	27

## Reference Meter (WTM)

## Standardized Data

Test Meter		Reference Meter		Correction Factor		Flow Rate		ΔH@ (mm H <sub>2</sub> O)	
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	0.0212 SCMM	Variation	
V <sub>ref</sub> (m <sup>3</sup> )	Q <sub>ref</sub> (m <sup>3</sup> /min)	V <sub>uut</sub> (m <sup>3</sup> )	Q <sub>uut</sub> (m <sup>3</sup> /min)	(Y)	(ΔY)	Q <sub>uut</sub> (m <sup>3</sup> /min)	ΔH <sub>uut</sub>	ΔΔH <sub>uut</sub>	
0.159	0.011	0.160	0.011	1.005	0.010	0.011	50.181	2.747	
0.152	0.015	0.152	0.015	0.996	0.000	0.015	48.086	0.662	
0.174	0.022	0.173	0.022	0.995	-0.001	0.022	47.605	0.171	
0.197	0.028	0.196	0.028	0.993	-0.003	0.028	45.688	-1.747	
0.174	0.035	0.172	0.034	0.990	-0.006	0.034	45.602	-1.832	
				0.996	= Y Avg		47.434	= ΔH@ Avg	

Pass/Fail Result: **Pass**

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 ±0.02

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

Approved By: \_\_\_\_\_

(Palpasu Chaisana)  
 Service Manager

Date: 3-Jul-23

บริษัท วิสโดม ไซนซ์ แอนด์ เซอร์วิส กรุ๊ป จำกัด  
 WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

## TEMPERATURE DISPLAY CALIBRATION

**Calibration Conditions**  
 Cal. Date: 3-Jul-23  
 Due Date: 2-Jul-24  
 Cal. Report No.: WDS-SV660107  
 Ambient Temp. (°C): 25  
 Pressure (mm Hg): 758  
 Humidity (%): 60

**Reference Equipment**  
 Temp. Simulator Model: FLUKE 7148  
 Serial No.: 60590035

**Meter Console Information**  
 Console Model: XC572V  
 Console serial: 1110070  
 Temp Indicator Model: 765-KF  
 Temp. Indicator Serial: JC17852

## Temperature Sensor Calibration

Reference Point	Ref. Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
#			
1	-18.0	-17.0	1.0
2	38.0	37.0	1.0
3	93.0	93.0	0.0
4	149.0	149.0	0.0
5	260.0	259.0	1.0
6	371.0	372.0	-1.0
7	482.0	482.0	0.0
8	593.0	594.0	-1.0
9	816.0	816.0	0.0
10	1038.0	1039.0	-1.0
		Maximum <sup>1</sup>	1.0

PASS

## Note

<sup>1</sup> For valid test results, the maximum difference between temperature readings should be ≤1.0°C (EPA Method 5, Section 6.1.1.8).  
 Perform all TC Channel calibrations. Except meter (DGM) channel

## DGM Out Temperature Sensor Calibration

Temperature point	Ref. Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
#			
Ambient	26.5	27.0	-0.5
Heat	100.5	102.5	-2.0

## Difference Rang

DGM Out Temp. Diff. ±3 °C

PASS

Approved By: \_\_\_\_\_

Palpasu Chaisana  
 Service Manager

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 WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Address 9/115 Lumpini Town Ville Ratichaphuek-Phitak Village No. 4, Bang Kharun, Bang Kruai, Nonthaburi 11130 Thailand  
 Tel. 090-860-1392, 084-596-1944, 084-704-1620



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## ELAPSED TIMER CALIBRATION

### Meter Console Information

Model #: XC572V  
Serial #: 1110070  
Elapsed Timer Model #: C342-1464  
Elapsed Timer Serial #: -

### Calibration Conditions

Cal. Date : 03-Jul-23  
Due Date : 02-Jul-24  
Cal. Report No. : WDS-SV660107  
Ambient Temp. (°C) : 25  
Pressure (mm Hg) : 758  
Humidity (%) : 60

### Reference Equipment

Calibration Standard: JS-307  
Method Reference: Compare

Run Time Elapsed STO	Calibration Results				Average Time	Deviation
	Elapsed Timer		Reference			
Minute	1	2	3	4	Minute	Minute
2.00	2.00	2.00	2.00	2.00	2.000	0.000
3.00	3.00	3.00	3.00	3.00	3.000	0.000
5.00	5.00	5.00	5.00	5.00	5.000	0.000
7.00	7.00	7.00	7.00	7.00	7.000	0.000
9.00	9.00	9.00	9.00	9.00	9.000	0.000

Approved By

(Palpasu Chalsana)  
Service Engineer

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Tel. 090-660-1392, 084-598-1944, 084-704-1620

**Flue gas Analyzer**

**Testo 350 NEW**

**Serial No. 63455616/0722**



# Calibration Certificate

Certificate No.: G 660489  
Date of issue : 17-Aug-23

Instrument description : Flue Gas Analyzer  
Instrument model : Testo 350 New  
Instrument serial no. : 63455616/0722  
Control unit serial no. : 03600177/0722  
ID no. or control no. :  
Manufacturer : Testo SE & Co. KGaA  
Probe description :  
Probe model :  
Probe serial :  
Customer name : Eastern Thai Consulting 1992 Company Limited  
Customer address : 683 Moo 11, Sukhaplarn 8 Road, Nongkham, Si Racha, Chon Buri 20280

Total pages of certificate : 2 Pages  
Receiving no. : L-232625  
Receiving date. : 10-Aug-23  
Parameter of calibration : Gas Calibration(Oxygen 2.498,10.04,21.02 %vol, Carbon Monoxide 80.14,302,1003 ppm, Nitrogen Dioxide 80.96 ppm, Nitric Oxide 151.5 ppm, Sulphur Dioxide 100.8 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, Laksi, Bangkok 10210

Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration work instruction no. WI-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 and The results relate only to the items tested/calibrated.*  
*This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).*

Date of calibration : 17-Aug-23

*Kwanchoek*  
Mr. Kwanchai Khamdoung  
Calibration Technician  
*Wongsettee*  
Mrs. Nongluck Wongsettee  
Technical Manager

COPY



# Calibration Certificate

Certificate No.: G 660489

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen ( O2 ) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen ( O2 ) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen ( O2 ) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide ( CO ) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide ( CO ) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide ( CO ) 1003 ppm	2583/22	Linde	09-Aug-24
Nitrogen Dioxide ( NO2 ) 80.96 ppm	3240/21	Linde	26-Jun-24
Nitric Oxide ( NO ) 151.5 ppm	0161/23	Linde	22-Jan-25
Sulphur Dioxide ( SO2 ) 100.8 ppm	3507/22	Linde	09-Nov-24

Measured room conditions

Temperature : 23.8 °C Humidity : 62.1 %RH Pressure : 1008.9 mbar

Calibration conditions

Gas Temperature : 24 °C Flow rate : 1,300 ml/min Gas pressure : 1016.8 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.498	2.55	0.052	0.15
O2 (%Vol)	10.04	10.11	0.07	0.20
O2 (%Vol)	21.02	21.14	0.12	0.30
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	302	302	0	6.0
CO (ppm)	1003	999	-4	12
*NO2 (ppm)	80.96	81.5	0.54	8.0
*NO (ppm)	151.5	150	-1.5	8.0
*SO2 (ppm)	100.8	100	-0.8	6.0

Remark : 1 cmol/mol = 1 %vol, 1 µmol/mol = 1 ppm.

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

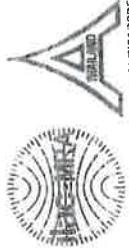
## End of Report

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**Hot Air Oven**

**Model : UFE 500**

**Serial No. : G511.0182**



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NSC-TISI-TIS1 7025  
CALIBRATION 0152

Page 2 of 3

Certificate No. : 23-006679

Sample Code : 23-02820-002

## REPORT OF CALIBRATION

### Results of Calibration

Resolution : 0.5 °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		
104	103.5	104.10	104.08	103.87	103.99	104.08	104.08	103.96	104.01	103.84	2.00

#### 2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
104.0	0.08	0.32	0.39

#### Notes

UUC\* = Unit Under Calibration



NSC-TISI-TIS1 7025  
CALIBRATION 0152

Page 1 of 3

Certificate No. : 23-006679

Sample Code : 23-02820-002

## 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.

(Hot Lab)

Equipment : Temperature controlled enclosures (Hot air oven)

Manufacturer : Memmert

Model : UFE 500

Serial No. : G511.0182

Date of Receipt : 20 January 2023

ID No. : LABE 17/4

Date of Calibration : 20 January 2023

Condition of Calibration

1. Environment : Maximum 27.9 °C : Minimum 25.3 °C

1.1 Ambient temperature : Maximum 50.9 % : Minimum 38.5 %

1.2 Relative humidity : Maximum 221.9 VAC : Minimum 218.5 VAC

1.3 Line voltage supplied

#### 2. Calibration method

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

#### 3. Reference standard instrument

Instrument : Data Acquisition With Sensor

ID No. : LB-DA-11 (RTD-138 to RTD-146)

Certificate No. : 22-040309

Due Date : 21 April 2023

#### 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. Serawoot Thammo

Scientist

Issue date

24 January 2023

Approved by

(Mr. Somchai Neampunt)

Signed for Director

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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 standard 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 01

Effective Date 15/10/2

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Effective Date 15/10/2

Rev 01



## REPORT OF CALIBRATION

Page 3 of 3

Certificate No. : 23-006679

Sample Code : 23-02820-002

## 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 = 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.

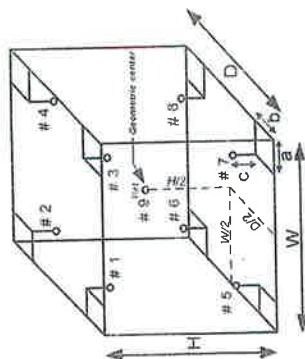


Figure: Example of sensor installation positions

- 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 UKAS M3003

COPY



**UV/VIS SPECTROPHOTOMETER**

**Model : UV - 1800**

**Serial No. : A11635101643 CD**





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

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# Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No.

Equipment UV/Vis Spectrophotometer

Model UV-1800

Manufacturer Shimadzu

Serial No. A11635101643 CD

ID No. N/A

Date of receipt 25 April 2023

Date of calibration 25 April 2023

Date of issue 27 April 2023

Customer name

Eastern Thai Consulting 1992 Co., Ltd

Address

683 Moo 11, Sukkaphibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230

Temperature

(22.4-23.1) °C (On site)  
(44.5-45.2) %RH (On site)

Humidity

Good Operation

Equipment condition

Analysis Department

Calibration Location

In-house method W/UV-702-01 based on ASTM E275-01

Traceability

Wavelength Accuracy is traceable to certificate No. 94780 and 94775  
Photometric Accuracy is traceable to certificate No. 94808 and 100147  
Stray Light is traceable to certificate No. 94791  
The above certificate are traceable to SI unit through Starna Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by

Mr.Pannaphong Phannmekakul

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. BSCC-UV-152/23

Calibration Results:

1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
287.71	287.65	-0.06	0.18
445.82	445.80	-0.02	0.18
536.52	536.35	-0.17	0.18
741.02	740.99	-0.03	0.18
879.41	879.27	-0.14	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	0.7313	0.0002	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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# Certificate of Calibration

Certificate No.

BSCC-UV-152/23

Number of Page(s)

3 of 3

Calibration Results:

## 3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty ( $\pm A$ )
420.0	0.0000 0.5488 0.7527 1.0756	0.0000 0.5508 0.7535 1.0758	0.0000 0.0020 0.0008 0.0002	0.0042 0.0042 0.0042 0.0042
440.0	0.0000 0.5391 0.7355 1.0509	0.0000 0.5406 0.7360 1.0501	0.0000 0.0015 0.0005 -0.0008	0.0042 0.0042 0.0042 0.0042
465.0	CNR CNR CNR	CNR CNR CNR	CNR CNR CNR	CNR CNR CNR
546.1	0.0000 0.5045 0.6884 0.9816	0.0000 0.5044 0.6885 0.9808	0.0000 -0.0001 0.0001 -0.0008	0.0042 0.0042 0.0042 0.0042
590.0	CNR CNR CNR CNR	CNR CNR CNR CNR	CNR CNR CNR CNR	CNR CNR CNR CNR
635.0	0.0000 0.5183 0.6864 0.9747	0.0000 0.5178 0.6868 0.9739	0.0000 -0.0005 0.0004 -0.0008	0.0042 0.0042 0.0042 0.0042

\*CNR = Customer not request

## 4. Stray Light\*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)	
	Wavelength (nm)	Absorbance (A)
200.7 $\pm$ 0.11nm	200.72	2.0164

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  
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**ANALYTICAL BALANCE (DU)**

**Model. : XS205DU**

**Serial No. : 1126323724**

NSC-TS1-TS17025  
CALIBRATION 0132

Page 1 of 4

Certificate No. : 23-006683

Sample Code : 23-02820-006

## 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.  
(Analytical Balance Room)

**Equipment** : ELECTRONIC BALANCE**Manufacturer** : METTLER TOLEDO**Model** : XS205DU**Serial No.** : 1126323724**ID No.** : LABE 05/1**Date of Receipt** : 20 January 2023**Date of Calibration** : 20 January 2023

**Calibrated by** Mr. Thanadol Pholthep  
Scientist

**Issue date** : 25 January 2023

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.

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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NSC-TS1-TS17025  
CALIBRATION 0132

Page 2 of 4

Certificate No. : 23-006683

Sample Code : 23-02820-006

## REPORT OF CALIBRATION

**ELECTRONIC BALANCE**  
**Manufacturer :** METTLER TOLEDO  
**Model :** XS205DU  
**Capacity :** Max 81 g / 220 g  
**Resolution :** 0.01 mg / 0.1 mg  
**Serial No. :** 1126323724  
**ID No. :** LABE 05/1

## 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 : 80	Before adjustment	After adjustment
<input checked="" type="checkbox"/> No adjustment	Nominal value	40	30
<input type="checkbox"/> Adjustment	Standard weight	40.000042	80.000045
	Average reading of indicator	40.00015	80.00019
	Standard deviation	0.000004	0.000007
Unit : g	Range : 200	Before adjustment	After adjustment
<input checked="" type="checkbox"/> No adjustment	Nominal value	100	200
<input type="checkbox"/> Adjustment	Standard weight	100.000022	200.000199
	Average reading of indicator	100.00001	200.00004
	Standard deviation	0.000004	0.000008

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Certificate No. : 23-006683

Sample Code : 23-02820-006

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:	80	Test Point	Sensitivity, S	Range:	200	Test Point	Sensitivity, S
	0	0	0.99800		0	0	0.9980
	40	40	0.99800		100	100	0.9980
	80	80	0.99800		200	200	0.9980

## 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	0.00000	0.00000	0.0000090	2.01
0.01	0.0100036	0.01000	0.00000	0.0000093	2.01
0.1	0.1000062	0.10000	0.00001	0.000012	2.00
1	1.0000036	1.00001	-0.00001	0.000014	2.00
5	5.0000044	5.00003	-0.00003	0.000020	2.00
10	10.0000000	10.00007	-0.00007	0.000032	2.00
20	20.0000016	20.00011	-0.00009	0.000036	2.00
50	50.0000029	50.00013	-0.00010	0.000067	2.00
100	100.0000022	100.0001	-0.0001	0.00016	2.00
150	150.0000051	150.0001	0.0000	0.00023	2.00
200	200.0000199	200.0003	-0.0001	0.00028	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. : 23-006683

Sample Code : 23-02820-006

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 ☐ Triangular ☒ Rectangular  
Test weight : 50 and 100  
Unit : g

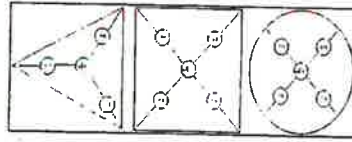
Range	Position	Reading of indicator	Reading of Indicator	Test weight
				Unit : g
1	50.00014	50.00014	100.0001	200
2	50.00014	50.00014	99.9998	
3	50.00006	50.00006	100.0000	
4	50.00010	50.00010	100.0001	
5	50.00017	50.00017	100.0001	
6	50.00014	50.00014	100.0001	
Maximum difference		0.00008	0.00003	

## 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. Condition of Calibration item: Normal
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 Public Company Limited (instrument number 1).
5. Reference standard instrument :

Instrument : STANDARD WEIGHT 1 mg to 1 kg  
Class : E2  
ID No. : LB-WE-57  
Certificate No. : 22-060639  
Date Date : 27 June 2023

6. Ambient conditions	Min	Max
Temperature (°C)	21.3	22.4
Relative Humidity (%RH)	38.2	40.4
Air pressure (hPa)	1008.4	1010.1

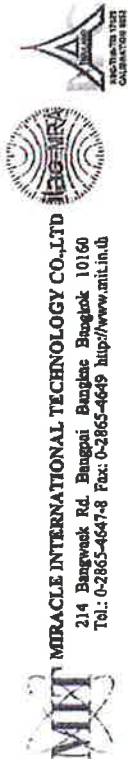


- End of Report -

## **BAROMETER**

**Equipment : Analog Barometer**

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



## CALIBRATION CERTIFICATE



Certificate No. : L202305085-002  
Date issued : 16-May-23

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

Equipment : Analog Barometer

Manufacturer : Barigo  
Model : -  
Serial No. : -  
ID No./Tag No. : BM001/41  
Date Received : 11-May-23  
Date Calibrated : 15-May-23

Calibrated by : Mr. Jane Khaothong

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.

This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

Approved by: *Sasayuthi*  
(Mr. Sarayuth Tothua)



Page 1 of 2

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Certificate No. : L202305085-002  
Environment : Ambient Temperature : (25 ± 2)°C  
Relative Humidity : (50 ± 15)%RH

STD Reading mbar	UUC Reading (mbar) Before Adjusted	UUC Reading (mbar) After Adjusted	UUC Error mbar	Uncertainty ± mbar
990.00	990.0	-	0.00	0.61
1000.00	1000.0	-	0.00	0.61
1010.00	1010.0	-	0.00	0.61
1020.00	1020.0	-	0.00	0.61
1030.00	1030.0	-	0.00	0.61

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  
Conversion Factor : Multiply by 1.0 E-02 - Pa unit

Description of UUC :

Range : 990 - 1030 mbar Absolute  
Calibration Range : 990 - 1030 mbar Absolute  
Scale Interval : 1 mbar  
Resolution : 0.5 mbar 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-P220104 for Reference Pressure Monitor Serial No. 1598, Due 11-Nov-23

End of Certificate

Page 2 of 2

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**GAS CHROMATOGRAPH**

**MODEL : GC-2010 Plus AF**

**S/N : C12095200986**

## Operational Qualification

## 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		Serial Number (SN)		Model Name		GC-2010Plus JF		Criteria		Results		Pass		Fail					
1	Display, LED test	C 1 2 0 9 5 2 0 0 9 8 6		Gas Chromatograph		LAE 04/17		All LEDs light. Screen contrast adjustment is possible.		LED Display		Good		Pass		Fail			
2	Standard self-diagnostic test							"Good" displayed as the result of the self-diagnostic test.				Good		Pass		Fail			
3	Hardware version check							Version number and build number are displayed.		Ver.		Version: 2.1.0.0 Build No.: 2.1.0.0		Pass		Fail			
4	Temperature test							Verify that temperature control is normal.		TEMP LED lights green.		Set value		Measured value		Pass		Fail	
	Column inlet pressure test							Verify the accuracy of the column inlet pressure.		Pressure gauge reading		Set value		Measured value		Pass		Fail	
								Pressure gauge reading		Set value		Measured value		Pass		Fail			
								Pressure gauge reading		Set value		Measured value		Pass		Fail			
								Pressure gauge reading		Set value		Measured value		Pass		Fail			
								Pressure gauge reading		Set value		Measured value		Pass		Fail			

Performer (signature):

Date: 25 / 01 / 2022

Reviewer (signature):

Date: 25 / 01 / 22

## Operational Qualification

## Operational Qualification Record

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 ± 5.0 kPa Inspection pressure gauge reading 8 minutes after start 250.0 ± 20.0 kPa	Pass	Fail
7	Flowrate test	Verify the accuracy of the full-flow and septum purging.	Septum purge vent measured flow rate 3.0 ± 1.0 mL/min Total of septum purge and split vent flow rate values 10.0 ± 3.0 mL/min	Pass	Fail
8	Column oven test	Verify the accuracy of the column oven temperature.	Temp. correction value Temp. sensor reading Corrected temp. value Temp. correction value Temp. sensor reading Corrected temp. value	Pass	Fail
9	Temperature program test	Verify that the column temperature program operates normally.	Monitored temperature 6 minutes after start 200 ± 1°C Inspection temperature reading 8 minutes after start 200.0 ± 4.7°C Using a temperature sensor with 1°C minimum display increment 200 ± 3°C	Pass	Fail
10	Sensitivity test	Verify the detector sensitivity.	CiAREA value 61462 Calculated S value 1.5 (0.0 × 10 <sup>-3</sup> C/g) CiAREA value Flowrate at vent Calculated S value 4.00 × 10 <sup>-3</sup> mV·min/mg	Pass	Fail

Performer (signature):

Date: 25 / 01 / 2022

Reviewer (signature):

Date: 25 / 01 / 22

## 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. (SN)		C 1 2 1 9 5 4 1 0 8 0 9	
No.	Item	Criteria	Results
1	Display, LED test	Verify the display and LED operation. All LEDs light, except decimal point.	<input checked="" type="checkbox"/>
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally. Display shows "000".	<input checked="" type="checkbox"/>
3	Firmware version check	Verify the program version. Version number is displayed. The version number matches the controlled version number.	<input checked="" type="checkbox"/>
4	Basic operation test	Verify that the auto injector basic operation is correct. Sample injected into the GC and GC operation starts.	<input checked="" type="checkbox"/>

☒ Not Applicable ☐ Dual system, sub injector

Component ID		Model Name	AOC-20i
Serial No. (SN)			
No.	Item	Criteria	Results
1	Display, LED test	Verify the display and LED operation. All LEDs light, except decimal point.	<input type="checkbox"/>
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally. Display shows "000".	<input type="checkbox"/>
3	Firmware version check	Verify the program version. Version number is displayed. The version number matches the controlled version number.	<input type="checkbox"/>
4	Basic operation test	Verify that the auto injector basic operation is correct. Sample No. 1 transferred to the main injector, sample No. 2 transferred to the sub-injector. Sub-injector injects into the GC simultaneously with the main AOC.	<input type="checkbox"/>

Performer (signature):

Date: 25 / 02 / 2022

Reviewer (signature):

Date: 25 / 8 / 22

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## Operational Qualification

## Operational Qualification Record

## 3-3 AOC-20s Auto Sampler

☒ Applicable ☐ Not Applicable

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

Performer (signature):

Date: 25 / 02 / 2022

Reviewer (signature):

Date: 25 / 8 / 22

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**Hot Air Oven**

**Model. : UM 400**

**Serial No. : 900982**

## 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 position (°C)								Uncertainty ± (°C)	Coverage factor k
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8		
85	85.0	85.0	85.18	85.04	84.82	84.82	85.03	85.04	85.00	84.96	0.25	2.00

#### 2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
85	0.07	0.49	0.68

#### Notes

UUC\* = Unit Under Calibration

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

583 Moo 11, Sukhaphiban 8 Rd., Nongkham,

Srisaka, 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

ID No. : LABE 17/1

Date of Receipt : 21 February 2023

Date of Calibration : 21 February 2023

Condition of Calibration

1. Environment

1.1 Ambient temperature

1.2 Relative humidity

1.3 Line voltage supplied

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-158 to RTD-166)

(RTD-Pt100)

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. Sarewoot Thammoo

Approved by

(Mr. Somchai Neerapunt)

Solentist

24 February 2023

Issue date

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

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).

33/ Soi Ledprao 122, Ledprao Road, Phlabphla, Wang Thonglang, Bangkok 10310

Phlabphla, Wang Thonglang, Bangkok 10310

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## REPORT OF CALIBRATION

Page 3 of 3  
Certificate No. : 23-018635  
Sample Code : 23-07651-001

### 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 at the geometric center of the chamber.
2. Interior dimensions approx of chamber :  
W = 40 cm ; D = 26 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

The result extended 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 M0003.

- End of Report -

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**IC-THERMO**

**Serial No. : 20053176**





### Certificate of Calibration

**Integration : Anion and Cation (ID#960)**

This certificate is to verify that Instrument below are calibrated  
by Archemica Lab Co., Ltd.

Integration	S/N : 20053176
AS-DV	S/N : 2008880131

For

**Easternthai Consulting 1992 Co., Ltd.**

Operator Signature : Nutdanai Date : Oct 20, 2022

(Mr. Nutdanai Laekthwan)

Application Chemist

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**Primary Flow Calibrator**

**Serial No. : 110619 , 207510**

### Certificate of Calibration

Certificate No : 23-AFM-022  
 Request No : Req-2023-0128

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

**Sensor Model :**  
**Sensor Serial Number :**

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

**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 : 20 January 2023  
 Calibration Date : 6 February 2023

**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	15 June 2023
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	15 June 2023

**Traceability :**  
 This certificate provides traceability of measurement to recognized national standard, and to the realization of the International System of

Units (SI)

Note :

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

**Calibration By :** Mr. Noppadon Luangart  
 Service Calibration Engineer

**Approved By :** Mr. Puitt Mathavom  
 Calibration Engineer Supervisor

**Result of Calibration :**

Flow Setting (L/min)	STD Flow Reading (L/min)	UUC Flow Reading (L/min)	Correction Flow (L/min)	Uncertainty (L/min)
0.02	0.02018	0.020259	-0.00008	0.00032
0.05	0.05041	0.050541	-0.00013	0.00083
0.1	0.1025	0.10153	0.0010	0.0015
0.25	0.2519	0.25043	0.0015	0.0036
0.5	0.5023	0.50069	0.0016	0.0072

Note  
 STD : Standard  
 UUC : Unit Under Calibration

End of Certificate

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Certificate No : 23-AFM-024  
Request No : Req-2023-0196

Result of Calibration :

Calibration Point (cc/min)	STD Flow Reading (cc/min)	UUC Flow Reading (cc/min)	Correction Flow (cc/min)	Uncertainty (±) (cc/min)
500	501.1	506.43	-5.3	7.2
1000	1019	1032.2	-13	15
2000	2003	2017.8	-15	29
3000	3007	3023.8	-17	43
4000	4013	4027.2	-15	57

Note  
STD : Standard  
UUC : Unit Under Calibration

End of Certificate

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Certificate of Calibration  
Customer : Eastern Thai Consulting 1992 Co., Ltd.  
Name : 682 Moo 11, Subphaban 8 Rd., Nongkham, Sriracha, Chonburi 20230  
Address : 682 Moo 11, Subphaban 8 Rd., Nongkham, Sriracha, Chonburi 20230

Unit Under Calibration Details  
Measurement Item : Primary Flow Calibrator  
Manufacturer : Mesa Labs  
Model : Defender 510-M  
Serial Number : 207510  
ID : -  
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 : 25 January 2023  
Calibration Date : 6 February 2023  
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 Standard flow	19031011003	Sealidyne	15 June 2023

Traceability :  
This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI)  
Note :  
The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k=2, providing a level of confidence approximately 95 %.

Calibration By : Mr. Noppadon Luangart  
Service Calibration Engineer  
Approved By : Mr. Pacit Mahavorn  
Calibration Engineer Supervisor

Issue Date : 6 February 2023  
COPY

**ANALYTICAL BALANCE (DU)**

**Model. : XS205DU**

**Serial No. : 1126323724**



Certificate No. : 23-006683  
Sample Code : 23-02820-006

## CERTIFICATE OF CALIBRATION

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

Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.  
(Analytical Balance Room)

Equipment : ELECTRONIC BALANCE

Manufacturer : METTLER TOLEDO

Model : XS205DU

Serial No. : 1126323724

ID No. : LABE 05/1

Date of Receipt : 20 January 2023

Date of Calibration : 20 January 2023

Calibrated by Mr. Thanadol Pholthep  
Scientist

Issue date 25 January 2023

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)



Certificate No. : 23-006683  
Sample Code : 23-02820-006

## REPORT OF CALIBRATION

Equipment : ELECTRONIC BALANCE  
Manufacturer : METTLER TOLEDO  
Model : XS205DU  
Capacity : Max 81 g / 220 g  
Resolution : 0.01 mg / 0.1 mg  
Serial No. : 1126323724  
ID No. : LABE 05/1

## 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 : 80	<input type="checkbox"/> Before adjustment	<input type="checkbox"/> After adjustment
<input checked="" type="checkbox"/> No adjustment	Nominal value	40	90
<input type="checkbox"/> Adjustment	Standard weight	40.000042	60.000045
	Average reading of indicator	40.00015	90.00019
	Standard deviation	0.000004	0.000007
Unit : g	Range : 200	<input type="checkbox"/> Before adjustment	<input type="checkbox"/> After adjustment
<input checked="" type="checkbox"/> No adjustment	Nominal value	100	200
<input type="checkbox"/> Adjustment	Standard weight	100.000022	200.000199
	Average reading of indicator	100.0001	200.0004
	Standard deviation	0.00004	0.00008

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Certificate No. : 23-006683

Sample Code : 23-02820-006

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 :		Range :	
Test Point	Sensitivity, S	Test Point	Sensitivity, S
0	0.99800	0	0.9980
40	0.99800	100	0.9980
80	0.99800	200	0.9980

## 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	0.000000	0.00000	0.00000	0.000090	2.01
0.01	0.0100036	0.01000	0.00000	0.000093	2.01
0.1	0.1000062	0.10000	0.00001	0.000012	2.00
1	1.0000036	1.00001	-0.00001	0.000014	2.00
5	5.0000044	5.00003	-0.00003	0.000020	2.00
10	10.000000	10.00007	-0.00007	0.000032	2.00
20	20.000016	20.00011	-0.00009	0.000036	2.00
50	50.000029	50.00013	-0.00010	0.000067	2.00
100	100.000022	100.0001	-0.0001	0.00016	2.00
150	150.000051	150.0001	0.0000	0.00023	2.00
200	200.000199	200.0003	-0.0001	0.00028	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.

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Certificate No. : 23-006683

Sample Code : 23-02820-006

## 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.

Weighting pan ☐ Circle ☐ Triangular ☒ Rectangular

Test weight : 50 and 100  
Unit : g

Range	Position	Reading of indicator	Reading of indicator
1	50.00014	100.0001	100.0001
2	50.00014	99.9998	99.9998
3	50.00006	100.0000	100.0000
4	50.00010	100.0001	100.0001
5	50.00017	100.0001	100.0001
6	50.00014	100.0001	100.0001
Maximum difference	0.00008	0.0003	0.0003

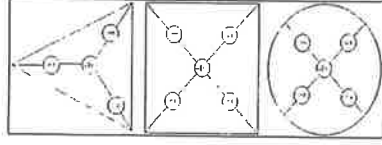
## Condition of Calibration

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. Condition of Calibration item: Normal
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 Public Company Limited (Instrument number 1 ).

## 5. Reference standard instrument :

Instrument  
1) STANDARD WEIGHT 1 mg to 1 kgClass ID No.  
E2 LB-WE-57Certificate No.  
22-060639Due Date  
27 June 2023

6. Ambient conditions	Min	Max
Temperature (°C)	21.3	22.4
Relative Humidity (%Rh)	39.2	40.4
Air pressure (hPa)	1008.4	1010.1



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End of Report -



**ANALYTICAL BALANCE**

**Model. : SECURA224-1S**

**Serial No. : 0036707137**

**AMARC**

Certificate No. : 23-006682

Sample Code : 23-02820-005

## 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 type="checkbox"/> Before adjustment	<input type="checkbox"/> After adjustment
<input checked="" type="checkbox"/> No adjustment	Nominal value	100	200
<input type="checkbox"/> Adjustment	Standard weight	100.000022	200.000199
	Average reading of indicator	99.9998	199.9999
	Standard deviation	0.00007	0.00007
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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**AMARC**

Certificate No. : 23-006682

Sample Code : 23-02820-005

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapiban 8 Rd., Nongkham,  
Siriracha, 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 : 20 January 2023

Date of Calibration : 20 January 2023

Calibrated by : Mr. Thanadol Pholthep  
Scientist

Issue date : 25 January 2023

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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Certificate No. : 23-006682

Sample Code : 23-02820-005

## 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	Range	Sensitivity, S	Test Point	Sensitivity, S
0	220	0.9980		
100		0.9980		
200		0.9980		

## 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	0.00011	2.04
0.01	0.0100036	0.0100	0.0000	0.00011	2.04
0.1	0.1000062	0.1000	0.0000	0.00011	2.04
1	1.0000036	1.0000	0.0000	0.00011	2.04
2	2.0000128	2.0000	0.0000	0.00011	2.04
5	5.0000044	5.0000	0.0000	0.00011	2.04
10	10.0000000	10.0000	0.0000	0.00011	2.03
20	20.0000016	20.0000	0.0000	0.00012	2.03
50	50.0000029	50.0000	0.0000	0.00013	2.02
100	100.0000022	99.9998	0.0002	0.00017	2.01
200	200.0000199	200.0000	0.0002	0.00028	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.

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27 June 2023



Certificate No. : 23-006682

Sample Code : 23-02820-005

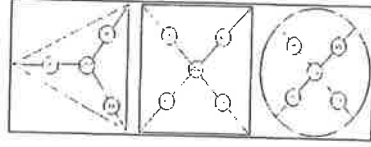
## REPORT OF CALIBRATION

## 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.

Weighting pan	Test weight : 100
<input checked="" type="radio"/> Circle	Unit : g
<input type="radio"/> Triangular	
<input type="radio"/> Rectangular	
Range	Reading of indicator
220	
Position	Reading of indicator
1	99.9998
2	100.0001
3	99.9997
4	99.9998
5	99.9998
6	99.9998
Maximum difference	0.0003
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. Condition of Calibration item: Normal

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 Public Company Limited (Instrument number 1).

5. Reference standard instrument :

Instrument

1) STANDARD WEIGHT 1 mg to 1 kg

Class

E2

Certificate No.

22-060639

Due Date

27 June 2023

27 June 2023

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.

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- End of Report -

**BOD INCUBATOR**

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

NSC-TSI-TSI7025  
CALIBRATION 0152

Page 1 of 3

Certificate No. : 22-136844

Sample Code : 22-51164-006

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapiban 8 Rd., Nongkham,  
Sriacha, Cho-buri 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 : 21 December 2022 Date of Calibration : 21 December 2022

## Condition of Calibration

1. Environment  
1.1 Ambient temperature : Maximum 25.1 °C : Minimum 24.3 °C  
1.2 Relative humidity : Maximum 52.3 % : Minimum 48.5 %  
1.3 Line voltage supplied : Maximum 223.6 VAC : Minimum 221.9 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)	22-040308	24 April 2023

## 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. Nathanan Phosri  
Approved by : (Mr. Somchai Neampunt)  
Scientist

Issue date : 26 December 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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PM-CL-114  
Rev.01  
Effective Date 15/10/21

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WWW.AMARC.CO.TH

Effective Date 15/10/21

NSC-TSI-TSI7025  
CALIBRATION 0152

Page 2 of 3

Certificate No. : 22-136844

Sample Code : 22-51164-006

## 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 <sup>Ref</sup>		
20	20.0	20.0	19.65	19.56	19.47	19.29	20.96	20.47	20.23	20.58	20.29	0.35	2.00

## 2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
20	0.13	1.09	1.90

## Notes

- UUC\* = Unit Under Calibration

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WWW.AMARC.CO.TH  
Effective Date 15/10/21TEL 02-516-2422  
FAX 02-516-6949  
Rev.09361 Soi Ladprao 122, Ladprao Road,  
Phlabphla, Wang Thonglang, Bangkok 10310  
PM-CL-018



## REPORT OF CALIBRATION

Page 3 of 3

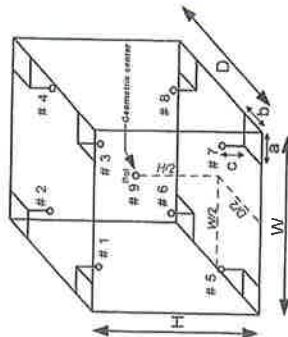
Certificate No. : 22-136844

Sample Code : 22-51164-006

## 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 at 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<sup>o</sup> 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 UKAS M3003.

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**BOD INCUBATOR**

**ID No. : LABE 19/5**



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 <sup>ref</sup>
20	20.0	20.0	20.06	19.92	19.96	19.89	19.93	20.08	19.97	19.79	19.86	0.42	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
20	0.32	0.37	0.85

Notes

UUC\* = Unit Under Calibration

*[Signature]*

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.  
(Laboratory)

Equipment : Temperature controlled enclosures (Incubator)  
Manufacturer : Lovibond  
Model : Tc44SS  
Serial No. : 0520/005227  
ID No. : LABE 19/5  
Date of Receipt : 21 April 2023  
Date of Calibration : 21 April 2023

Condition of Calibration

1. Environment	1.1 Ambient temperature	: Maximum 36.1 °C	: Minimum 34.5 °C
	1.2 Relative humidity	: Maximum 51.8 %	: Minimum 49.3 %
	1.3 Line voltage supplied	: Maximum 224.7 VAC	: Minimum 221.9 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-08 (RTD-239 to RTD-247)	22-077888	09 August 2023

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. Sarawoot Thamno  
Scientist

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

Issue date : 24 April 2023

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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Phlabphla, Wang Thonglang, Bangkok 10310  
FW-CL-014

TEL 02-516-2472  
FAX 02-516-6949  
Rev 01

Effective Date: 15/11/21

*[Signature]*

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NSC-TSI-11517025  
CALIBRATION0152

Page 3 of 3

## REPORT OF CALIBRATION

Certificate No. : 23-040768

Sample Code : 23-16178-002

### 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 = 60 cm ; D = 56 cm ; H = 146 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.

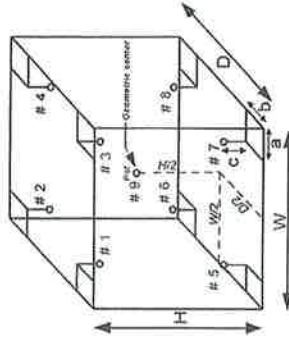


Figure:-Example of sensor  
Installation Positions

The result expanded uncertainty of measurement  $U$  is stated 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 -

**COPY**

**Hot Air Oven**

**Model. : UM 400**

**Serial No. : 900982**

## 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 <sup>Ref</sup>	
85	85.0	85.0	85.18	85.04	84.62	84.82	85.03	85.04	85.00	84.96	85.08	2.00

### 2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
85	0.07	0.49	0.68

### Notes

UUC\* = Unit Under Calibration

## CERTIFICATE OF CALIBRATION

**Customer** : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapibon 8 Rd., Nongkham,  
Siracha, 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

**ID No.** : LABE 17/1

**Date of Receipt** : 21 February 2023

**Date of Calibration** : 21 February 2023

### Condition of Calibration

1. Environment	1.1 Ambient temperature	Maximum : 31.2 °C	Minimum : 28.7 °C
	1.2 Relative humidity	Maximum : 50.2 %	Minimum : 40.1 %
	1.3 Line voltage supplied	Maximum : 223.9 VAC	Minimum : 221.5 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)	22-040312	02 May 2023

### 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. Sarawoot Thammo

Scientist

(Mr. Somchai Neampunt)

Signed for Director

**Issue date** : 24 February 2023

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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## REPORT OF CALIBRATION

Page 3 of 3

Certificate No. : 23-018635

Sample Code : 23-07651-001

### 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.

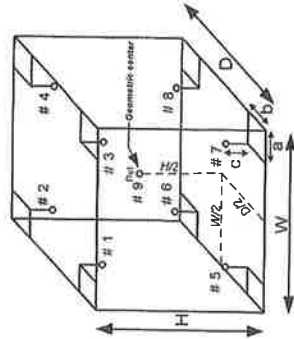


Figure: Example of sensor installation Positions

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 -

**COPY**

**LIQUID IN GLASS THERMOMETER**

**Model : Total immersion**

**Serial No. : 43560**

# Calibration Certificate

**Certificate No.:** 2300368-001-01  
**Client name:** EASTERN THAI CONSULTING 1992 CO., LTD.  
**Address:** 683 Moo 11, Sukhapibam 8 Rd.,  
 Nongkham, Sriracha, Chonburi 20230

**Equipment:** Liquid-in-Glass Thermometer  
**Manufacturer:** Precision  
**Model / Type:** Total Immersion  
**Serial No.:** 43560  
**ID No.:** LABE 16/1  
**Order No.:** 2300368  
**Operation No.:** 2300368-001  
**Date of Receipt:** 7 November 2022  
**Date of Calibration:** 15 November 2022

**Calibrated by** Mr.Nuttapol Miyomchet  
 Specialist  
**Approved by** ( Mr.Pheraphat Tuanjit )  
 Manager, Division of Calibration Laboratory  
 Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95 %.  
 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 units 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 National Food Institute.



# Calibration Report

**Certificate No.:** 2300368-001-01  
**Equipment:** Liquid-in-Glass Thermometer  
 Range: -1.9 to 101.1 °C  
 ID No.: LABE 16/1  
 Manufacturer: Precision  
 Date of Calibration: 15 November 2022

**Location:** Temperature Calibration Laboratory, National Food Institute  
**Environment Condition:** Ambient Temperature 23 °C ± 3 °C,  
 Relative Humidity 55 % ± 15 %

## Condition of this results of Calibration:

- Calibration Method : - In-house method : W-TE-015 based on ASTM E77-07
  - The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
  - The temperature Scale in use at this laboratory is the International Temperature Scale of 1990 ( ITS-90 ).

## 2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
BLACK STACK THERMOMETER	1560/2560	A39258/A39719	PSL-T 0674/65	7-Jun-23	TISTR
Platinum Resistance Thermometer (PRT)	5615	808926			

Support Equipment : - Ice point Unit, ID No.: ana. 614/21

- Low Temperature Bath (Deep Well Compact Bath), Model: 7381, S/N: B53496.
- Low Temperature Bath (Deep Well Compact Bath), Model: 7341, S/N: A5A084.
- High Temperature Bath (Deep Well Compact Bath), Model: 6331, S/N: A5A087.

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibrated item : Good
- Result of Calibration : ☒ Without adjustment ☐ After adjustment





## Calibration Report

**Certificate No.:** 2300368-001-01  
**Equipment:** Liquid-in-Glass Thermometer  
**Type:** Total Immersion  
**Range:** -1.9 to 101.1 °C  
**Resolution:** 0.1 °C  
**ID No.:** LABE 16/1  
**Serial No.:** 43560  
**Manufacturer:** Precision  
**Date of Calibration:** 15 November 2022

Page 3 of 3

**Calibration point:** 3.0, 25.0 and 50.0 °C  
**Calibration result:**

### Reporting of ice-point or reference point

UUC* Reading (°C)	Standard Temperature/Ice Point (°C)	Correction Value (°C)	Uncertainty ± (°C)
0.0	0.0032	0.0	0.091

### Reporting of temperature calibration point

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
25.0	24.9990	0.0	0.088
50.0	49.9943	0.0	0.088

### Note

\* UUC\* : Unit Under Calibration

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

----- End -----



**COPY**

**pH Meter**

**Model. : SevenCompact S220**

**Serial No. : B448305208**



## CERTIFICATE OF CALIBRATION

Page 1 of 3  
Certificate No. : 23-011524  
Sample Code : 23-04833-001Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapiban 8 Rd., Nongkham,  
Siriracha, Chonburi 20230Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited  
(Calibration Laboratory)Equipment : pH Meter  
Manufacturer : METTLER TOLEDO Model : SevenCompact S220  
Serial No. : B448305208 ID No. : LABE 11/4  
Date of Receipt : 01 February 2023 Date of Calibration : 01 February 2023

## Condition of Calibration

1. Environment  
1.1 Ambient temperature : 25.0 ± 2.5 °C 1.2 Relative humidity : 55.0 % ± 15.0 %

## 2. Calibration method

In house method WI-CL-019: based on direct measurement by using standard voltage calibrator and using certified reference material (CRM).

## 3. Reference standard / Certified reference material

Instrument	ID No.	Certificate No.	Due Date
3.1 Voltage Calibrator	LB-AMC-01	22E3240	03 October 2023
3.2 Digital Thermometer	LB-TH-33	22-107027	02 October 2023
Certified Reference Material			
Lot No.	Ref No.	Expire Date	
3.3 Buffer Solution pH 4.008	838357	PH216.L5	15 September 2024
3.4 Buffer Solution pH 6.985	838358	PH107.L5	15 September 2023
3.5 Buffer Solution pH 10.008	838359	PH220.L5	15 September 2023

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

- 4.1 Instrument No. 3.1 through Technology Promotion Association (Thailand-Japan).  
4.2 Instrument No. 3.2 through Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.  
4.3 Buffer Solution No. 3.3 and No. 3.5 traceable to CPA chem (through primary measurement method-Harned cell using calibrated thermometer, barometer, and nanovoltmeter. Accredited laboratory ISO/IEC 17025 and ISO/IEC 17034).  
4.4 Buffer Solution No. 3.4 traceable to CPA chem (BIM RefN HI-27 LoIN 04.06.2021 ; BIM RefN HI-28 LoIN 28.05.2021 ; BIM RefN HI-27 LoIN 04.06.2021 ; BIM RefN HI-28 LoIN 28.05.2021 Accredited laboratory ISO/IEC 17025 and ISO/IEC 17034).

## 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. Anupong Lakawin Approved by : (Ms. Pawana Pan-on)  
Scientist

Issue date : 03 February 2023

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)



## REPORT OF CALIBRATION

Page 2 of 3  
Certificate No. : 23-011524  
Sample Code : 23-04833-001Equipment : pH Meter Resolution : ± 0.01 pH ; 0.1 mV ; 0.1°C  
Manufacturer : METTLER TOLEDO Model : SevenCompact S220  
Serial No. : B448305208 ID No. : LABE 11/4  
Range : -2.000 pH to 20.000 pH ; ± 2000.0 mV ; -5.0°C to 130.0°C

## Results of Calibration

## Part 1. DC Voltage measurement

pH Meter Serial No. : B448305208

Nominal Value	Applied DC Voltage	Average indicator reading		Uncertainty	Coverage factor
		mV	pH		
0	414.113	414.0	0.00	± 0.083	2.00
4	177.477	177.5	4.00	± 0.083	2.00
7	0.000	0.1	7.00	± 0.083	2.00
10	-177.477	-178.3	10.00	± 0.083	2.00
14	-414.113	-413.8	14.00	± 0.083	2.00

## Part 2. Performance of Electrode system

Electrode Manufacturer : METTLER TOLEDO Model :

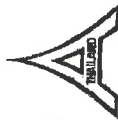
Electrode Serial No. : 2365921

Three-Point Calibration at pH4 and pH7 Percent Slope : 99.6 ; at pH7 and pH10 Percent Slope : 98.4

Standard Buffer Solution	Average indicator reading		Error Value	Uncertainty	Coverage factor
	pH (@ 25 °C)	mV			
4.008	4.01	184.2	0.002	± 0.011	2.00
6.985	6.99	8.9	0.005	± 0.010	2.00
10.008	10.01	-166.8	0.002	± 0.010	2.00

The result expanded uncertainty (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

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## REPORT OF CALIBRATION

Page 3 of 3

Certificate No. : 23-011524

Sample Code : 23-04833-001

Equipment : pH Meter (Digital Thermometer with sensor)

Thermometer readout

Manufacturer : METTLER TOLEDO Model : SevenCompact S220

Serial No. : B448305208 ID No. : LABE 11/4

Resolution : 0.1 °C Range : -5.0 °C to 130.0 °C

Thermometer sensor

Manufacturer : METTLER TOLEDO Model : InLab Expert Pro-ISM

Serial No. : 2365921 ID No. : N/A

## Condition of Calibration

1. Environment
  - 1.1 Ambient temperature : 23.0 °C ± 3.0 °C
  - 1.2 Relative humidity : 55.0 % ± 15.0 %

## 2. Calibration method

- 2.1 The calibration use in house method WI-CL-021 : by comparison with standard thermometer
- 2.2 The calibration by comparison unit under calibration (UUC) to the standard thermometer in a calibration bath at the controlled temperature.
- 2.3 The temperature scale in use of this laboratory is the international temperature scale of 1990 (ITS-90).

## 3. Reference standard instrument

Instrument	Model	ID No.	Certificate No.	Due date
3.1 Platinum Resistance Thermometer	PT-100	RTD-90	22-107027	02 October 2023
3.2 Thermometer Readout	GT-11	LB-TM-33	22-107027	02 October 2023

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (Accreditation Under TLAS Laboratory Calibration No.0152)

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

6. Condition of Calibration item : Normal

## Results of Calibration

Calibration point °C	Average of standard reading °C	Unit under calibration		Expanded uncertainty °C	Coverage factor k
		Immersion depth mm	Average reading °C		
25	25.002	120	25.0	± 0.13	2.00

## Notes

- 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 JGAS M3003

DD

- End of report -

COPY

**STANDARD WEIGHT 50 g**



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

## 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 : 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  
Approved by : ( Mr. Somchai Neampunt )  
Signed for Director

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).



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

## 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.
	(mg)	Mass	Uncertainty	Permissible Error	
			(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 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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Certificate No. : 22-052238

Sample Code : 22-19150-003

Page 3 of 3

## 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  $1.20 \text{ kg/m}^3$
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).



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 ( $\rho_a$ ) 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 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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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/m<sup>3</sup>

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-78	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 100 g
Shape :	Cylindrical weight with knob
Material :	Stainless steel
Case :	Wooden Box
Comments :	Recalibration

- End of Report -

COPY

**STANDARD WEIGHT 50 g**



Certificate No. : 22-052237

Sample Code : 22-19150-002

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

689 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 : 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).



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 ( $\rho_0$ ) of 1.2 kg.m<sup>-3</sup>

Description	Deviation	Conventional		Expanded	Maximum		ID No.
		Mass			Permissible Error		
	(mg)			Uncertainty	± (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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NSC-TIS-71517025  
CALIBRATION 0152

Certificate No. : 22-052237

Sample Code : 22-19150-002

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 1.18 kg/m<sup>3</sup>
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

**NOISE DOSI METER**

**MODEL : CR:110A**

**SERIAL No. : CB0643**



# CERTIFICATE OF CALIBRATION

ISSUED BY      Cirrus Research plc

DATE OF ISSUE    12 January 2023    CERTIFICATE NUMBER    185805

**Cirrus Research plc**  
Acoustic House  
Bridlington Road  
Hunmanby  
North Yorkshire  
YO14 0PH  
United Kingdom

Page 1 of 2

Approved signatory  
N.Smith  
Electronically signed:



**Dosimeter : IEC 61252-1993+A1:2000**

## Instrument information

Manufacturer:    Cirrus Research plc  
Model:            CR:110A  
Serial number:    CB0643  
Firmware version: 5.4

Notes:

## Test summary

Date of calibration:    12 January 2023  
The calibration was performed respecting the requirements of ISO/IEC 17025:2017.  
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.  
The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

## Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	TTi	TG4001	395851
Attenuator	Cirrus Research	ZE:952	52200
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	79620

## Notes

Eastern Thai Consulting 1992 Co.,Ltd. 683 Moo.11 , Sukaphibal 8 Rd., Nongkham , Sriracha , Chonburi 20230



This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

# CERTIFICATE OF CALIBRATION

Certificate Number:  
**185805**

Page 2 of 2

## Environmental conditions

The following conditions were recorded at the time of the test:

**Before**    Pressure: 98.92 kPa    Temperature: 20.7 °C    Humidity: 36.5 %  
**After**     Pressure: 98.98 kPa    Temperature: 20.9 °C    Humidity: 36.5 %

## Test results summary

Test	Result
Absolute Acoustic Sensitivity	Complies
Linearity	Complies
Short Duration	Complies
Overload Latching	Complies
Frequency weighting	Complies



**NOISE DOSI METER**

**MODEL : CR:110A**

**SERIAL No. : CB0644**

# CERTIFICATE OF CALIBRATION

ISSUED BY      Cirrus Research plc

DATE OF ISSUE    12 January 2023      CERTIFICATE NUMBER    185807

**Cirrus Research plc**  
Acoustic House  
Bridlington Road  
Hunmanby  
North Yorkshire  
YO14 0PH  
United Kingdom

Page 1 of 2  
Approved signatory  
N. Smith  
Electronically signed:

*N. Smith*

## Dosimeter : IEC 61252-1993+A1:2000

### Instrument information

Notes:

Manufacturer:      Cirrus Research plc

Model:              CR-110A

Serial number:    CB0644

Firmware version:    5.4

### Test summary

Date of calibration:    11 January 2023

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.

The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.

The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

### Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	TTi	TG4001	395851
Attenuator	Cirrus Research	ZE:952	52200
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC-110A	79620

### Notes

Eastern Thai Consulting 1992 Co.,Ltd. 683 Moo.11 , Sukaphibal 8 Rd., Nongkham , Siracha , Chonburi 20230

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This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

# CERTIFICATE OF CALIBRATION

### Environmental conditions

The following conditions were recorded at the time of the test:

**Before**    Pressure: 99.14 kPa      Temperature: 22.5 °C      Humidity: 43.1 %

**After**      Pressure: 99.13 kPa      Temperature: 22.5 °C      Humidity: 43.6 %

### Test results summary

Test	Result
Absolute Acoustic Sensitivity	Complies
Linearity	Complies
Short Duration	Complies
Overload Latching	Complies
Frequency weighting	Complies

Certificate Number:  
**185807**

Page 2 of 2

*COPY*

**SOUND LEVEL METER**

**MODEL : NL-42A**

**SERIAL No. : 00322745**



## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42A/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00322745 / 196468 / 15477  
**ID No.:**

**Condition As Found :** GOOD

**Customer :** EASTERN THAI CONSULTING 1992 CO., LTD.  
SAHA GROUP INDUSTRIAL PARK, 683 MOO 11,  
NONGKHAM, SIRACHA, CHONBURI 20230 THAILAND.

**Location :**  
**Ambient Temperature :** ( 23.0 ± 3 ) °C  
**Pressure :** ( 101.3 ± 3 ) kPa  
**Relative Humidity :** ( 50.0 ± 20 ) %  
**Received Date :** 10 MAY 2023  
**Calibration Date :** 17-18 MAY 2023  
**Date of Issue :** 24 MAY 2023

Nathakorn Pisutpaisan

**Calibrated by :**

**Approved by :**

*T. Petchur*  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

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**Calibration Procedure :** CP-AC-01

### Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

### Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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Continuation of Calibration Certificate

Continuation of Calibration Certificate

Cert. No. : ACL23166  
Job No. : VC66AC0058  
Pages : 3 of 8

Cert. No. : ACL23166  
Job No. : VC66AC0058  
Pages : 4 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	17.2
Flat	23.0

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at ± level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.2	0.3	0.3
1000	0.0	0.0	0.0
8000	0.5	0.6	0.6
			Acceptance Limits
			±1.5
			±1.0
			±5.0



4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight Acceptance Limits
63	0.0	-0.1	±2.0
125	0.0	0.0	±1.5
250	0.0	0.0	±1.5
500	0.0	0.0	±1.5
1000	0.0	0.0	±1.0
2000	0.0	0.0	±2.0
4000	0.0	0.0	±3.0
8000	0.0	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial ( dB )	SLM Display at final ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	94.0	94.0	0.0	± 0.3

7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.0	0.0	± 1.1



Continuation of Calibration Certificate

Continuation of Calibration Certificate

Cert No. : ACL23166  
Job No. : VC66AC0058  
Pages : 7 of 8

Cert No. : ACL23166  
Job No. : VC66AC0058  
Pages : 8 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
	133.0	133.0	0.0	±3.0
	One	136.4	-0.2	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
	Continuous	133.0	133.0	±2.0
	Positive half cycle	135.4	135.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle		
89.8	89.6	-0.2
		±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

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**SOUND LEVEL METER**

**MODEL : NL-42**

**SERIAL No. : 01147298**



NSC-TIST-TIS 17025  
CALIBRATION 0037

NSC-TIST-TIS 17025  
CALIBRATION 0037

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NSC-TIST-TIS 17025  
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0321

MTC No. EEL. BP. 113/0266

## CALIBRATION CERTIFICATE

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

Address : 683 Moo 11, Sukhapibarn 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.

### Ambient Environment

Instrument Calibrated :  
Description : Sound Level Meter :  $(23 \pm 3) ^\circ\text{C}$   
Manufacturer : Rion : Relative Humidity :  $(50 \pm 15) \%$   
Model : NL-42 : Ambient Pressure :  $(101.325 \pm 1.5) \text{ kPa}$

Serial No. : 01147298 (No.25)  
Microphone : UC-52 No.191028  
Preamplifier : NH-24 No.47531

### 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. Pistophone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 20 Feb. 2023

Date of Calibration : 15 Mar. 2023

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0321

MTC No. EEL. BP. 113/0266

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 (2013). 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 : 15 Mar. 2023

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E-mail : sumalee@tistr.or.th

### 1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.97	114.1	114.0	0.0	1.0	0.30	N/A

**Note:** The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 113.9 dB.

### 2. Self-generated noise

#### 2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
15.7	0.10	N/A

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

Frequency	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Weighting	11.8	0.10	N/A
A-Weight	17.5	0.10	N/A
C-Weight	22.9	0.10	N/A
Flat			

Date of Calibration : 15 Mar. 2023

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### 3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	0.2	0.3	1.5	0.45	0.6
1 000	-0.2	-0.2	1.0	0.45	0.6
8 000	1.4	1.4	5.0	0.45	0.7

### 4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	0.0	0.1	2.0	0.20	0.6
125	0.0	0.1	1.5	0.20	0.6
250	0.0	0.1	1.5	0.20	0.6
500	0.0	0.1	1.5	0.20	0.6
1 000	0.0	0.0	1.0	0.20	0.6
2 000	-0.2	-0.1	2.0	0.20	0.6
4 000	-0.3	-0.3	3.0	0.20	0.6
8 000	0.0	0.0	5.0	0.20	0.7

Date of Calibration : 15 Mar. 2023

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL. BP. 113/0266

Request No. 21-66/0321

### 5. Long-term stability

Time	Measured value (dB)	Deviated (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

### 6. Frequency and time weightings at 1 kHz

#### 6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

#### 6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 15 Mar. 2023

S / 9

Signature

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0321

MTC No. EEL. BP. 113/0266

### 7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
128	128.1	0.1	1.1	0.30	0.3
127	127.1	0.1	1.1	0.30	0.3
126	126.1	0.1	1.1	0.30	0.3
125	125.1	0.1	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.1	0.1	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.1	0.1	1.1	0.30	0.3
104	104.1	0.1	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.1	0.1	1.1	0.30	0.3
74	74.1	0.1	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3
59	59.0	0.0	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3

Date of Calibration : 15 Mar. 2023

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### 7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
44	44.0	0.0	1.1	0.30	0.3
39	39.0	0.0	1.1	0.30	0.3
34	34.0	0.0	1.1	0.30	0.3
29	29.0	0.0	1.1	0.30	0.3
28	28.0	0.0	1.1	0.30	0.3
27	27.0	0.0	1.1	0.30	0.3
26	26.0	0.0	1.1	0.30	0.3
25	24.9	-0.1	1.1	0.30	0.3

### 8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	94.0	94.0	0.0	1.1	0.30	0.3
30-120	94.0	94.0	0.0	1.1	0.30	0.3
20-110	94.0	94.0	0.0	1.1	0.30	0.3
20-100	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 15 Mar. 2023

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### 8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	45	45.0	0.0	1.1	0.30	0.3
30-120	35	35.0	0.0	1.1	0.30	0.3
20-110	25	25.0	0.0	1.1	0.30	0.3
20-100	25	25.0	0.0	1.1	0.30	0.3
20-90	25	25.0	0.0	1.1	0.30	0.3
20-80	25	25.0	0.0	1.1	0.30	0.3

### 9. Tone burst response

Time Weighting	Toneburst Duration, T <sub>b</sub> (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	116.0	0.0	±1.0	0.20	0.3
	2	98.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	89.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	109.5	-0.1	+1.0	0.20	0.3
	2	90.0	0.0	+1.0; -5.0	0.20	0.3
	200	110.0	0.0	±1.0	0.20	0.3
SEL	2	90.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	80.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 15 Mar. 2023

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NSC-TISTR

NSC-TISTR 17025  
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL BP. 113/0266

Request No. 21-66/0321

#### 10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
Complete cycle	125.4	125.3	-0.1	3.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	2.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	2.0	0.20	0.35

#### 11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
Positive one-half cycle	Negative one-half cycle	0.0	1.5	0.20	0.25
136.5	136.5				

#### 12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by :

*W. Wittawat Supanich*

(Mr. Wittawat Supanich)

Approved by :

*Mr. Prawate Klumpan*

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011266022000725001

Date of Calibration : 15 Mar. 2023

Date of Issue : 16 Mar. 2023

End of Certificate

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Rev. 1.0 : 16 Mar. 2023



**SOUND LEVEL METER**

**MODEL : NL-42A**

**SERIAL No. : 00322752**



## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42A/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00322752 / 196475 / 15484  
**ID No.:**

**Condition As Found :** GOOD  
**Customer :** EASTERN THAI CONSULTING 1992 CO., LTD.  
SAHA GROUP INDUSTRIAL PARK, 683 MOO 11,  
NONGKHAM, SIRACHA, CHONBURI 20230 THAILAND.

**Location :**  
**Ambient Temperature :** ( 23.0 ± 3 ) °C  
**Pressure :** ( 101.3 ± 3 ) kPa  
**Relative Humidity :** ( 50.0 ± 20 ) %

**Received Date :** 02 MAY 2023  
**Calibration Date :** 02 -04 MAY 2023  
**Date of Issue :** 05 MAY 2023

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**   
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

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## Continuation of Calibration Certificate

**Calibration Procedure :** CP-AC-01

### Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

### Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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Continuation of Calibration Certificate

Cert No. : ACL23141  
Job No. : VC66AC0047  
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

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Continuation of Calibration Certificate

Cert No. : ACL23141  
Job No. : VC66AC0047  
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	16.8
Flat	22.6

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.3	0.3	0.3
1000	0.0	0.0	0.0
8000	0.9	1.0	1.0
			Acceptance Limits
			± 1.5
			± 1.0
			±5.0

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Cert. No. : ACL23141  
Job No. : VC66AC0047  
Pages : 5 of 8Cert. No. : ACL23141  
Job No. : VC66AC0047  
Pages : 6 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight Acceptance Limits
63	0.0	-0.1	±2.0
125	0.0	0.0	±1.5
250	0.0	0.0	±1.5
500	0.0	0.0	±1.5
1000	0.0	0.0	±1.0
2000	0.0	0.0	±2.0
4000	0.0	0.0	±3.0
8000	0.0	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.1	0.1	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1



Continuation of Calibration Certificate

Cert. No. : ACL23141  
Job No. : VC66AC0047  
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.1	-0.3	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	±2.0
Positive half cycle	135.4	135.3	-0.1	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

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Continuation of Calibration Certificate

Cert. No. : ACL23141  
Job No. : VC66AC0047  
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle			
89.5	89.7	0.2	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

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**SOUND LEVEL METER**

**MODEL : NL-42**

**SERIAL No. : 00646443**

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



NSC-TIS-17025  
CALIBRATION 0394

Cert. No. : ACL23122

Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00646443 / 155616 / 26184  
**ID No.:**

**Condition As Found :** GOOD

**Customer :** EASTERN THAI CONSULTING 1992 CO., LTD.  
SAHA GROUP INDUSTRIAL PARK, 683 MOO 11,  
NONGKHAM, SIRACHA, CHONBURI 20230 THAILAND.

**Location :**  
**Ambient Temperature :** ( 23.0 ± 3 ) °C  
**Pressure :** ( 101.3 ± 3 ) kPa  
**Relative Humidity :** ( 50.0 ± 20 ) %

**Received Date :** 03 APRIL 2023  
**Calibration Date :** 18-20 APRIL 2023  
**Date of Issue :** 21 APRIL 2023

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

( Thanakul Petchurai )

*T. Petchurai*

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

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# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL23122  
Job No. : VC66AC0037  
Pages : 2 of 8

**Calibration Procedure :** CP-AC-01

### Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

### Condition of this result of calibration :

#### 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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## Continuation of Calibration Certificate

Cert. No. : ACL23122  
Job No. : VC66AC0037  
Pages : 3 of 8Cert. No. : ACL23122  
Job No. : VC66AC0037  
Pages : 4 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.5	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

## Result of Calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
93.9 (93.98)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A - weight	13.4
C - weight	19.9
Flat	25.6

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.2	0.2	0.2
1000	0.0	0.0	0.0
8000	-1.7	-0.7	-1.6
Acceptance Limits			±1.5 ±1.0 ±5.0

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Continuation of Calibration Certificate

Cert. No. : ACL23122  
Job No. : VC66AC0037  
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
63	-0.1	-0.1	-0.1
125	0.0	0.0	0.0
250	0.0	0.0	-0.1
500	0.0	0.0	0.0
1000	0.0	0.0	0.0
2000	0.0	0.0	0.0
4000	0.0	0.0	0.0
8000	0.0	0.1	0.1

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	$\pm 0.2$
C - weight	94.0	94.0	0.0	$\pm 0.2$
Flat	94.0	94.0	0.0	$\pm 0.2$

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	$\pm 0.1$
Slow	94.0	94.0	0.0	$\pm 0.1$
Leq	94.0	94.0	0.0	$\pm 0.1$

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	$\pm 0.3$

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	$\pm 1.1$
136.0	136.0	0.0	$\pm 1.1$
135.0	135.0	0.0	$\pm 1.1$
134.0	134.0	0.0	$\pm 1.1$
133.0	133.0	0.0	$\pm 1.1$
132.0	132.0	0.0	$\pm 1.1$
131.0	131.0	0.0	$\pm 1.1$
129.0	129.0	0.0	$\pm 1.1$
124.0	124.0	0.0	$\pm 1.1$
119.0	119.0	0.0	$\pm 1.1$
114.0	114.0	0.0	$\pm 1.1$
109.0	109.0	0.0	$\pm 1.1$
104.0	104.0	0.0	$\pm 1.1$
99.0	99.0	0.0	$\pm 1.1$
94.0	94.0	0.0	$\pm 1.1$
89.0	89.1	0.1	$\pm 1.1$
84.0	84.1	0.1	$\pm 1.1$
79.0	79.0	0.0	$\pm 1.1$
74.0	74.1	0.1	$\pm 1.1$
69.0	69.1	0.1	$\pm 1.1$
64.0	64.0	0.0	$\pm 1.1$
59.0	59.1	0.1	$\pm 1.1$
54.0	54.0	0.0	$\pm 1.1$
49.0	49.0	0.0	$\pm 1.1$
44.0	44.0	0.0	$\pm 1.1$
39.0	39.0	0.0	$\pm 1.1$
34.0	34.0	0.0	$\pm 1.1$
30.0	30.0	0.0	$\pm 1.1$
29.0	29.0	0.0	$\pm 1.1$
28.0	28.0	0.0	$\pm 1.1$
27.0	27.0	0.0	$\pm 1.1$
26.0	25.9	-0.1	$\pm 1.1$
25.0	24.9	-0.1	$\pm 1.1$

Continuation of Calibration Certificate

Cert. No. : ACL23122  
Job No. : VC66AC0037  
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.2	-0.2	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

Continuation of Calibration Certificate

Cert. No. : ACL23122  
Job No. : VC66AC0037  
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.2	±1.5
89.5	89.7		

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

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**SOUND LEVEL CALIBRATOR**

**MODEL : NC-75**

**SERIAL No. : 34302326**



# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACC23013  
Pages : 1 of 3

## Calibration Certificate

Equipment : SOUND CALIBRATOR

Manufacturer : RION

Model : NC-75

Serial No.: 34302326

ID No.:

Condition As Found : GOOD

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
SAHA GROUP INDUSTRIAL PARK, 683 MOO 11,  
NONGKHAM, SIRACHA, CHONBURI 20230 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 10 MAY 2023  
Calibration Date : 19 MAY 2023  
Date of Issue : 24 MAY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchu.

( Thanakul Petchurai )

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# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACC23013  
Job No. : VC66AC0058  
Pages : 2 of 3

Calibration Procedure : CP-AC-03

### Calibration Method :

This equipment was calibrated by based on IEC-60942-2003 Standard.

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

### Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 30/0267	13-FEB-24
Digital Multimeter	33461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24
Audio Analyzer	AVR-3360A	V744B6069	EF-0012-23	10-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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Continuation of Calibration Certificate

Cert. No. : ACC23013  
Job No. : VC66AC0058  
Pages : 3 of 3

Result of calibration :

**1. Sound pressure level**

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	94.03	0.03	0.14	0.40

**2. Frequency**

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Acceptance limit (%)
1000	1000.0	0.0	0.1	1.0

**3. Total distortion**

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
0.32	0.10	3.0

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

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**SOUND LEVEL METER**

**MODEL : CR:172A**

**SERIAL No. : G301638**





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL. BP. 121/0266

Request No. 21-66/0322

## CALIBRATION CERTIFICATE

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

Address : 683 Moo 11 Sukhapibam 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 : Cirrus

Model : CR-172A

Serial No. : G301638 (No.33)

Microphone : Cirrus MK216 No.412753E

Preamplifier : No.10402F

### 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. Pistophone 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 :  $(101.325 \pm 1.5) \text{ kPa}$

### 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 (2013). 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 Receipt : 20 Feb. 2023

Date of Calibration : 13-17 Mar. 2023

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FM.BLMTC.002 Rev



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL. BP. 121/0266

Request No. 21-66/0322

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 (2013). 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 : 13-17 Mar. 2023

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FM.BLMTC.002 Rev.4

### 1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
93.96	94.3	93.7	-0.3	1.0	0.30	N/A

**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)	Maximum-permitted uncertainty of measurement (±dB)
20.9	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	under-range		N/A
C-Weight	15.9	0.10	N/A
Flat	29.2	0.10	N/A

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

Date of Calibration : 13-17 Mar. 2023

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FM.BL.MTC.002 Rev.4

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**Office/Laboratory**  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
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### 3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	0.4	0.2	1.5	0.45	0.6
1 000	0.3	0.3	1.0	0.45	0.6
8 000	-4.8	-4.6	5.0	0.45	0.7

### 4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	0.4	0.0	2.0	0.20	0.6
125	0.3	0.1	1.5	0.20	0.6
250	0.2	0.0	1.5	0.20	0.6
500	0.2	0.0	1.5	0.20	0.6
1 000	0.0	0.0	1.0	0.20	0.6
2 000	-0.1	0.0	2.0	0.20	0.6
4 000	-0.3	-0.2	3.0	0.20	0.6
8 000	-0.5	-0.4	5.0	0.20	0.7

Date of Calibration : 13-17 Mar. 2023

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Request No. 21-66/0322

### 5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	114.0	0.0	0.3	0.10	0.1
End	114.0				

### 6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz					
Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	114.0	0.0	0.2	0.20	0.2
C-weight	114.0	0.0	0.2	0.20	0.2
Flat	114.0	0.0	0.2	0.20	0.2

### 6.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	114.0	0.0	0.1	0.20	0.2
Slow	114.0	0.0	0.1	0.20	0.2
Leq	114.0	0.0	0.1	0.20	0.2

Date of Calibration : 13-17 Mar. 2023

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### 7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
140	139.7	-0.3	1.1	0.30	0.3
139	138.7	-0.3	1.1	0.30	0.3
134	133.7	-0.3	1.1	0.30	0.3
129	128.8	-0.2	1.1	0.30	0.3
124	123.9	-0.1	1.1	0.30	0.3
119	118.9	-0.1	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	103.8	-0.2	1.1	0.30	0.3
99	98.8	-0.2	1.1	0.30	0.3
94	93.8	-0.2	1.1	0.30	0.3
89	88.8	-0.2	1.1	0.30	0.3
84	83.7	-0.3	1.1	0.30	0.3
79	78.8	-0.2	1.1	0.30	0.3
74	73.8	-0.2	1.1	0.30	0.3
69	68.7	-0.3	1.1	0.30	0.3
64	63.7	-0.3	1.1	0.30	0.3
59	58.7	-0.3	1.1	0.30	0.3
54	53.7	-0.3	1.1	0.30	0.3
49	48.7	-0.3	1.1	0.30	0.3
44	43.7	-0.3	1.1	0.30	0.3
39	38.7	-0.3	1.1	0.30	0.3

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

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
34	33.7	-0.3	1.1	0.30	0.3
29	28.7	-0.3	1.1	0.30	0.3
24	23.7	-0.3	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20-140	114.0	114.0	0.0	1.1	0.30	0.3

8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20-140	25	25.0	0.0	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, T <sub>b</sub> (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	136.0	0.0	±1.0	0.20	0.3
	2	119.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	109.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	129.6	0.0	±1.0	0.20	0.3
	2	110.0	0.0	+1.0; -5.0	0.20	0.3
	200	109.9	0.0	±1.0	0.20	0.3
SEL	2	129.6	0.0	+1.0; -2.5	0.20	0.3
	0.25	110.0	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 13-17 Mar. 2023

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Date of Calibration : 13-17 Mar. 2023

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#### 10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	135.4	135.6	0.2	3.0	0.20	0.35
Positive half cycle	134.4	134.2	-0.2	2.0	0.20	0.35
Negative half cycle	134.4	134.2	-0.2	2.0	0.20	0.35

#### 11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle	139.1	0.0	1.5	0.20
139.1					

#### 12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	139.0	0.0	0.3	0.10	0.1
End	139.0				

Calibrated by : *Pannasit Phasingri*

(Mr. Pannasit Phasingri)

Approved by :

*Prawate Klaiyapa*  
(Mr. Prawate Klaiyapa)

Director

Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 13-17 Mar. 2023

Date of Issue : 17 Mar. 2023

Ref : 2011266022000726003

End of Certificate

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**COPY**

**SOUND LEVEL METER**

**MODEL : CR:172A**

**SERIAL No. : G301660**



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL. BP. 5/0166

Request No. 21-66/0181

## 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** : Cirrus  
**Model** : CR-172A  
**Serial No.** : G301660  
**Microphone** : MK216 PM2 No.414171B  
**Preamplifier** : PA40 No.10093F

### 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 2810358.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

**Date of Receipt** : 28 Dec. 2022

**Date of Calibration** : 16-19 Jan. 2023

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MTC No. EEL. BP. 5/0166

Request No. 21-66/0181

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 (2013). 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** : 16-19 Jan. 2023

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2/9



### 1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
93.73	94.4	93.7	0.0	1.0	0.50	N/A

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)	Maximum-permitted uncertainty of measurement (±dB)
20.6	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	under-range	-	N/A
C-Weight	18.9	0.10	N/A
Flat	29.0	0.10	N/A

Note: The under-range means that the indicator cannot display for setting the range 20-140 dB.

### 3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	0.3	0.1	1.5	0.45	0.6
1 000	-0.3	-0.3	1.0	0.45	0.6
8 000	-1.2	-1.1	5.0	0.45	0.7

### 4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	0.4	0.1	2.0	0.20	0.6
125	0.3	0.1	1.5	0.20	0.6
250	0.2	0.1	1.5	0.20	0.6
500	0.1	0.0	1.5	0.20	0.6
1 000	0.0	0.0	1.0	0.20	0.6
2 000	-0.1	0.1	2.0	0.20	0.6
4 000	-0.3	-0.1	3.0	0.20	0.6
8 000	-0.4	-0.3	5.0	0.20	0.7



NSC-TSITIS 17025  
CALIBRATION 0037

NSC-TSITIS 17025  
CALIBRATION 0037

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MTC No. EEL. BP. 5/0166

Request No. 21-66/0181

5. Long-term stability

Time	Measured Value	Deviated value	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency	Measured value	Deviated value	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
Weighting		(dB)			
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency	Measured value	Deviated value	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
Weighting		(dB)			
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2



5/5

Date of Calibration : 16-19 Jan. 2023

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MTC No. EEL. BP. 5/0166

Request No. 21-66/0181

7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
139	139.1	0.1	1.1	0.30	0.3
134	134.0	0.0	1.1	0.30	0.3
129	129.0	0.0	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	93.9	-0.1	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	83.9	-0.1	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	68.9	-0.1	1.1	0.30	0.3
64	63.9	-0.1	1.1	0.30	0.3
59	58.9	-0.1	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3
49	48.9	-0.1	1.1	0.30	0.3
44	43.9	-0.1	1.1	0.30	0.3



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

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
39	38.9	-0.1	1.1	0.30	0.3
34	33.9	-0.1	1.1	0.30	0.3
29	29.0	0.0	1.1	0.30	0.3
24	24.1	0.1	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20-140	94.0	94.0	0.0	1.1	0.30	0.3

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8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20-140	25.0	25.0	0.0	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	136.0	0.0	±1.0	0.20	0.3
	2	118.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	109.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	129.5	-0.1	±1.0	0.20	0.3
	2	109.9	-0.1	+1.0; -5.0	0.20	0.3
	200	130.0	0.0	±1.0	0.20	0.3
SEL	2	110.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	100.9	-0.1	+1.5; -5.0	0.20	0.3

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MTC No. BEL. BP. 5/0166

Request No. 21-66/0181

#### 10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	135.4	135.2	-0.2	3.0	0.20	0.35
Positive half cycle	134.4	134.2	-0.2	2.0	0.20	0.35
Negative half cycle	134.4	134.2	-0.2	2.0	0.20	0.35

#### 11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle	(dB)	(±dB)	(±dB)	(±dB)
138.8	138.8	0.0	1.5	0.20	0.25

#### 12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	139.0	0.0	0.3	0.10	0.1
End	139.0				

Approved by :

Calibrated by : *Pannasit Phasingst*  
(Mr. Pannasit Phasingst)



Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 16-19 Jan. 2023

Date of Issue : 25 Jan. 2023

Ref : 2011265122805497003

End of Certificate

9/5

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**SOUND LEVEL METER**

**MODEL : CR:172A**

**SERIAL No. : G301607**



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL. BP. 120/0266

Request No. 21-66/0322

## CALIBRATION CERTIFICATE

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

Address : 683 Moo 11 Sukhaphibam 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 : Cirrus

Model : CR-172A

Serial No. : G301607 (No.31)

Microphone : Cirrus MK216 No.413445B

Preamplifier : No.9548F

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 :  $(101.325 \pm 1.5) \text{ kPa}$

### 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 (2013). 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 Receipt : 20 Feb. 2023

Date of Calibration : 13-17 Mar. 2023

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

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2/9

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL. BP. 120/0266

Request No. 21-66/0322

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 (2013). 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 : 13-17 Mar. 2023

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### 1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
93.96	94.0	94.0	0.0	1.0	0.30	N/A

**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)	Maximum-permitted uncertainty of measurement (±dB)
20.9	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	under-range	-	N/A
C-Weight	15.9	0.10	N/A
Flat	28.7	0.10	N/A

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

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### 3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	0.4	0.2	1.5	0.45	0.6
1 000	-0.3	-0.4	1.0	0.45	0.6
8 000	-2.2	-1.9	5.0	0.45	0.7

### 4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	0.4	0.1	2.0	0.20	0.6
125	0.2	0.0	1.5	0.20	0.6
250	0.1	0.0	1.5	0.20	0.6
500	0.1	0.0	1.5	0.20	0.6
1 000	0.0	0.0	1.0	0.20	0.6
2 000	-0.2	0.0	2.0	0.20	0.6
4 000	-0.3	-0.2	3.0	0.20	0.6
8 000	-0.5	-0.4	5.0	0.20	0.7

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### 5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	114.0	0.0	0.3	0.10	0.1
End	114.0				

### 6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz					
Frequency	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Weighting					
A-weight	114.0	0.0	0.2	0.20	0.2
C-weight	114.0	0.0	0.2	0.20	0.2
Flat	114.0	0.0	0.2	0.20	0.2

### 6.2 Time weightings at 1 kHz

Frequency	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Weighting					
Fast	114.0	0.0	0.1	0.20	0.2
Slow	114.0	0.0	0.1	0.20	0.2
Leq	114.0	0.0	0.1	0.20	0.2

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### 7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
140	140.1	0.1	1.1	0.30	0.3
139	139.1	0.1	1.1	0.30	0.3
134	134.1	0.1	1.1	0.30	0.3
129	129.1	0.1	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.1	0.1	1.1	0.30	0.3
89	89.1	0.1	1.1	0.30	0.3
84	84.1	0.1	1.1	0.30	0.3
79	79.1	0.1	1.1	0.30	0.3
74	74.1	0.1	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3
59	59.0	0.0	1.1	0.30	0.3
54	54.0	0.0	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	39.0	0.0	1.1	0.30	0.3

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

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
34	34.0	0.0	1.1	0.30	0.3
29	29.0	0.0	1.1	0.30	0.3
24	24.1	0.1	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20-140	114.0	114.0	0.0	1.1	0.30	0.3

8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20-140	25	25.0	0.0	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	135.0	0.0	±1.0	0.20	0.3
	2	113.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	109.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	129.6	0.0	±1.0	0.20	0.3
	2	110.0	0.0	+1.0; -5.0	0.20	0.3
	0.25	109.9	0.0	±1.0	0.20	0.3
SEL	200	129.6	0.0	+1.0; -2.5	0.20	0.3
	2	110.0	-0.1	+1.5; -5.0	0.20	0.3
	0.25	110.0	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 13-17 Mar. 2023

7/1  
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Date of Calibration : 13-17 Mar. 2023

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MTC No. EEL. BP. 120/0266

Request No. 21-66/0322

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	135.4	135.6	0.2	3.0	0.20	0.35
Positive half cycle	134.4	134.2	-0.2	2.0	0.20	0.35
Negative half cycle	134.4	134.2	-0.2	2.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle				
139.1	139.1	0.0	1.5	0.20	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	139.0	0.0	0.3	0.10	0.1
End	139.0				

Calibrated by : *Pannasit P.*  
(Mr. Pannasit Phasingri)

Approved by :



Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 13-17 Mar. 2023

Date of Issue : 17 Mar. 2023

Ref : 2011266022000726002

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**SOUND LEVEL METER**

**MODEL : CR:172A**

**SERIAL No. : G300957**



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL, BP, 27/1265

Request No. 21-66/0140

## 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.

### Ambient Environment

**Instrument Calibrated :**  
Description : Sound Level Meter :  $(23 \pm 3) ^\circ\text{C}$   
Manufacturer : Cirrus : Relative Humidity :  $(50 \pm 15) \%$   
Model : CR:172A : Ambient Pressure :  $(101.325 \pm 1.5) \text{ kPa}$

Serial No. : G300957 (No.28)  
Microphone : MK216 No.4124158  
Preamplifier : 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 2810358 with Coupler UA0915 S/N 2810358.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 7 Dec, 2022

Date of Calibration : 23 Dec, 2022

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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 (2013). 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 : 23 Dec, 2022

2 / 9

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### 1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
93.69	93.8	93.7	0.0	1.0	0.50	N/A

**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)	Maximum-permitted uncertainty of measurement (±dB)
15.9	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	under-range	-	N/A
C-Weight	16.3	0.10	N/A
Flat	27.7	0.10	N/A

**Note:** The under-range means that the indicator cannot display for setting the range of 20-140 dB.

### 3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)		Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	-0.1	-0.3	-0.3	0.45	0.6
1 000	0.0	0.1	0.0	0.45	0.6
8 000	-1.7	-1.7	-1.4	0.45	0.7

### 4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)		Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	0.4	0.1	0.1	0.20	0.6
125	0.2	0.1	0.0	0.20	0.6
250	0.1	0.0	0.0	0.20	0.6
500	0.0	0.0	0.0	0.20	0.6
1 000	0.0	0.0	0.0	0.20	0.6
2 000	-0.1	0.1	0.0	0.20	0.6
4 000	-0.3	-0.2	0.0	0.20	0.6
8 000	-0.5	-0.3	-0.1	0.20	0.7



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MTC No. EEL, BP. 27/1265

Request No. 21-66/0140

### 7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
138	138.1	0.1	1.1	0.30	0.3
137	137.1	0.1	1.1	0.30	0.3
136	136.1	0.1	1.1	0.30	0.3
135	135.0	0.0	1.1	0.30	0.3
134	134.0	0.0	1.1	0.30	0.3
129	129.0	0.0	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.1	0.1	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	63.9	-0.1	1.1	0.30	0.3
59	59.0	0.0	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3

Date of Calibration : 23 Dec. 2022

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MTC No. EEL, BP. 27/1265

Request No. 21-66/0140

### 5. Long-term stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	114.0	0.0	0.3	0.10	0.1
End	114.0				

### 6. Frequency and time weightings at 1 kHz

#### 6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	114.0	0.0	0.2	0.20	0.2
C-weight	114.0	0.0	0.2	0.20	0.2
Flat	113.9	-0.1	0.2	0.20	0.2

#### 6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	114.0	0.0	0.1	0.20	0.2
Slow	114.0	0.0	0.1	0.20	0.2
Leq	114.0	0.0	0.1	0.20	0.2

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### 7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
49	49.0	0.0	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	39.0	0.0	1.1	0.30	0.3
34	33.9	-0.1	1.1	0.30	0.3
29	29.0	0.0	1.1	0.30	0.3
24	24.0	0.0	1.1	0.30	0.3

### 8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20-140	114.0	114.0	0.0	1.1	0.30	0.3

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### 8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range.

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20-140	25	25.0	0.0	1.1	0.30	0.3

### 9. Tone burst response

Time Weighting	Toneburst Duration, Tbm(ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	136.0	0.0	+1.0	0.20	0.3
	2	118.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	109.8	-0.2	+1.5; -5.0	0.20	0.3
Slow	200	129.5	-0.1	±1.0	0.20	0.3
	2	110.0	0.0	+1.0; -5.0	0.20	0.3
	200	130.0	0.0	±1.0	0.20	0.3
SEL	2	110.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	100.9	-0.1	+1.5; -5.0	0.20	0.3

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MTC No. EEL. BP. 27/1265

Request No. 21-66/0140

#### 10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
Complete cycle	135.4	135.6	0.2	3.0	0.20	0.35
Positive half cycle	134.4	134.3	-0.1	2.0	0.20	0.35
Negative half cycle	134.4	134.3	-0.1	2.0	0.20	0.35

#### 11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
Positive one-half cycle	Negative one-half cycle				
138.7	138.7	0.0	1.5	0.25	0.25

#### 12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
Begin	139.0	0.0	0.3	0.10	0.1
End	139.0				

Calibrated by :

*Wittawat Supanich*

(Mr. Wittawat Supanich)



Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011265120705238001

Date of Calibration : 23 Dec. 2022

Date of Issue : 23 Dec. 2022

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**SOUND LEVEL METER**

**MODEL : CR:172A**

**SERIAL No. : G301013**



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ISO-TIS-17025  
CALIBRATION 0394

Cert. No. : ACL23123  
Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** CIRRUS  
**Model :** CR :172A/ Microphone MK 216/ Preamplifier -  
**Serial No.:** G301013 / 412272B/ 9334F  
**ID No.:**

**Condition As Found :** GOOD  
**Customer :** EASTERN THAI CONSULTING 1992 CO., LTD.  
SAHA GROUP INDUSTRIAL PARK, 683 MOO 11,  
NONGKHAM, SIRACHA, CHONBURI 20230 THAILAND.

**Location :**  
**Ambient Temperature :** ( 23.0 ± 3 ) °C  
**Pressure :** ( 101.3 ± 3 ) kPa  
**Relative Humidity :** ( 50.0 ± 20 ) %

**Received Date :** 03 APRIL 2023  
**Calibration Date :** 18 -20 APRIL 2023  
**Date of Issue :** 21 APRIL 2023

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

*T. Petchurai*  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

# SITHIPORN SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL23123  
Job No. : VC66AC0037  
Pages : 2 of 8

**Calibration Procedure :** CP-AC-02

### Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

### Condition of this result of calibration :

#### 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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Continuation of Calibration Certificate

Continuation of Calibration Certificate

Cert. No. : ACL23123  
Job No. : VC66AC0037  
Pages : 3 of 8

Cert. No. : ACL23123  
Job No. : VC66AC0037  
Pages : 4 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
17.1

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

Frequency Weighting	Measured value (dB)
A - weight	14.2
C - weight	20.8
Flat	30.4

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.0	0.1	0.3
1000	0.0	0.0	0.0
8000	-0.8	-1.0	-1.2
			Acceptance Limits
			± 1.5
			± 1.0
			± 5.0

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## Continuation of Calibration Certificate

Cert. No. : ACL23123  
Job No. : VC66AC0037  
Pages : 5 of 8Cert. No. : ACL23123  
Job No. : VC66AC0037  
Pages : 6 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
63	0.1	0.1	0.5
125	0.0	0.1	0.3
250	0.0	0.0	0.2
500	0.0	0.0	0.1
1000	0.0	0.0	0.0
2000	0.0	0.0	-0.2
4000	0.0	-0.2	-0.4
8000	-0.2	-0.4	-0.5
Acceptance Limits			
			±2.0
			±1.5
			±1.5
			±1.5
			±1.0
			±2.0
			±3.0
			±5.0

## 5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	83.9	-0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1

Continuation of Calibration Certificate

Cert No. : ACL23123  
Job No. : VC66AC0037  
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lopeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.1	-0.3	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.3	-0.1	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

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Continuation of Calibration Certificate

Cert No. : ACL23123  
Job No. : VC66AC0037  
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle			
89.5	89.5	0.0	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

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