

ภาคผนวก จ

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สรุปเอกสารการสอบเทียบอุปกรณ์เครื่องมือ

**ANALYTICAL BALANCE (DU)**

**Model : XS205DU**

**Serial No. : 1126323724**

Mettler-Toledo (Thailand) Ltd.  
846/4 - 846/5846/4 - 846/5 Lasalle Rd., Bangna Tai  
Bangna District, Bangkok 10260  
+66 2723 0392  
MT-TH.ServiceSupport@mtl.com



## Accuracy Calibration Certificate

### Customer

Company: EASTERN THAI CONSULTING 1992 CO., LTD.  
Address: 683 Moo 11, Sukhaphiban 8 Rd., Nong Kham  
City: Sriracha  
Zip / Postal: 20230  
State / Province: Chonburi  
Contact: Sasiporn Nakin  
Order Number: 0333319619

### Weighing Device

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

Range	Max. Capacity	Readability (d)
1	81 g	0.0001 g
2	220 g	0.0001 g

### Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)  
Mettler Toledo Work Instruction: CP/W002/20  
This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.  
The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.  
In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

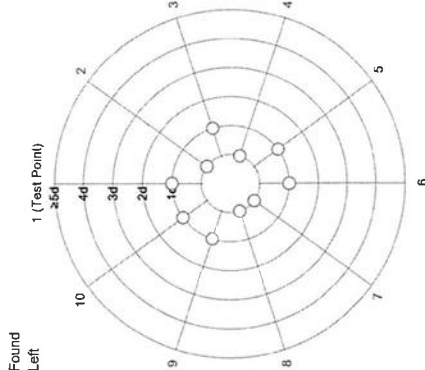
As Found	Temperature	Humidity
	Start: 25.7 °C End: 25.8 °C	Start: 50.9 % End: 50.6 %

As Found Calibration Date: 09-Dec-2024  
As Left Calibration Date: N/A  
Issue Date: 11-Dec-2024  
Calibrator: Somsak Sattanaco  
Approved Signatory: Surachai P.  
Technical Manager / Head of Calibration Center

### Measurement Results

#### Repeatability

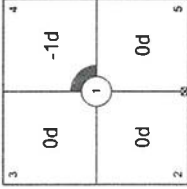
Test Load: 70 g	As Found	As Left
1	70.00004 g	N/A
2	70.00005 g	N/A
3	70.00004 g	N/A
4	70.00005 g	N/A
5	70.00006 g	N/A
6	70.00004 g	N/A
7	70.00005 g	N/A
8	70.00005 g	N/A
9	70.00006 g	N/A
10	70.00006 g	N/A
Standard Deviation	0.000008 g	N/A



The "d" in the graph represents the readability of the range/interval in which the test was performed.  
The results of this graph are based upon the absolute values of the differences from the mean value.

### Eccentricity

Test Load: 100 g	Position	As Found	As Left
1	100.0000 g	N/A	N/A
2	100.0000 g	N/A	N/A
3	100.0000 g	N/A	N/A
4	99.9999 g	N/A	N/A
5	100.0000 g	N/A	N/A
Maximum Deviation		0.0001 g	N/A

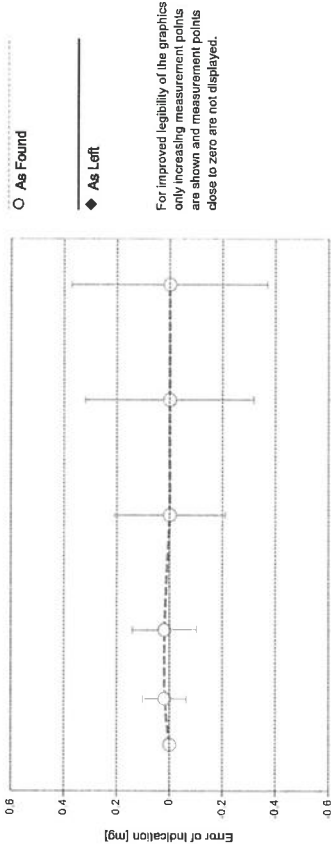


The "d" in the graph represents the readability of the range/interval in which the test was performed.

Error of Indication

As Found				
	Reference Value	Indication	Error of Indication	Expanded Uncertainty
1	0.00000 g	0.00000 g	0.00000 g	0.017 mg
2	0.01000 g	0.01000 g	0.00000 g	0.020 mg
3	0.10000 g	0.10000 g	0.00000 g	0.023 mg
4	1.00000 g	1.00000 g	0.00000 g	0.032 mg
5	4.99998 g	5.00000 g	0.00002 g	0.048 mg
6	10.00001 g	10.00001 g	0.00000 g	0.061 mg
7	19.99999 g	20.00001 g	0.00002 g	0.082 mg
8 *	50.00003 g	50.00005 g	0.00002 g	0.12 mg
9	100.00000 g	100.00000 g	0.00000 g	0.21 mg
10	150.00000 g	150.00000 g	0.00000 g	0.32 mg
11	200.00000 g	200.00000 g	0.00000 g	0.37 mg

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



The expanded measurement uncertainty is reported as the standard measurement uncertainty multiplied by the coverage factor  $k$  such that the coverage probability corresponds to approximately 95 %.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated. The results of this calibration certificate relate only to the calibrated item.

Test Equipment

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

Weight Set 1: OIML E2

Weight Set No.:	WS37	Date of Issue:	17-Jun-2024
Certificate Number:	186753-1	Calibration Due Date:	20-Jan-2025

Weight Set 2: OIML E2

Weight Set No.:	WS87	Date of Issue:	04-Jul-2023
Certificate Number:	186520	Calibration Due Date:	02-Jan-2025

Thermo Hygrometer

Equipment No.:	IN279	Date of Issue:	19-Jun-2024
Certificate Number:	SG-H-00577/67	Calibration Due Date:	17-Jun-2025

Remarks

FACT adjustment functionality activated

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

End of Accredited Section

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





Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: 1.5 · 10<sup>-6</sup> / K  
Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

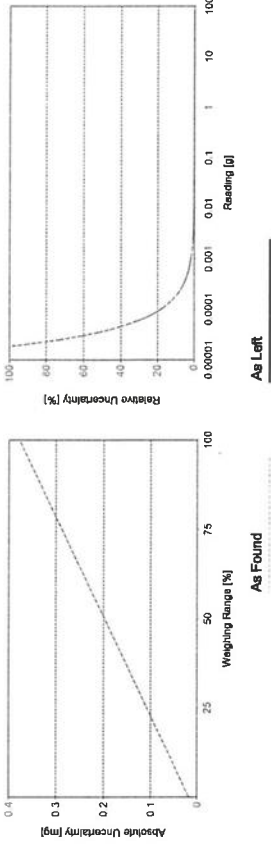
Linearization of Uncertainty Equation

Range		As Found		As Left
d	Max			
1	0.00001 g	81 g	$U_1 = 0.018 \text{ mg} + 0.00444 \text{ mg/g} \cdot R$	N/A
2	0.0001 g	220 g	$U_2 = 0.06 \text{ mg} + 0.00439 \text{ mg/g} \cdot R$	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
0.00220 g	0.018 mg	0.82%
0.02200 g	0.018 mg	0.082%
0.22000 g	0.019 mg	0.0086%
2.20000 g	0.028 mg	0.0013%
220.0000 g	1.0 mg	0.00047%



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

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Certificate



As Found ✓ As Left ✓

The weighing device meets the given process requirements.

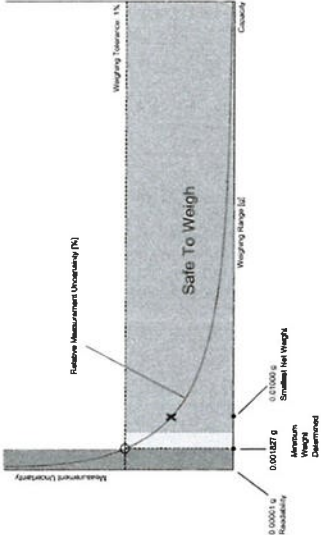
The weighing device meets the given process requirements.

Tests Performed: ☒ As Found ☐ As Left ☒ No adjustments/modifications made. As Left results correspond to As Found.

Process Requirements

Weighing Tolerance: 1% | Smallest Net Weight: 0.01000 g | Safety Factor: 2

Safe Weighing Range



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



Minimum Weight

As Found Minimum Weight Table

Range 1

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.018339 g	0.036642 g	0.055111 g	0.093358 g	0.191052 g
0.2%	0.009149 g	0.018339 g	0.027570 g	0.046156 g	0.093358 g
0.5%	0.003655 g	0.007316 g	0.010984 g	0.018339 g	0.036642 g
1%	0.001827 g	0.003655 g	0.005485 g	0.009149 g	0.018339 g
2%	0.000913 g	0.001827 g	0.002740 g	0.004569 g	0.009149 g
5%	0.000365 g	0.000730 g	0.001096 g	0.001827 g	0.003655 g

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

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

As Left Minimum Weight Table

Range 1

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.018339 g	0.036642 g	0.055111 g	0.093358 g	0.191052 g
0.2%	0.009149 g	0.018339 g	0.027570 g	0.046156 g	0.093358 g
0.5%	0.003655 g	0.007316 g	0.010984 g	0.018339 g	0.036642 g
1%	0.001827 g	0.003655 g	0.005485 g	0.009149 g	0.018339 g
2%	0.000913 g	0.001827 g	0.002740 g	0.004569 g	0.009149 g
5%	0.000365 g	0.000730 g	0.001096 g	0.001827 g	0.003655 g

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

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

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

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

Notes on minimum weight values in above table:

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

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Measurement Results

Results Summary

Repeatability			
As Found		Eccentricity	
As Left		Error of Indication	
✓ = Passed		✓	
✗ = Failed		✓	
A = Safety Factor not met		✓	

Repeatability

Test Load: 70 g

Tolerance		Control Limit		As Found		As Left	
				Std. Deviation		Std. Deviation	
0.1%		0.000005 g		✗		✗	
0.2%		0.000010 g		✓		A	
0.5%		0.000025 g		✓		✓	
1%		0.000050 g		0.000008 g		0.000008 g	
2%		0.000100 g		✓		✓	
5%		0.000250 g		✓		✓	

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

Eccentricity

Test Load: 100 g

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

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

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As Found

Reference Value		Error	Control limits for various weighing tolerances							
			0.1%	0.2%	0.5%	1%	2%	5%		
0.00000 g		0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A		
19.99999 g		0.00002 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.20000 g	0.50000 g		
50.00003 g		0.00002 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g	1.25000 g		
100.00000 g		0.00000 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	1.00000 g	2.50000 g		
150.00000 g		0.00000 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	1.50000 g	3.75000 g		
200.00000 g		0.00000 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	2.00000 g	5.00000 g		
Result			✓	✓	✓	✓	✓	✓		✓

As Left

Reference Value		Error	Control limits for various weighing tolerances							
			0.1%	0.2%	0.5%	1%	2%	5%		
0.00000 g		0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A		
19.99999 g		0.00002 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.20000 g	0.50000 g		
50.00003 g		0.00002 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g	1.25000 g		
100.00000 g		0.00000 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	1.00000 g	2.50000 g		
150.00000 g		0.00000 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	1.50000 g	3.75000 g		
200.00000 g		0.00000 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	2.00000 g	5.00000 g		
Result			✓	✓	✓	✓	✓	✓		✓

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

**ANALYTICAL BALANCE**

**Model : SECURA224-1S**

**Serial No. : 0036707137**



Certificate No. : 24-164695

Sample Code : 24-67405-005

## CERTIFICATE OF CALIBRATION

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

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

Equipment : ELECTRONIC BALANCE

Manufacturer : SARTORIUS

Model : SECURA224-1S

Serial No. : 0036707137

ID No. : LABE 05/2

Date of Receipt : 19 December 2024

Date of Calibration : 19 December 2024

Calibrated by Mr. Thanadol Pholthep  
Scientist

Issue date 20 December 2024

The uncertainties are (or 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. : 24-164695

Sample Code : 24-67405-005

## REPORT OF CALIBRATION

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

## Result of Calibration

## 1. Test weight and repeatability of reading

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

Unit : g	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	100.000016	200.000028
	Average reading of indicator	100.0000	200.0000
	Standard deviation	0.00005	0.00005
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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Certificate No. : 24-164695

Sample Code : 24-67405-005

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## 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	0.9998		
100	0.9998		
200	0.9998		

## 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)
Unlead	0.0000000	0.0000	0.0000	0.000094	2.01
0.01	0.0100015	0.0100	0.0000	0.000094	2.01
0.1	0.1000064	0.1000	0.0000	0.000094	2.01
1	1.0000017	1.0000	0.0000	0.000095	2.01
2	2.0000049	2.0000	0.0000	0.000095	2.01
5	5.0000012	5.0000	0.0000	0.000096	2.01
10	9.9999992	10.0000	0.0000	0.000097	2.01
20	20.0000042	20.0000	0.0000	0.00010	2.01
50	50.0000046	50.0000	0.0000	0.00012	2.01
100	100.0000016	100.0000	0.0000	0.00016	2.00
200	200.0000028	200.0000	0.0000	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. : 24-164695

Sample Code : 24-67405-005

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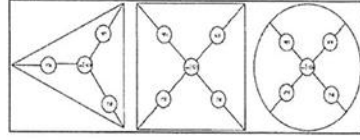
## REPORT OF CALIBRATION

## Result of Calibration :

## 4. Eccentric or off-centre loading

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

Weighing pan		Test weight : 100	
		Unit : g	
		Range	
		220	
Position	Reading of indicator	Reading of indicator	
1	99.9999		
2	100.0001		
3	99.9999		
4	99.9998		
5	99.9999		
6	99.9999		
Maximum difference	0.0002		



## 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 LB-WE-78

Certificate No. :  
24-097116

Due Date :  
02 August 2025

- 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.



# **BOD INCUBATOR**

**Model : LABE 19/3**



## CERTIFICATE OF CALIBRATION

Page 1 of 3

Certificate No. : 24-089291

Sample Code : 24-35676-001

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhaphibarn 8 Rd., Nongkham, Sriracha,

Chonburi 20230

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

(Laboratory)

Equipment : Temperature controlled enclosures (Incubator)

Manufacturer : บริษัท เจริญชัย : N/A

Serial No. : S43020027 : LABE19/3

Date of Receipt : 16 July 2024 : Date of Calibration : 16 July 2024

## Condition of Calibration

1. Environment	1.1 Ambient temperature	: Maximum	30.6 °C	: Minimum	28.9 °C
	1.2 Relative humidity	: Maximum	76.9 %	: Minimum	69.4 %
	1.3 Line voltage supplied	: Maximum	219.8 VAC	: Minimum	217.1 VAC

## 2. Calibration method

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

## 3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data acquisition with sensor (RTD-P100)	LB-DA-12 (RTD-168 to RTD-176)	24-046389	28 April 2025

## 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. Pattanapong Pulngern

Approved by

(Mr. Somchai Neampunt)

Scientist

Signed for Director

Issue date

17 July 2024

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 capability to recognize 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

FM CL-114

TEL 02-516-2422

FAX 02-516-6049

Rev.01

CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH

Effective Date: 15/10/21



## REPORT OF CALIBRATION

Page 2 of 3

Certificate No. : 24-089291

Sample Code : 24-35676-001

## Results of Calibration

Resolution : 0.1 °C

## 1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)/reading (°C)	Measured temperature at each positions (°C)										Uncertainty ± (°C)	Coverage factor k
		# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 <sup>1/4</sup>	# 10		
20	20.0	20.56	20.45	20.01	19.85	20.21	20.25	20.17	20.05	20.11	20.11	0.24	2.00

## 2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
20	0.08	0.50	0.87

## Notes

\* UUC\* = Unit Under Calibration

361 Soi Laddprao 122, Laddprao Road,

Phlabphla, Wang Thonglang, Bangkok 10310

FM CL-018

TEL 02-516-2422

FAX 02-516-6049

Rev.01

CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH

Effective Date: 15/10/21



## REPORT OF CALIBRATION

Certificate No. : 24-089291  
Sample Code : 24-35676-001

**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 = 70 cm ; D = 55 cm ; H = 140 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.

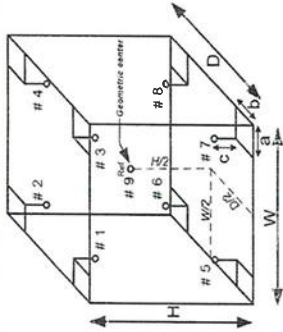


Figure: Example of sensor  
Installation Positions

The result expanded uncertainty of measurement  $U$  is stated as the standard uncertainty 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 M3000.

- End of Report -

**GOPY**

# **BOD INCUBATOR**

**Model : LABE 19/5**

NSC-TSI-T1517025  
CALIBRATION 0152

Page 1 of 3

Certificate No. : 25-042561

Sample Code : 25-18090-002

## CERTIFICATE OF CALIBRATION

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

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

(Laboratory)

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

**Manufacturer** : Lovibond **Model** : TC 445 S

**Serial No.** : 0520/005227 **ID No.** : LABE 19/S

**Date of Receipt** : 20 March 2025 **Date of Calibration** : 20 March 2025

**Condition of Calibration**

1. **Environment**

1.1 Ambient temperature	: Maximum	29.9 °C	: Minimum	27.5 °C
1.2 Relative humidity	: Maximum	51.9 %	: Minimum	43.4 %
1.3 Line voltage supplied	: Maximum	239.4 VAC	: Minimum	232.8 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-11 (RTD-148 to RTD-155, RTD-227)	24-040190	03 April 2025

**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. Pattanapong Puhgern

Approved by

(Mr. Somchai Neampunt)

Scientist

24 March 2025

**Issue date**

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 capability to recognize national standards and to the unit of measurement involved in the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

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WWW.AMARC.CO.TH

Effective Date: 15/10/21

NSC-TSI-T1517025  
CALIBRATION 0152

Page 2 of 3

Certificate No. : 25-042561

Sample Code : 25-18090-002

## 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	20.5	20.5	19.91	19.78	19.82	19.86	19.78	19.85	19.93	19.63	19.79	0.38	2.00

**2. Characterization results**

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
20	0.28	0.25	0.83

**Notes**

\* UUC\* = Unit Under Calibration

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Effective Date: 15/10/21



## REPORT OF CALIBRATION

Certificate No. : 25-042561

Sample Code : 25-18090-002

## 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.

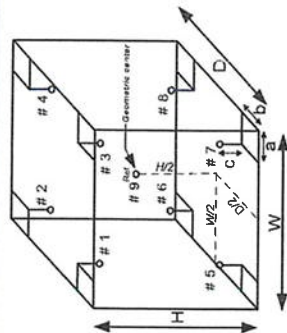


Figure: Example of sensor  
Installation Positions

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 M3009.

- End of Report -

**COPY**

**Hot Air Oven**

**Model : UM 400**

**Serial No. : 900982**

## CERTIFICATE OF CALIBRATION

Page 1 of 3

Certificate No. : 24-164692  
Sample Code : 24-57405-002

**Customer** : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapibarn 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  
**Serial No.** : 900982  
**Date of Receipt** : 19 December 2024  
**Condition of Calibration** : UM 400  
ID No. : LABE 17/1  
Date of Calibration : 19 December 2024

**1. Environment**

1.1 Ambient temperature	: Maximum	32.1 °C	: Minimum	30.4 °C
1.2 Relative humidity	: Maximum	48.9 %	: Minimum	42.4 %
1.3 Line voltage supplied	: Maximum	226.3 VAC	: Minimum	221.0 VAC

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

**3. Reference standard instrument**

Instrument	ID No.	Certificate No.	Due Date
Date Acquisition With Sensor (RTD-R100)	LB-DA-11 (RTD-148 to RTD-155, RTD-227)	24-040190	03 April 2025

**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. Nophanon Anusuk  
Scientist

(Mr. Sonchai Neampunt)  
Signed for Director

**Issue date** : 20 December 2024

The uncertainties are to 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 this laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

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Effective Date 15/10/21

## REPORT OF CALIBRATION

Page 2 of 3

Certificate No. : 24-164692  
Sample Code : 24-57405-002

## Results of Calibration

Resolution : 0.1 °C

## 1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)									Uncertainty ± (°C)	Coverage factor k
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 <sup>u/l</sup>		
85	85.0	85.0	85.33	85.28	84.83	85.01	85.15	85.18	85.32	85.12	85.23	0.25	2.00

## 2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
85	0.10	0.43	0.69

## Notes

UUC\* = Unit Under Calibration

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## REPORT OF CALIBRATION

Page 3 of 3

Certificate No. : 24-164692

Sample Code : 24-67405-002

NSC-TSI-TS17025  
CALIBRATION 0152

## 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.

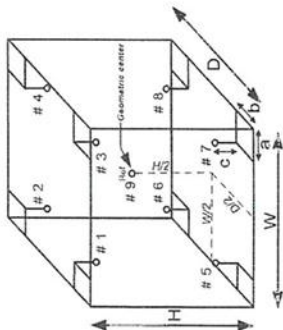


Figure: Example of sensor  
installation Positions

The result expanded uncertainty of measurement  $U$  is stated as the standard uncertainty 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 -

**COPY**

**LIQUID IN GLASS THERMOMETER**

**Model / Type : 0-100 °C**

**Serial No. : 43560**





**CALIBRATION LABORATORY CO., LTD.**  
210-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230  
Tel. 02-578-0253-4 Fax: 02-578-2672 www.cali-laboratory.com E-mail: sale@cali-laboratory.com



## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : LIQUID IN GLASS THERMOMETER  
MANUFACTURER : AA PRECISION  
MODEL / TYPE : 0-100 °C  
SERIAL NO. : 43560[LABE 16/1]  
CLID. NO. : 232403905  
JOB CONTROL NO. : 241031116258  
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

CUSTOMER : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 MOO 11, SUKHAPIBARN 8 RD,  
NONGKHAM, SRIRACHA, CHONBURI 20230

DATE OF RECEIVED : 31 October 2024 DATE OF ISSUED : 05 November 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Pimsiti Hemtanon  
Calibration Engineer



Approved By : Mongkol Yotsoontorn  
Authorized Signatory  
05 November 2024

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q24116258  
F3-011-05/12-23



page 1 of 3



edcalibration



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Tel. 02-578-0253-4 Fax: 02-578-2672 www.cali-laboratory.com E-mail: sale@cali-laboratory.com



## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : LIQUID IN GLASS THERMOMETER  
MANUFACTURER : AA PRECISION  
MODEL / TYPE : 0-100 °C  
SERIAL NO. : 43560[LABE 16/1]  
DATE OF CALIBRATION : 04 November 2024

#### ENVIRONMENT CONDITIONS :

Temperature :  $(23 \pm 2) ^\circ\text{C}$  Relative Humidity :  $(55 \pm 10) \% \text{ RH}$

#### PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPTH-02 based on ASTM E 77-07 as calibration guidelines.  
The calibration was performed by comparison with Calibration Bath, Precision Thermometer and IPT  
which maintained by the Calibration Laboratory Co., Ltd.

#### REFERENCE STANDARD USED :

1. Calibration Bath, Kumbic Model OB-22/2 ULT, OB-22/2 S/N. 17115653, 17115654.
2. Precision Thermometer, ASL Model F200-A-8 S/N. 014433/03 with IPT S/N. L0193A-1-1, PO106346-1-18.

#### TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q23136342, Q23126517. Due Date 20 December 2024, 20 November 2024.
2. The measurements are traceable to International System of Units (SI), through Thailand Institute of Scientific and Technological Research (TISTR) and National Institute of Metrology (Thailand). Certificate No. PSL-T 0203/67, TT-0136-23, TT-0110-24. Due Date 07 December 2024, 12 December 2024, 06 August 2025.

#### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2,00$  which for a normal distribution corresponds to a coverage probability of approximately 95 %.  
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q24116258  
F3-011-05/12-23



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# CALIBRATION LABORATORY CO., LTD.

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ANAB  
ASQ Business Accreditation and Training  
A C C R E D I T E D  
CALIBRATION  
FACILITY  
UNIVERSITY OF CALIFORNIA, BERKELEY  
AC/01/2814

CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment

The DUC Reading were recorded and the means value were reported of four times measurement in the table below.

## CALIBRATION DATA

### CORRECTION OF TEMPERATURE

STD Reading ( °C )	DUC Reading ( °C )	Correction ( °C )	Uncertainty ± ( °C )
0.039	0.00	+0.039	0.065
25.003	25.00	+0.003	
50.008	50.00	+0.008	
100.013	100.00	+0.013	

Range : 0 °C to 100 °C

Graduation : 0.1 °C

Immersion Type : Total Immersion.

Correction of Reference Temperature ( 0 °C ) = 0.039 °C

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 56 of 67

This report is valid for the above stated instrument/s only.

### End of Certificate ###

Certificate No. Q24116258

F3-011-05/12-23

**COPY**

page 3 of 3



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**pH Meter**

**Model : SevenCompact S220**

**Serial No. : B835349235**

Certificate Number CCP-2401-24

Certificate Number CCP-2401-24

Calibration Certificate  
SevenCompact™ pH/Ion Meter S220

Certification Tools

Customer

Company EASTERN THAI CONSULTING 1992 CO., LTD.  
Address 683 Moo 11, Sukhaphiban 8 Rd., Nong Kham, Sriracha  
Chonburi 20230  
Customer ID number 301609441  
Customer representative Sasiporn Nakin

Manufacturer Keysight Technologies  
Type 34401A

Serial number MY60051376  
Certificate number ETU2303781  
Date of certification December 10, 2023

Instrument

Type SevenCompact™ S220  
Internal Identification LABE 11/6  
Instrument serial number B835349235  
Firmware version 2.01.03

Manufacturer METTLER-TOLEDO  
Type 51302410

Serial number A425  
Certificate number 71447  
Date of certification September 26, 2023

Technical Specifications

Measuring range -2000.0 ... 2000.0 mV  
Resolution 0.1 mV  
Limit of error ± 0.2 mV; ± 0.1 mV in range -1000 ... 1000 mV  
± 0.002 pH  
-2,000 ... 20,000 pH  
0,001 pH  
± 0,002 pH  
Temperature range MTC -30.0 ... 130.0 °C  
Temperature range ATC -5.0 ... 130.0 °C  
Resolution 0.1 °C  
Limit of error ± 0.1 °C

Designation	Nominal value	Certified value
NTC 30 kΩ, 0 °C	94 990 kΩ	94 941 kΩ
NTC 30 kΩ, 25 °C	30 000 kΩ	29 992 kΩ
NTC 30 kΩ, 50 °C	10 969 kΩ	10 975 kΩ
NTC 30 kΩ, 75 °C	4 528 kΩ	4 528 kΩ
NTC 30 kΩ, 100 °C	2 070 kΩ	2 069 kΩ
PT1000, 0 °C	1 0000 kΩ	1 0001 kΩ
PT1000, 25 °C	1 0974 kΩ	1 0974 kΩ
PT1000, 50 °C	1 1940 kΩ	1 1940 kΩ
PT1000, 75 °C	1 2899 kΩ	1 2900 kΩ
PT1000, 100 °C	1 3851 kΩ	1 3852 kΩ

Procedure Statement

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

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Certificate Number    CCP-2401-24

Mettler-Toledo (Thailand) Limited

METTLER TOLEDO

Performance Test

Attachment to Certificate No.    CCP-2401-24

pH Electrode

Type:    InLab® Expert Pro-ISM    S/N:    2463982

Certification Measurements

pH/mV sensor Input				
Designation	Certified value	Measured value	Max. tolerance	Passed / Failed
-1900 mV	-1900.0 mV	-1899.9 mV	0.2 mV	Passed
-1000 mV	-1000.0 mV	-999.9 mV	0.1 mV	Passed
-500 mV	-500.0 mV	-500.0 mV	0.1 mV	Passed
-180 mV	-180.0 mV	-180.0 mV	0.1 mV	Passed
0 mV	0.0 mV	0.0 mV	0.1 mV	Passed
180 mV	180.0 mV	179.9 mV	0.1 mV	Passed
500 mV	500.0 mV	499.9 mV	0.1 mV	Passed
1000 mV	1000.0 mV	999.9 mV	0.1 mV	Passed
1900 mV	1900.0 mV	1899.9 mV	0.2 mV	Passed
pH/mV sensor Input at high impedance				
Designation	Measured low imp.	Measured high imp.	Max. difference	Passed / Failed
1900 mV	1899.9 mV	1899.9 mV	0.6 mV	Passed

Temperature sensor Input

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

Digital sensor Input with pH sensor

Sensor recognition	The sensor was recognized correctly by the meter	Passed
--------------------	--	--------

Summary of Certification

Certification of instrument

Passed

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

Remarks

Service Assignment ID : 0332980040-001

Certification of the instrument was performed by

Name    Thiraphong Salanot    Function    Service Engineer  
Company    Mettler-Toledo (Thailand) Ltd.  
Date    February 5, 2024    Signature

Certified standards used

Standard 1:	Type:	pH Buffer	Manufacturer: METTLER TOLEDO	Exp. date:	7/Jul/2025
	Nominal value:	pH ( 25.00 °C):	4.01	Lot No.:	1J188G
Standard 2:	Type:	pH Buffer	Manufacturer: METTLER TOLEDO	Exp. date:	10/Jul/2025
	Nominal value:	pH ( 25.00 °C):	7.00	Lot No.:	1J191H
Standard 3:	Type:	pH Buffer	Manufacturer: METTLER TOLEDO	Exp. date:	23/Nov/2024
	Nominal value:	pH ( 25.00 °C):	10.01	Lot No.:	1H327A
Standard 4:	Type:	Redox Solution	Manufacturer: METTLER TOLEDO	Exp. date:	-
	Nominal value:	pH ( 25.00 °C):	-	Lot No.:	-

Adjustment

B1 (25 °C) 1.68, 4.01, 7.00, 10.01									
Set Calibration Buffer		3-Point calibration		2-Point calibration		2-Point calibration		2-Point calibration	
Select Calibration Mode Segment		°C		pH		°C		pH	
3-Point Calibration									
Cal 1		ATC		27.1		4.01		ATC	
Cal 2		ATC		27.0		7.00		ATC	
Offset (mV)				6.1					
Slope % (or mV/pH)				96.5					
Cal 3		ATC		27.1		10.01			
Offset (mV)				6.1					
Slope % (or mV/pH)				98.1					

Measurements

As Found				As Left			
Buffer Values	Measured	Difference	Buffer Values	Measured	Difference	Buffer Values	Difference
pH	°C	pH	pH	°C	pH	pH	pH
4.01	27.0	ATC	4.03	0.02	4.01	27.0	ATC
7.00	27.1	ATC	7.04	0.04	7.00	26.8	ATC
9.99	27.1	ATC	9.98	-0.01	9.99	27.1	ATC

Redox Measurement Result =    mV

Note:    The difference result of calibrated electrode should be within +/- 0.05 pH

Remarks:

Place:    Laboratory Room    Calibration Date:    5/Feb/2024  
Service Specialist:    Thiraphong Salanot    Signature:

**pH Meter**

**Model : SevenCompact S220**

**Serial No. : B835349235**

Certificate Number CCP-0403-25

Calibration Certificate  
SevenCompact™ pH/Ion Meter S220

Customer

Company EASTERN THAI CONSULTING 1992 CO., LTD.  
Address 683 Moo 11, Sukhaphiban 8 Rd., Nong Kham  
Sriracha  
CHONBURI 20230  
Customer ID number 301608441  
Customer representative รุณ ธีรพรดี บุณย์บุณย

Instrument

Type SevenCompact™ S220 Instrument Serial Number B835349235  
Internal Identification LABE 11/6 Firmware version 1.20.06

Technical specifications

Measuring Range -1999.9 ... 1999.9 mV -2.000 ... 20.000 pH  
Resolution 0.1 mV 0.001 pH  
Limit of Error ± 0.2 mV ± 0.002 pH

Temperature range MTC -30.0 ... 130.0 °C

Temperature range ATC -5.0 ... 130.0 °C

Resolution 0.1 °C

Limit of Error ± 0.1 °C

Procedure Statement

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

COPY

Certificate Number CCP-0403-25

Certification Tools

Certified digital voltmeter  
Manufacturer KEYSIGHT TECHNOLOGIES  
Type 34461A  
Control No. ANA1143

Serial number MY60036967  
Certificate number E102401054  
Due date March 10, 2025

Certified Temperature  
Resistors

Manufacturer METTLER-TOLEDO  
Type 51302410  
Control No. ANA1114

Serial number A275  
Certificate number 73757  
Due date February 12, 2026

Designation	Nominal value	Certified value
NTC 30 kΩ, 0 °C	94.980 kΩ	94.9730 kΩ
NTC 30 kΩ, 25 °C	30.000 kΩ	29.9950 kΩ
NTC 30 kΩ, 50 °C	10.969 kΩ	10.9704 kΩ
NTC 30 kΩ, 75 °C	4.528 kΩ	4.5275 kΩ
NTC 30 kΩ, 100 °C	2.070 kΩ	2.0714 kΩ
PT1000, 0 °C	1.000 kΩ	1.0001 kΩ
PT1000, 25 °C	1.0974 kΩ	1.0975 kΩ
PT1000, 50 °C	1.1940 kΩ	1.1942 kΩ
PT1000, 75 °C	1.2899 kΩ	1.2900 kΩ
PT1000, 100 °C	1.3851 kΩ	1.3851 kΩ

COPY



Certificate Number CCP-0403-25

## Certification Measurements

pH/mV Sensor Input				
Designation	Certified value	Measured value	Max. Tolerance	Passed / Failed
-1900 mV	-1900.0 mV	-1899.98 mV	0.2 mV	Passed
-1000 mV	-1000.0 mV	-1000.00 mV	0.2 mV	Passed
-500 mV	-500.0 mV	-499.98 mV	0.2 mV	Passed
-180 mV	-180.0 mV	-180.00 mV	0.2 mV	Passed
0 mV	0.0 mV	0.01 mV	0.2 mV	Passed
180 mV	180.0 mV	179.98 mV	0.2 mV	Passed
500 mV	500.0 mV	499.99 mV	0.2 mV	Passed
1000 mV	1000.0 mV	1000.00 mV	0.2 mV	Passed
1900 mV	1900.0 mV	1899.99 mV	0.2 mV	Passed

pH/mV Sensor Input at high impedance				
Designation	Measured low imp.	Measured high imp.	Max. Tolerance	Passed / Failed
1900 mV	1900.0 mV	1899.8 mV	0.6 mV	Passed

Temperature Sensor Input				
Designation	Nominal value	Measured value	Max. Tolerance	Passed / Failed
NTC 30 kΩ, 0 °C	0.0 °C	0.0 °C	0.1 °C	Passed
NTC 30 kΩ, 25 °C	25.0 °C	25.0 °C	0.1 °C	Passed
NTC 30 kΩ, 50 °C	50.0 °C	50.0 °C	0.1 °C	Passed
NTC 30 kΩ, 75 °C	75.0 °C	74.9 °C	0.1 °C	Passed
NTC 30 kΩ, 100 °C	100.0 °C	100.0 °C	0.1 °C	Passed
PT1000, 0 °C	0.0 °C	0.1 °C	0.1 °C	Passed
PT1000, 25 °C	25.0 °C	25.0 °C	0.1 °C	Passed
PT1000, 50 °C	50.0 °C	50.0 °C	0.1 °C	Passed
PT1000, 75 °C	75.0 °C	74.9 °C	0.1 °C	Passed
PT1000, 100 °C	100.0 °C	99.9 °C	0.1 °C	Passed

## Summary of Certification

Certification of instrument

Passed

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

Remarks - Test high impedance at 1900.0 mV. Results : 1899.8 mV

Difference = 0.005% Within MPE (0.033%)

Certification of the instrument was performed by

Name Khomsan Praetung Function Service

Place Mettler-Toledo (Thailand) Ltd.

Calibration Date: 29-Jan-2025

Signature

Mettler-Toledo (Thailand) Limited

METTLER TOLEDO

## Performance Test

Attachment to Certificate No. CCP-0403-25

## pH Electrode

Type InLab Expert Pro-ISM S/N: 2463982

## Certified standards used

Standard 1:				
Type:	pH Buffer	Manufacturer: METTLER TOLEDO	Exp. date:	3-Dec-2026
Nominal value:		pH ( 25.00 °C):	4.01	Lot No.: 1J338E
Standard 2:				
Type:	pH Buffer	Manufacturer: METTLER TOLEDO	Exp. date:	27-Nov-2026
Nominal value:		pH ( 25.00 °C):	7.00	Lot No.: 1J331B
Standard 3:				
Type:	pH Buffer	Manufacturer: METTLER TOLEDO	Exp. date:	11-Jan-2026
Nominal value:		pH ( 25.00 °C):	10.00	Lot No.: 1K011B
Standard 4:				
Type:	Redox Solution	Manufacturer: METTLER TOLEDO	Exp. date:	-
Nominal value:		pH ( 25.00 °C):	-	Lot No.: -

## Adjustment

Set Calibration Buffer									
Select Calibration Mode									
Segment									
3-Point Calibration									
Cal 1	ATC		25.5	7.00	ATC		pH		°C
	ATC		25.5	4.00	ATC		pH		°C
Cal 2	ATC		25.5	4.00	ATC		pH		°C
Offset (mV)	-27.2								
Slope % (or mV/pH)	95.9								
Cal 3	ATC		25.5	10.01					
Offset (mV)	-27.2								
Slope % (or mV/pH)	97.4								

## Measurements

Resolution: 2 Decimal places

As Found					As Left				
Buffer Values	Measured	Difference	Buffer Values	Measured	Buffer Values	Measured	Difference	Buffer Values	Measured
pH	°C	pH	pH	°C	pH	°C	pH	pH	°C
4.01	25.3 ATC	4.02	4.01	25.3 ATC	4.01	25.3 ATC	4.01	4.01	25.3 ATC
7.00	25.2 ATC	6.98	-0.02	7.00	25.2 ATC	7.01	0.01	7.01	25.2 ATC
9.99	25.3 ATC	10.11	0.12	9.99	25.2 ATC	10.00	0.01	10.00	25.2 ATC

Redox Measurement Result = - mV

Note: The difference result of calibrated electrode should be within +/- 0.05 pH

Remarks: N/A

Place: Laboratory

Calibration Date: 29-Jan-2025

Service Specialist: Khomsan Praetung

Signature:



**STANDARD WEIGHT 50 g**



Certificate No. : 24-062445

Sample Code : 24-25551-001

Page 1 of 3

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapibarn 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 : 23 May 2024

Date of Calibration : 03 June 2024

Calibrated by : Mr. Somwang Sangdee  
Scientist

Issue date : 04 June 2024

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. : 24-062445

Sample Code : 24-25551-001

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

Description	Deviation (mg)	Conventional Mass g	Expanded Uncertainty (mg)	Maximum Permissible Error $\pm$ (mg)	ID No.
50 g	-0.343	49.999857	0.10	0.30	LABE 10/1

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

Certificate No. : 24-062445

Sample Code : 24-25551-001

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 1.19 kg/m<sup>3</sup>
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-WF-83	24-001894	11 January 2025

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. : 24-079772

Sample Code : 24-31841-002

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapibarn 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 100 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/2

Date of Receipt : 25 June 2024

Date of Calibration : 30 June 2024

Calibrated by : Mr. Nawa Sisuwan  
Scientist  
Approved by : ( Mr. Somchai Neampunt )  
Signed for Director

Issue date : 03 July 2024

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).



Certificate No. : 24-079772

Sample Code : 24-31841-002

## 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 ☐ AdjustmentConventional 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	-0.173	99.999827 g	0.16	0.50	LABE 10/2

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

Certificate No. : 24-079772  
Sample Code : 24-31841-002

## REPORT OF CALIBRATION

### Condition of Calibration

1. Ambient Conditions : Temperature 20 °C ± 1.5°C, Relative humidity 50% ± 10% and air density 1.19 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-83	24-001894	11 January 2025

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 -



**STANDARD WEIGHT 50 g**



Certificate No. : 24-079773

Sample Code : 24-31841-003

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapibarn 8 Rd., NongKham,

Sriracha, Chonburi 20230

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

Equipment : Standard Weight 50 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/4

Date of Receipt : 25 June 2024

Date of Calibration : 30 June 2024

Calibrated by : Mr. Nawa Sisuwan  
Scientist  
Issue date : 03 July 2024

Approved by : ( Mr. Somchai Neampunt )

Signed for Director

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

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

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. : 24-079773

Sample Code : 24-31841-003

## 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☐ AdjustmentConventional 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	-0.176	49.999824 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





Certificate No. : 24-079773

Sample Code : 24-31841-003

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## 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  $1.19 \text{ kg/m}^3$
2. Calibration Method : WI-CL-007 base on OIML R 111-1 : 2004(E)
3. Reference standard instrument

Instrument	Class	ID No.	Certificate No.	Due Date
Standard Weight 1 mg to 1 kg	E2	LB-WE-83	24-001894	11 January 2025

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 -

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**SPECTROPHOTOMETER**

**Model : PROVE 100**

**Serial No. : 1613110857**



CERTIFICATE OF CALIBRATION

Instrument : SPECTROPHOTOMETER  
Model : PROVE 100  
Date of Calibration : Feb 9, 2024  
Customer Name : Eastern Thai Consulting 1992 Co., Ltd.  
Procedure used

The wavelength accuracy and the linearity of the absorbance measurement of photometers are checked using Check solutions according to Merck calibration laboratory work instruction.

Measurements results

Function : Absorbance measurement.  
All data shown below as received values of blank solution before adjustment.

Check Solution (Abs.)	Wavelength (nm)	Desired Absorbance (Abs.)	Measured Absorbance (Abs.)	Error (Abs)
0.000	445	0.000 ± 0.005	0.000	0.000
0.000	525	0.000 ± 0.005	0.000	0.000
0.000	690	0.000 ± 0.005	0.000	0.000

CERTIFICATE No. WO-02723295



Merck Ltd. Thailand  
19<sup>th</sup> Floor, Emporium Tower, 622 Sukhumvit Road  
Klongton, Klongtoey, Bangkok 10110  
Tel. : +66 (0) 2667 8000  
Fax : +66 (0) 2667 8399  
Customer Care Center : +66 (0) 2667 8333



CERTIFICATE OF CALIBRATION

Function : Absorbance measurement.  
All data shown below were final value of standard solution after adjustment.

Check Solution* (Abs.)	Desired Absorbance (Abs.)	Allowed tolerance (Abs.)	Actual Absorbce (Abs.)	Assessment Yes/No
445-1	0.197	± 0.020	0.189	Yes
445-2	0.497	± 0.030	0.481	Yes
445-3	0.990	± 0.040	0.970	Yes
445-4	1.494	± 0.050	1.474	Yes
525-1	0.198	± 0.020	0.191	Yes
525-2	0.493	± 0.030	0.485	Yes
525-3	0.988	± 0.040	0.966	Yes
525-4	1.485	± 0.050	1.471	Yes
690-1	0.204	± 0.020	0.197	Yes
690-2	0.504	± 0.030	0.494	Yes
690-3	0.987	± 0.040	0.989	Yes
690-4	1.498	± 0.050	1.493	Yes

\* Spectroquant Photocheck (Check Solution) Lot : HC299606

- Check solution for this certification is traceable to : Reference Photometer Agilent Cary 4000 checked and calibrated using NIST-grey glass filter SRM 1930 and Holmiumoxide Solution NIST SRM 2034  
- Desired absorbance round cell has been calculated from the absorbance of the 1 cm cell using the path length of the round cell and is entered as the desired



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Customer Care Center : +66 (0) 2667 8333



CERTIFICATE OF CALIBRATION

Software version: 1.5.1

Wavelength Accuracy				
Equipment	Nominal value	Tolerance limit	Actual value	Result
Holmium Oxide Solution Standard 6	361.1 nm	359.1 – 363.1 nm	361.0 nm	P
	385.3 nm	382.3 – 390.3 nm	385.5 nm	P
	417.1 nm	413.1 – 421.1 nm	416.4 nm	P
	451.4 nm	447.4 – 455.4 nm	450.0 nm	P
	485.3 nm	481.3 – 489.3 nm	485.2 nm	P
	537.6 nm	533.6 – 541.6 nm	537.3 nm	P
Photometric Accuracy				
Equipment	Wavelength	Nominal value	Tolerance limit	Actual value
Neutral Density 1.00 Abs. Hellma 666-F4	440 nm	1.079 A	1.067 - 1.091 A	1.074 A
	546 nm	1.012 A	1.004 - 1.020 A	1.010 A
	635 nm	1.050 A	1.042 - 1.058 A	1.048 A
Stray Light				
Equipment	Wavelength	Nominal value	Actual value	Result
UV-VIS Standard 2 Sodium Nitrite Solution	340 nm	≤0.10 %T	0.05 %T	P
Self-test Hardware				
No visual flaws, no burrs, no loose parts and fastenings				P



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CERTIFICATE OF CALIBRATION

INSTRUMENT : SPECTROPHOTOMETER

MANUFACTURER : Merck KGaA, Darmstadt, Germany

MODEL : PROVE 100

SERIAL No. : 1613110857

CLIENT : Eastern Thai Consulting 1992 Co., Ltd.

DATE OF ISSUE : Feb 9, 2024

APPROVED SIGNATORY

NAME : Mr. Rawat Rattanachethakul  
(SERVICE ENGINEER)

SIGNATURE :

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CERTIFICATE No. WO-02723295

**SPECTROPHOTOMETER**

**Model : PROVE 100**

**Serial No. : 1613110857**



## CERTIFICATE OF CALIBRATION

**Instrument** : SPECTROPHOTOMETER  
**Model** : PROVE 100  
**Date of Calibration** : February 07, 2025  
**Customer Name** : Eastern Thai Consulting 1992 Co., Ltd.

### Procedure used.

The wavelength accuracy and the linearity of the absorbance measurement of photometers are checked using Check solutions according to Merck calibration laboratory work instruction.

### Measurements results

**Function** : **Photometric Accuracy** Absorbance measurement.  
All data shown below as received values of blank solution before adjustment.

Check Solution (Abs.)	Wavelength (nm)	Desired Absorbance (Abs.)	Measured Absorbance (Abs.)	Error (Abs)
0.000	445	$0.000 \pm 0.005$	0.000	0.000
0.000	525	$0.000 \pm 0.005$	0.000	0.000
0.000	690	$0.000 \pm 0.005$	0.000	0.000

CERTIFICATE No. **WO-02931344**



**Merck Ltd. Thailand**  
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## CERTIFICATE OF CALIBRATION

**Function** : **Photometric Accuracy** Absorbance measurement.  
All data shown below were final value of standard solution after adjustment.

Check Solution (Abs.)	Desired Absorbance (Abs.)	Allowed tolerance. (Abs.)	Actual Absorbance (Abs.)	Assessment Yes/No
445-1	0.197	$\pm 0.020$	0.193	Yes
445-2	0.497	$\pm 0.030$	0.491	Yes
445-3	0.990	$\pm 0.040$	0.979	Yes
445-4	1.494	$\pm 0.050$	1.479	Yes
525-1	0.198	$\pm 0.020$	0.198	Yes
525-2	0.493	$\pm 0.030$	0.491	Yes
525-3	0.988	$\pm 0.040$	0.975	Yes
525-4	1.485	$\pm 0.050$	1.468	Yes
690-1	0.204	$\pm 0.020$	0.202	Yes
690-2	0.504	$\pm 0.030$	0.495	Yes
690-3	0.987	$\pm 0.040$	0.995	Yes
690-4	1.498	$\pm 0.050$	1.496	Yes

\* Spectroquant Photo check (Check Solution) **Lot: HC299606**

- Check solution for this certification is traceable to: Reference Photometer Agilent Cary 4000  
checked and calibrated using NIST-grey glass filter SRM 1930 and Holmium oxide Solution NIST SRM 2034  
- Desired absorbance round cell has been calculated from the absorbance of the 1 cm cell using the path length of the round cell and is entered as the desired



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CERTIFICATE OF CALIBRATION

Software version: 2.0.1

Wavelength Accuracy				
Equipment	Nominal value	Tolerance limit	Actual value	Result
Holmium Oxide Liquid Filter Hellma 667-UV5	361.25 nm	360.05 - 362.45 nm	361.0 nm	P
	451.35 nm	450.15 - 452.55 nm	451.3 nm	P
	485.25 nm	484.05 - 486.45 nm	485.0 nm	P
	536.60 nm	535.40 - 537.80 nm	537.6 nm	P
	640.50 nm	639.30 - 641.70 nm	641.2 nm	P
Stray Light				
Equipment	Wavelength	Nominal value	Actual value	Result
Sodium Nitrite Hellma 667-UV11	340 nm	≤0.10 %T	0.05 %T	P
Self-test Hardware				
No visual flaws, no burrs, no loose parts, and fastenings				P



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CERTIFICATE OF CALIBRATION

INSTRUMENT : SPECTROPHOTOMETER

MANUFACTURER : Merck KGaA, Darmstadt, Germany

MODEL : PROVE 100

SERIAL No. : 1613110857

CLIENT : Eastern Thai Consulting 1992 Co., Ltd.

DATE OF ISSUE : February 07, 2025

APPROVED SIGNATORY

NAME : Mr.Supachai Konthong  
(INSTRUMENTAL SERVICE ENGINEER)

SIGNATURE :

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CERTIFICATE No. WO-02931344



**ANALYTICAL BALANCE (DU)**

**Model : XS205DU**


**Serial No. : 1126323724**

**Mettler-Toledo (Thailand) Ltd.**  
846/4 - 846/5846/4 - 846/5 Lasalle Rd., Bangna Tai  
Bangna District, Bangkok 10260  
+66 2723 0382  
MT-TH.ServiceSupport@mtl.com

NSC-TISL-TIS 17025  
CALIBRATION 0062

# Accuracy Calibration Certificate

## Customer

<b>Company:</b>	EASTERN THAI CONSULTING 1982 CO., LTD.
<b>Address:</b>	803 Moo 11, Sukhaphiban 8 Rd., Nong Khiam
<b>City:</b>	Sriacha
<b>Zip / Postal:</b>	20230
<b>State / Province:</b>	Chonburi
<b>Order Number:</b>	
<b>Contact:</b>	Sasiporn Nakin



## Weighing Device

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

Range	Max. Capacity	Readability (d)
1	81 g	0.00001 g
2	220 g	0.0001 g

## Procedure

Calibration Guideline:  
**METTLER TOLEDO** Work Instruction:  
 EURAMET cg-18 v. 4.0 (11/2015)  
 CPM002/20

The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight. In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

Temperature		Humidity
As Found	Start: 25.7 °C    End: 25.8 °C	Start: 50.9 %    End: 50.6 %

As Found Calibration Date:	09-Dec-2024	Calibrator:	SMS
As Left Calibration Date:	N/A		
Issue Date:	11-Dec-2024		Somsak Sallanaco

Approved Signatory: Surachai P.  
Technical Manager / Head of Calibration Centre

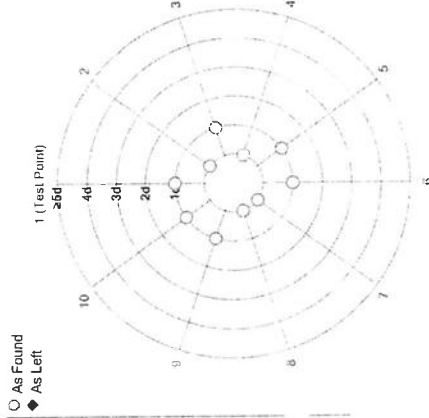
## Measurement Results

## Repeatability

Test Load: 70 g

	As Found	As Left
1	70.00004 g	N/A
2	70.00005 g	N/A
3	70.00004 g	N/A
4	70.00005 g	N/A
5	70.00006 g	N/A
6	70.00004 g	N/A
7	70.00005 g	N/A
8	70.00005 g	N/A
9	70.00006 g	N/A
10	70.00006 g	N/A

Standard Deviation	0.000008 g	N/A
--------------------	------------	-----



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

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

### Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.000 g	N/A
2	100.0000 g	N/A
3	100.0000 g	N/A
4	99.9999 g	N/A
5	100.0000 g	N/A
Maximum Deviation	0.0001 g	N/A

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

Error of Indication

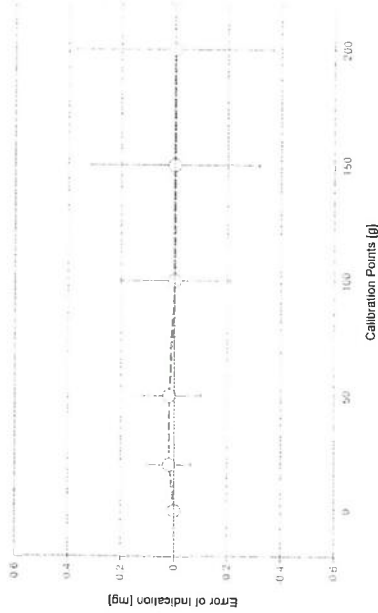
As Found					
Reference Value	Indication	Error of Indication	Expanded Uncertainty	k	
1 0.00000 g	0.00000 g	0.00000 g	0.017 mg	2	
2 0.01000 g	0.01000 g	0.00000 g	0.020 mg	2	
3 0.10000 g	0.10000 g	0.00000 g	0.023 mg	2	
4 1.00000 g	1.00000 g	0.00000 g	0.032 mg	2	
5 4.99998 g	5.00000 g	0.00002 g	0.048 mg	2	
6 10.00001 g	10.00001 g	0.00000 g	0.061 mg	2	
7 19.99999 g	20.00001 g	0.00002 g	0.082 mg	2	
8 50.00003 g	50.00005 g	0.00002 g	0.12 mg	2	
9 100.00000 g	100.00000 g	0.00000 g	0.21 mg	2	
10 150.00000 g	150.00000 g	0.00000 g	0.32 mg	2	
11 200.00000 g	200.00000 g	0.00000 g	0.37 mg	2	

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

○ As Found

◆ As Left

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



The expanded measurement uncertainty is reported as the standard measurement uncertainty multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95 %.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated. The results of this calibration certificate relate only to the calibrated item.



Test Equipment

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

Weight Set 1: OIML E2

Weight Set No.:	WS37	Date of Issue:	17-Jun-2024
Certificate Number:	186753-1	Calibration Due Date:	20-Jan-2025

Weight Set 2: OIML E2

Weight Set No.:	WS87	Date of Issue:	04-Jul-2023
Certificate Number:	186520	Calibration Due Date:	02-Jan-2025

Thermo Hygrometer

Equipment No.:	IN279	Date of Issue:	19-Jun-2024
Certificate Number:	SG-H-00577/67	Calibration Due Date:	17-Jun-2025

Remarks

FACT adjustment functionality activated

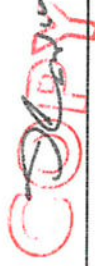
Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

End of Accredited Section

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



Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with  $k=2$  in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value  $R$  represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use:  $1.5 \cdot 10^{-6} / K$

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

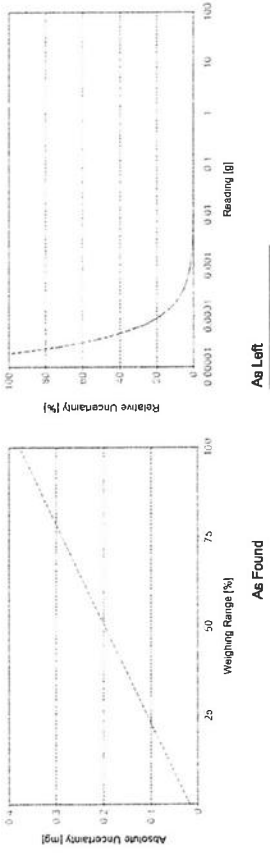
Linearization of Uncertainty Equation

Range		As Found		As Left	
d	Max				
1	0.00001 g	81 g	$U_1 = 0.018 \text{ mg} + 0.00444 \text{ mg/g} \cdot R$	N/A	N/A
2	0.0001 g	220 g	$U_2 = 0.06 \text{ mg} + 0.00439 \text{ mg/g} \cdot R$	N/A	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	
0.00220 g		0.018 mg	0.82%	N/A	N/A
0.02200 g		0.018 mg	0.082%	N/A	N/A
0.22000 g		0.019 mg	0.0086%	N/A	N/A
2.20000 g		0.028 mg	0.0013%	N/A	N/A
220.0000 g		1.0 mg	0.00047%	N/A	N/A



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



Certificate

As Found ✓ As Left ✓

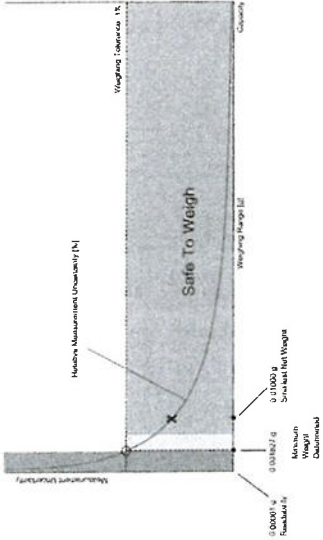
The weighing device meets the given process requirements.

Tests Performed: ☒ As Found ☐ As Left ☒ No adjustments/modifications made. As Left results correspond to As Found.

Process Requirements

Weighing Tolerance: 1% | Smallest Net Weight: 0.01000 g | Safety Factor: 2

Safe Weighing Range



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



## Minimum Weight

### As Found Minimum Weight Table

Range 1

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.018339 g	0.036842 g	0.055111 g	0.093358 g	0.191052 g
0.2%	0.009149 g	0.018339 g	0.027570 g	0.046156 g	0.093358 g
0.5%	0.003655 g	0.007316 g	0.010984 g	0.018339 g	0.036842 g
1%	0.001827 g	0.003655 g	0.005485 g	0.009149 g	0.018339 g
2%	0.000913 g	0.001827 g	0.002740 g	0.004569 g	0.009149 g
5%	0.000365 g	0.000730 g	0.001096 g	0.001827 g	0.003655 g

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



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

### As Left Minimum Weight Table

Range 1

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.018339 g	0.036842 g	0.055111 g	0.093358 g	0.191052 g
0.2%	0.009149 g	0.018339 g	0.027570 g	0.046156 g	0.093358 g
0.5%	0.003655 g	0.007316 g	0.010984 g	0.018339 g	0.036842 g
1%	0.001827 g	0.003655 g	0.005485 g	0.009149 g	0.018339 g
2%	0.000913 g	0.001827 g	0.002740 g	0.004569 g	0.009149 g
5%	0.000365 g	0.000730 g	0.001096 g	0.001827 g	0.003655 g

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



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

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

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

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

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

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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  
Δ = Safety Factor not met

### Repeatability

Test Load: 70 g

Tolerance		Control Limit		As Found		As Left	
				Std. Deviation	Result	Std. Deviation	Result
0.1%	0.000005 g	0.000005 g	✗		✗		✗
0.2%	0.000010 g	0.000010 g	✓		✓		Δ
0.5%	0.000025 g	0.000025 g	✓		✓		✓
1%	0.000050 g	0.000050 g	✓	0.000008 g	✓	0.000008 g	✓
2%	0.000100 g	0.000100 g	✓		✓		✓
5%	0.000250 g	0.000250 g	✓		✓		✓

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

### Eccentricity

Test Load: 100 g

Tolerance		Control Limit		As Found		As Left	
				Deviation	Result	Deviation	Result
0.1%	0.0500 g	0.0500 g	✓		✓		✓
0.2%	0.1000 g	0.1000 g	✓		✓		✓
0.5%	0.2500 g	0.2500 g	✓		✓		✓
1%	0.5000 g	0.5000 g	✓	0.0001 g	✓	0.0001 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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Error of Indication

As Found

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A
19.99999 g	0.00002 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.20000 g	0.50000 g
50.00003 g	0.00002 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g	1.25000 g
100.00000 g	0.00000 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	1.00000 g	2.50000 g
150.00000 g	0.00000 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	1.50000 g	3.75000 g
200.00000 g	0.00000 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	2.00000 g	5.00000 g
Result		✓	✓	✓	✓	✓	✓

As Left

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A
19.99999 g	0.00002 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.20000 g	0.50000 g
50.00003 g	0.00002 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g	1.25000 g
100.00000 g	0.00000 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	1.00000 g	2.50000 g
150.00000 g	0.00000 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	1.50000 g	3.75000 g
200.00000 g	0.00000 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	2.00000 g	5.00000 g
Result		✓	✓	✓	✓	✓	✓

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

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**ANALYTICAL BALANCE**

**Model : MS204TS/00**

**Serial No. : B904136539**



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

NSC-TIS|TIS 17025  
CALIBRATION 0062

# Accuracy Calibration Certificate

## Customer

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



## Weighing Device

<b>Manufacturer:</b>	Mettler Toledo	<b>Instrument Type:</b>	Weighing Instrument
<b>Model:</b>	MS204TS/00	<b>Asset Number:</b>	LABE 0514
<b>Serial No.:</b>	B904136539	<b>Terminal Model:</b>	N/A
<b>Building:</b>	Laboratory	<b>Terminal Serial No.:</b>	N/A
<b>Room:</b>	1	<b>Terminal Asset No.:</b>	N/A
	Balance		

Rango	Max. Capacity	Readability (d)
1	220 g	0.0001 g

## Procedure

**Calibration Guideline:**  
**METTLER TOLEDO Work Instruction:**  
EURAMET cg-18 v. 4.0 (11/2015)  
CPW002/20

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature	Humidity
As Found	Start: 24.2 °C    End: 24.3 °C	Start: 37.9 %    End: 37.9 %

As Found Calibration Date:	29-Jan-2025	Callibrator:	
As Left Calibration Date:	N/A		Khomsan Prataung
Issue Date:	01-Feb-2025	Approved Signatory:	

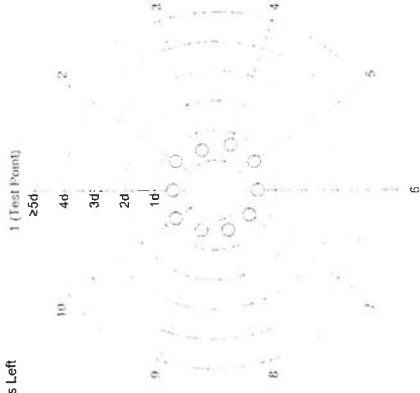
### Technical Manager / Head of Calibration Center

## Measurement Results

## Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0000 g	N/A
2	99.9999 g	N/A
3	100.0000 g	N/A
4	99.9999 g	N/A
5	99.9999 g	N/A
6	100.0000 g	N/A
7	100.0000 g	N/A
8	100.0000 g	N/A
9	100.0000 g	N/A
10	99.9999 g	N/A
Standard Deviation	0.00005 g	N/A



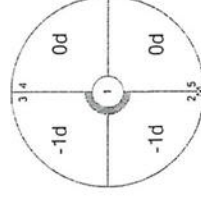
The "d" in the graph represents the readability of the range/interval in which the test was performed.

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

## Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	99.9999 g	N/A
3	99.9999 g	N/A
4	100.0000 g	N/A
5	100.0000 g	N/A
Maximum Deviation	0.0001 g	N/A



As Found

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

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.: WS32

Certificate Number: 193673

Date of Issue: 07-Aug-2024

Calibration Due Date: 30-Jan-2026

Weight Set 2: OIML E2

Weight Set No.: WS32-1

Certificate Number: C436717337

Date of Issue: 06-Sep-2024

Calibration Due Date: 26-Jan-2026

Thermo Hygrometer

Equipment No.: IN277

Certificate Number: SG-H-00575/67

Date of Issue: 19-Jun-2024

Calibration Due Date: 18-Jun-2025

Remarks

FACT adjustment functionally activated

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

End of Accredited Section

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

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.12 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	0.1000 g	0.0000 g	0.13 mg	2
5	1.0000 g	1.0000 g	0.0000 g	0.13 mg	2
6	5.0000 g	5.0000 g	0.0000 g	0.14 mg	2
7	10.0000 g	10.0000 g	0.0000 g	0.14 mg	2
8	50.0000 g	50.0000 g	0.0000 g	0.16 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.24 mg	2
10*	150.0000 g	150.0001 g	0.0001 g	0.31 mg	2
11*	200.0000 g	200.0002 g	0.0002 g	0.35 mg	2

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

As Found

As Left

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

Error of Indication [mg]

Calibration Points [g]

The expanded measurement uncertainty is reported as the standard measurement uncertainty multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95 %.

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

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

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 rel load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use:  $1.5 \cdot 10^{-6} / K$   
Temperature range on site for the evaluation of the measurement uncertainty in use:  $5 K$

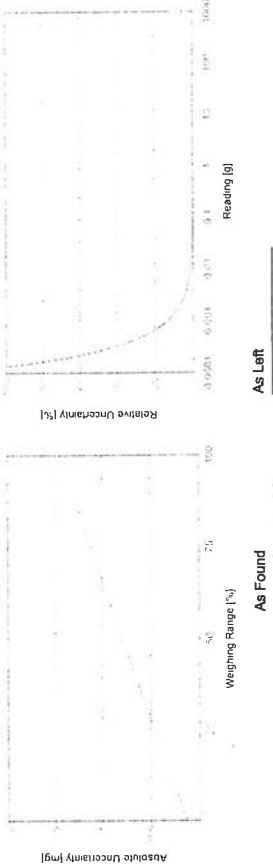
Linearization of Uncertainty Equation

Range		As Found		As Left	
d	Max				
1	0.0001 g	220 g	$U_1 = 0.13 \text{ mg} + 0.00598 \text{ mg/g} \cdot R$	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	0.26 mg	0.0012%	N/A	N/A
220.0000 g	1.4 mg	0.00066%	N/A	N/A



GWP®  
Certificate



As Found



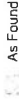
As Left



The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:



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

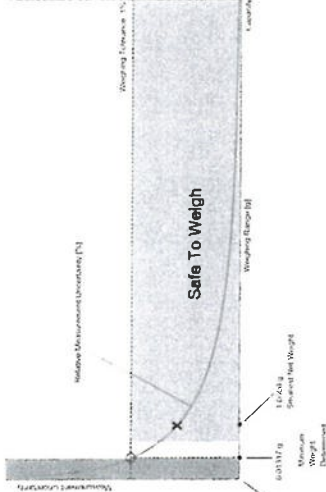
Process Requirements

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. The graph reflects As Left testing, unless only As Found was performed.



Minimum Weight

As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.13245 g	0.26650 g	0.40219 g	0.67859 g	1.40037 g
0.2%	0.06603 g	0.13245 g	0.19927 g	0.33414 g	0.67859 g
0.5%	0.02636 g	0.05279 g	0.07928 g	0.13245 g	0.26650 g
1%	0.01317 g	0.02636 g	0.03957 g	0.06603 g	0.13245 g
2%	0.00658 g	0.01317 g	0.01977 g	0.03296 g	0.06603 g
5%	0.00263 g	0.00527 g	0.00790 g	0.01317 g	0.02636 g

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

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.13245 g	0.26650 g	0.40219 g	0.67859 g	1.40037 g
0.2%	0.06603 g	0.13245 g	0.19927 g	0.33414 g	0.67859 g
0.5%	0.02636 g	0.05279 g	0.07928 g	0.13245 g	0.26650 g
1%	0.01317 g	0.02636 g	0.03957 g	0.06603 g	0.13245 g
2%	0.00658 g	0.01317 g	0.01977 g	0.03296 g	0.06603 g
5%	0.00263 g	0.00527 g	0.00790 g	0.01317 g	0.02636 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:

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

Measurement Results

Results Summary

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

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

Repeatability

Test Load: 100 g

Control Limit		As Found		As Left	
Tolerance	Std. Deviation	Result	Std. Deviation	Result	Std. Deviation
0.1%	0.00050 g	✓		✓	
0.2%	0.00100 g	✓		✓	
0.5%	0.00250 g	✓	0.00005 g	✓	0.00005 g
1%	0.00500 g	✓		✓	
2%	0.01000 g	✓		✓	
5%	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

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

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

As Found

Reference Value		Control limits for various weighing tolerances							
		Error	0.1%	0.2%	0.5%	1%	2%	5%	
0.0000 g	0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A	
50.0000 g	0.0000 g	0.0000 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g	
100.0000 g	0.0000 g	0.0000 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g	
150.0000 g	0.0001 g	0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g	
200.0000 g	0.0002 g	0.0002 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g	
Result			✓	✓	✓	✓	✓	✓	✓

As Left

Reference Value		Control limits for various weighing tolerances							
		Error	0.1%	0.2%	0.5%	1%	2%	5%	
0.0000 g	0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A	
50.0000 g	0.0000 g	0.0000 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g	
100.0000 g	0.0000 g	0.0000 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g	
150.0000 g	0.0001 g	0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g	
200.0000 g	0.0002 g	0.0002 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g	
Result			✓	✓	✓	✓	✓	✓	✓

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

**Area Heat Stress Monitor**

**Model : QUESTEMP 34**

**Serial No. : TEU080012**

## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-022-68

**MEASUREMENT ITEM**  
MANUFACTURER : Heat Stress Monitor  
MODEL/TYPE : TSI QUEST  
SERIAL NUMBER : Ques Temp 34  
ID NUMBER : TEU080012  
CONDITION AS-RECEIVED : NO. 11  
CUSTOMER : Used item  
: Eastern Thai consulting 1992 Co., Ltd.  
683 Moo 11, Sukhapharm 8 Rd,  
Nongkham, Sriracha, Chonburi 20230

**RECEIVED DATE** : 27 Dec 2024  
**MEASUREMENT DATE** : 10 Jan 2025  
**ISSUE DATE** : 14 Jan 2025

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature : 23.0 ± 3.0 °C  
Relative Humidity : 55.0 ± 15.0 %RH

**NOTED:** The certificate is valid only to the item calibrated on date and place of calibration.

### TABULATION OF RESULTS:

The table on next page give the measured values.

Page 1 of 2 Pages

### Calibration procedure:

The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

### Traceability:

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT).  
Certificate number: TT-00472-24, Certificate number: ER-0113524

### Reference Used During Calibration:

- Standard Temperature Probe  
Model: STS-100 AS500, Serial No.: 667682-09,  
Due date: 26 Mar 2025
- Digital Temperature Indicator  
Model: DTI-1000-A MK II, Serial No.: 671407,  
00591 Due date: 21 Oct 2025

### Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor  $k=2$ , Which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'

### Calibrated by:

- ☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol  
☐ Miss Ruangrumpai Phoommit

### Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

Continuation of Certificate of Calibration Number CDT-022-68

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

### Function:

Table 1: This equipment was connected with wet bulb Temperature probe Model: -, S/N: -.  
Dimension: Diameter 4.77 mm. Length 70 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
65	20.073	20.3	0.2	0.099
65	25.064	25.3	0.2	0.099
65	30.051	30.3	0.2	0.099
65	35.037	35.3	0.3	0.099
65	40.024	40.2	0.2	0.099

Table 2: This equipment was connected with Globe Temperature probe Model: -, S/N: -.  
Dimension: Diameter 4.77 mm. Length 70 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
65	20.073	20.3	0.2	0.099
65	25.064	25.3	0.2	0.099
65	30.051	30.3	0.2	0.099
65	35.037	35.3	0.3	0.099
65	40.024	40.3	0.3	0.099

Table 3: This equipment was connected with Dry Bulb Temperature probe Model: -, S/N: -.  
Dimension: Diameter 4.77 mm. Length 70 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
65	20.073	20.3	0.2	0.099
65	25.064	25.3	0.2	0.099
65	30.051	30.3	0.2	0.099
65	35.037	35.3	0.3	0.099
65	40.024	40.3	0.3	0.099

UUC\*: Unit Under Calibration

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



**COPY**





**Area Heat Stress Monitor**

**Model : QUESTEMP 34**

**Serial No. : TEU080013**

Result of Calibration: [x] Without Adjustment [ ] With Adjustment

Calibration Range: 20 °C to 40 °C

Function:

Table 1: This equipment was connected with wet bulb Temperature probe Model: -, S/N: -.  
Dimension: Diameter 4.77 mm. Length 70 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
65	20.070	20.4	0.3	0.099
65	25.060	25.3	0.2	0.099
65	30.051	30.2	0.1	0.099
65	35.035	35.0	0.0	0.099
65	40.024	39.8	-0.2	0.13

Table 2: This equipment was connected with Globe Temperature probe Model: -, S/N: -.  
Dimension: Diameter 4.77 mm. Length 70 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
65	20.070	20.5	0.4	0.099
65	25.060	25.3	0.2	0.099
65	30.051	30.1	0.0	0.099
65	35.035	34.9	-0.1	0.099
65	40.024	39.7	-0.3	0.099

Table 3: This equipment was connected with Dry Bulb Temperature probe Model: -, S/N: -.  
Dimension: Diameter 4.77 mm. Length 70 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
65	20.070	20.3	0.2	0.099
65	25.060	25.3	0.2	0.099
65	30.051	30.2	0.1	0.099
65	35.035	35.2	0.2	0.099
65	40.024	40.1	0.1	0.099

UUC\*: Unit Under Calibration

Remark: The reported uncertainty of measurement is 0.13, based on standard uncertainty multiplied by a coverage factor k=2.07 providing a level of confidence of approximately 95%.

## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-023-68

MEASUREMENT ITEM : Heat Stress Monitor  
MANUFACTURER : TSI QUEST  
MODEL/TYPE : Ques Temp 34  
SERIAL NUMBER : TEU080013  
ID NUMBER : NO. 12  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : Eastern Thai consulting 1992 Co., Ltd.  
683 Moo 11, Sukhaphibarn 8 Rd,  
Nongkham, Sriracha, Chonburi 20230

RECEIVED DATE : 27 Dec 2024  
MEASUREMENT DATE : 10 Jan 2025  
ISSUE DATE : 14 Jan 2025

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature : 23.0 ± 3.0 °C  
Relative Humidity : 55.0 ± 15.0 %RH

NOTED: The certificate is valid only to the item calibrated on date and place of calibration.

### TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol  
☐ Miss Ruengrumpai Phoommit



Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

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



COPY

**Area Heat Stress Monitor**

**Model : QUESTEMP 34**

**Serial No. : TEU080011**

## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-021-68

### MEASUREMENT ITEM

: Heat Stress Monitor  
 : TSI QUEST  
 : Ques Temp 34  
 : SERIAL NUMBER  
 : TEU080011  
 : NO. 10  
 : Used item  
 : Eastern Thai Consulting 1992 Co., Ltd.  
 683 Mao 11, Sukhlabarn 8 Rd.  
 Nongkham, Sriracha, Chonburi 20230

### RECEIVED DATE

: 27 Dec 2024  
 : 09 Jan 2025  
 : 14 Jan 2025

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
 Temperature :  $23.0 \pm 3.0$  °C  
 Relative Humidity :  $55.0 \pm 15.0$  %RH

NOTED: The certificate is valid only to the item calibrated on date and place of calibration.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

: Mr. Sorawit Thachalad  
 : Miss Jittaporn Lertsomphol  
 : Miss Ruangrumbai Phoommit

### Approved signatory

Mr. Panyai Booncharuen  
 Calibration Department Manager



**COPY**

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY



NSC - TISI - TIS 17025  
 CALIBRATION 0367

Page 1 of 2 Pages

**Calibration procedure:**  
 The temperature calibration was done by in-house calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale was based on ITS 90

**Traceability:**  
 The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number T-0017-24, Certificate number: 63-0113-24

### Reference Used During Calibration:

1. Standard Temperature Probe  
 Model: SFS 100 A500, Serial No. 467862 01,  
 Due date: 26 Mar 2025  
 2. Digital Temperature Indicator  
 Model: DTI 1000-A-MK, Serial No. 0714C7,  
 00591 Due date: 21 Oct 2025

### Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM Evaluation of measurement data Guide to the expression of uncertainty in measurement



Continuation of Certificate of Calibration Number CDT-021-68

Result of Calibration: Without Adjustment With Adjustment

Calibration Range: 20 °C to 40 °C

Function:

Table 1: This equipment was connected with wet bulb Temperature probe Model: , S/N: ,  
 Dimension: Diameter 4.77 mm, Length 70 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
65	20.074	20.3	0.2	0.14
65	25.064	25.3	0.2	0.14
65	30.050	30.3	0.2	0.14
65	35.038	35.2	0.1	0.14
65	40.018	40.1	0.1	0.14

Table 2: This equipment was connected with Globe Temperature probe Model: , S/N: ,  
 Dimension: Diameter 4.77 mm, Length 70 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
65	20.074	20.4	0.3	0.0-9
65	25.064	25.3	0.2	0.0-9
65	30.050	30.3	0.2	0.0-9
65	35.038	35.2	0.2	0.0-9
65	40.018	40.1	0.1	0.0-9

Table 3: This equipment was connected with Dry Bulb Temperature probe Model: , S/N: ,  
 Dimension: Diameter 4.77 mm, Length 70 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
65	20.074	20.2	0.1	0.11
65	25.064	25.1	0.0	0.0-9
65	30.051	30.1	0.0	0.0-9
65	35.038	35.1	0.1	0.0-9
65	40.018	40.0	0.0	0.0-9

UUC: Unit Under Calibration

Remark: The reported uncertainty of measurement is 0.14, based on standard uncertainty multiplied by a coverage factor  $k=2$ , L4 providing a level of confidence of approximately 95%.

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



**COPY**

**Area Heat Stress Monitor**

**Model : HD32.2**

**Serial No. : 22004320**

## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-044-68

**MEASUREMENT ITEM**  
MANUFACTURER : Heat Stress Monitor  
MODEL/TYPE : Delta OHM  
SERIAL NUMBER : HD32.2  
ID NUMBER : 22004320  
CONDITION AS-RECEIVED : NO. 18  
CUSTOMER : Used item  
: Eastern thai consulting 1992 Co., Ltd.  
683 Moo 11, Sukhapharn 8 Rd,  
Nongkham, Sriracha, Chonburi 20230

**RECEIVED DATE**  
**MEASUREMENT DATE**  
**ISSUE DATE**  
: 23 Jan 2025  
: 30 Jan 2025  
: 30 Jan 2025

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature : 23.0 ± 3.0 °C  
Relative Humidity : 55.0 ± 15.0 %RH

**NOTED:** The certificate is valid only to the item calibrated on date and place of calibration.

### TABULATION OF RESULTS:

The table on next page give the measured values.

**Calibration procedure:**  
The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

**Traceability:**  
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology (NIMT) Certificate number: TT-0047-24, Certificate number: ER-0113-24

### Reference Used During Calibration:

1. Standard Temperature Probe  
Model: STS-100 A500, Serial No.: 667682-05  
Due date: 26 Mar 2025
2. Digital Temperature Indicator  
Model: DT-1000-A MK II, Serial No.: 671407-00591 Due date: 21 Oct 2025

### Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM "Evaluation of measurement data - Guide to the expression of uncertainty in measurement"

Calibrated by:

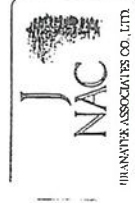
- ☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol  
☐ Miss Ruangrumpai Phaommit

Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager



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



Continuation of Certificate of Calibration Number CDT-044-68

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

### Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2, S/N: 2201.0220.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.063	20.1	0.0	0.099
80	25.062	25.1	0.0	0.099
80	30.052	30.1	0.0	0.099
80	35.043	35.1	0.1	0.099
80	40.025	40.1	0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2, S/N: 2201.4931.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.063	20.1	0.0	0.099
110	25.062	25.1	0.0	0.099
110	30.052	30.1	0.0	0.099
110	35.043	35.1	0.1	0.099
110	40.025	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 2201.5196.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.063	20.2	0.1	0.099
75	25.062	25.2	0.1	0.099
75	30.052	30.1	0.0	0.099
75	35.043	35.1	0.1	0.099
75	40.025	40.1	0.1	0.099

UUC\*: Unit Under Calibration

**COPY**

**Area Heat Stress Monitor**

**Model : HD32.2**

**Serial No. : 22004319**



## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-043-68

MEASUREMENT ITEM : Heat Stress Monitor  
MANUFACTURER : Delta OHM  
MODEL/TYPE : HD32.2  
SERIAL NUMBER : 22004319  
ID NUMBER : NO. 17  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : Eastern Thailand Consulting 1992 Co., Ltd.  
683 Moo 11, Sukhaphiban 8 Rd,  
Nongkham, Sriracha, Chonburi 20230

RECEIVED DATE : 23 Jan 2025  
MEASUREMENT DATE : 30 Jan 2025  
ISSUE DATE : 30 Jan 2025

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature : 23.0 ± 3.0 °C  
Relative Humidity : 55.0 ± 15.0 %RH

NOTED: The certificate is valid only to the item calibrated on date and place of calibration.

### TABULATION OF RESULTS:

The table on next page give the measured values.



Calibrated by:  
☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol  
☐ Miss Ruangumpal Phoommit

Approved signatory:

*Parinya Booncharoen*

Mr. Parinya Booncharoen  
Calibration Department Manager



NSC-TISI-TIS 17025  
CALIBRATION 0367

Page 1 of 2 Pages

Calibration procedure:  
The temperature calibration method was done by In-House calibration method as WHCL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability:  
The measurement results are traceable to the International system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0047-24, Certificate number: ER-0113-24

### Reference Used During Calibration:

1. Standard Temperature Probe  
Model: STS-100 A3500, Serial No.: 667682-09,  
Due date: 26 Mar 2025  
2. Digital Temperature Indicator  
Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 21 Oct 2025

Uncertainty of Measurement:  
The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM Evaluation of measurement data - Guide to the expression of uncertainty in measurement'



Continuation of Certificate of Calibration Number CDT-043-68

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

### Functions:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2, S/N: 22010215.  
Dimension: Diameter 3.3 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.063	20.0	-0.1	0.099
80	25.062	25.0	-0.1	0.099
80	30.052	30.0	-0.1	0.099
80	35.042	35.0	0.0	0.099
80	40.024	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2, S/N: 22014940.  
Dimension: Diameter 3.3 mm, Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.063	20.1	0.0	0.099
110	25.062	25.1	0.0	0.099
110	30.052	30.1	0.0	0.099
110	35.042	35.1	0.1	0.099
110	40.024	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 22003554.  
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.063	20.3	0.2	0.099
75	25.062	25.0	-0.1	0.099
75	30.052	29.9	-0.2	0.099
75	35.042	34.8	-0.2	0.099
75	40.024	39.7	-0.3	0.099

UUC\*: Unit Under Calibration

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



**Area Heat Stress Monitor**

**Model : HD32.2**

**Serial No. : 22004318**

## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-042-68

### MEASUREMENT ITEM

: Heat Stress Monitor  
: Delta OHM  
: HD32.2  
: 22004318  
: NO. 16  
: Used item  
: Eastern Thai Consulting 1992 Co., Ltd.  
683 Moo 11, Sukhaphiban 8 Rd,  
Nongkham, Sriacha, Chonburi 20230

### RECEIVED DATE

: 23 Jan 2025  
MEASUREMENT DATE : 29 Jan 2025  
ISSUE DATE : 30 Jan 2025

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature :  $23.0 \pm 3.0$  °C  
Relative Humidity :  $55.0 \pm 15.0$  %RH

NOTED: The certificate is valid only to the item calibrated on date and place of calibration.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol  
☐ Miss Ruangrumbal Phoommit



### Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager



JIRANANTHE ASSOCIATES CO., LTD.

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

Continuation of Certificate of Calibration Number CDT-042-68

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

### Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2, S/N: 22010218.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.073	20.1	0.0	0.099
80	25.064	25.1	0.0	0.099
80	30.055	30.1	0.0	0.099
80	35.046	35.1	0.1	0.099
80	40.036	40.1	0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2, S/N: 22014929.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.074	20.1	0.0	0.099
110	25.064	25.1	0.0	0.099
110	30.055	30.1	0.0	0.099
110	35.046	35.1	0.1	0.099
110	40.036	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 22015205.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.073	20.2	0.1	0.099
75	25.064	25.1	0.0	0.099
75	30.054	30.1	0.0	0.099
75	35.046	35.0	0.0	0.099
75	40.036	39.9	-0.1	0.099

UUC\*: Unit Under Calibration

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



**COPY**



## **BAROMETER**

**Equipment : Analog Barometer**

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



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



## CALIBRATION CERTIFICATE

Certificate No. : L202405022-0013  
Date Issued : 08-May-24

**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** : 03-May-24  
**Date Calibrated** : 06-May-24  
**Calibrated by** : Mr. Saruth Srihuikul

Calibration Method or Calibration Procedure Used

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

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

### Result of Calibration

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

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

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Certificate No : L202405022-0013

Environment  
Ambient Temperature : (25 ± 2)°C  
Relative Humidity : (50 ± 15)%RH

STD Reading	UUC Reading (mbar)	UUC Reading (mbar)	UUC Error	Uncertainty	MPE	Pass / Fail
mbar	Before Adjusted	After Adjusted	mbar	± mbar	± mbar	with Guard Band
990.00	990	-	0.00	0.59	10.3	Pass
1000.00	1000	-	0.00	0.59	10.3	Pass
1010.00	1010	-	0.00	0.59	10.3	Pass
1020.00	1020	-	0.00	0.59	10.3	Pass
1030.00	1030	-	0.00	0.59	10.3	Pass

STD = Standard  
UUC = Unit Under Calibration  
MPE = Maximum Permissible Error  
Calibrated condition :  
Pressure Medium  
Mounting Position  
Reference Level  
Conversion Factor

Pass =  $|\text{error}| + |\text{uncertainty}| \leq |\text{MPE}|$   
Fail =  $|\text{error}| + |\text{uncertainty}| > |\text{MPE}|$

Air : Density = 1.19 kg/m<sup>3</sup> @ 20°C, 1 bar  
Vertical  
at center of its dial  
Multiply by 1.0 E+02 - Pa unit

Description of UUC :  
Range  
Calibration Range  
Scale Interval

950 - 1080 mbar Absolute  
990 - 1030 mbar Absolute  
1 mbar

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-P230097 for Reference Pressure Monitor Serial No. 1598, Due 09-Nov-24  
End of Certificate

Page 2 of 2

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**CERTIFICATE OF ANALYSIS**

**EPA PROTOCOL GAS**

**Cylinder No. : EB0145030**



## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E03NI99E15AC014  
Cylinder Number: EB0145030  
Laboratory: 124 - Plumsteadville - PA  
PGVP Number: A12021  
Gas Code: CH4,PPN,BALN

Reference Number: 160-40224242-1  
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 800R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical uncertainty. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a 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			
Assay Dates				
				10/15/2021
				10/15/2021

CALIBRATION STANDARDS			
Type	Lot ID	Cylinder No	Concentration
NTRM	08011503	K002564	246.7 PPM METHANE/AIR
NTRM	200602-06	6162660Y	243.3 PPM PROPANE/AIR
Uncertainty			
			+/- 0.6%
			+/- 0.5%
Expiration Date			
			May 15, 2025
			Mar 17, 2027

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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*Mahmud A. Nader*

Approved for Release

**CERTIFICATE OF ANALYSIS**

**EPA PROTOCOL GAS**

**Cylinder No. : EB0062815**

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E04NI99E15ACX9C  
Cylinder Number: EB0062815  
Laboratory: 124 - Riverton (SAP) - NJ  
PGVP Number: B52018  
Gas Code: CO,NO,NOX,SO2,BALN

Reference Number: 82-401135335-1  
Cylinder Volume: 144.4 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 660  
Certification Date: Mar 13, 2018  
Expiration Date: Mar 13, 2026

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

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

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Assay Dates
NOX	50.00 PPM	50.55 PPM	G1	03/06/2018, 03/13/2018
NITRIC OXIDE	50.00 PPM	50.50 PPM	G1	+/- 1.4% NIST Traceable
SULFUR DIOXIDE	50.00 PPM	51.01 PPM	G1	+/- 1.4% NIST Traceable
CARBON MONOXIDE	2000 PPM	1977 PPM	G1	+/- 1.0% NIST Traceable
NITROGEN	Balance			+/- 1.0% NIST Traceable
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	16060607	CC442564	50.42 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%
PRM	12367	APEX1099237	9.82 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%
GMS	0315201604	CC503358	4.975 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%
NTRM	16011025	CC473218	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%
NTRM	12060735	CC356192	2486 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%
The SRM, PRM or RGM noted above is only in reference to the GMS used in the assay and not part of the analysis.				
ANALYTICAL EQUIPMENT				
Instrument/Make/Model	Analytical Principle		Last Multipoint Calibration	
Nicolet 6700 APW1100391 CO	FTIR		Feb 08, 2018	
Nicolet 6700 APW1100391 NO	FTIR		Feb 15, 2018	
Nicolet 6700 APW1100391 NO2	FTIR		Feb 16, 2018	
Nicolet 6700 APW1100391 SO2	FTIR		Mar 01, 2018	

#### Triad Data Available Upon Request

NOTES: NET WEIGHT: 10.43lbs  
GROSS WEIGHT: 60.93lbs  
PO# 5218000763

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



TESTING CERT No. 3082.05

*Don Moran*  
Approved for Release

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

**Serial No. : 1110070**



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SALE AND SERVICE GROUP COMPANY LIMITED

## Certificate Of Calibration

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

### Meter Console Information

Console Model : XC-572-V  
Console serial : 1110070  
DGM Model #: SK25EX  
DGM Serial #: 00006432

### Calibration Condition

Cal. Date : 28-Jun-24  
Due Date : 28-Jun-25  
Cal. Report No. : WDS-SV6706007  
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-5B WTM Cal. Due Date: Dec. 2024  
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	239.7603	239.9212	27	27	63.63889	63.79843	27	27
10.00	25.0	239.9406	240.0979	27	27	63.81777	63.97353	27	27
8.00	50.0	240.1147	240.2952	27	28	63.99028	64.16968	26	26
7.00	80.0	240.3308	240.5352	28	28	64.20536	64.40956	26	26
5.00	120.0	240.5641	240.7422	29	29	64.43852	64.61730	26	26

### 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>m(std)</sub> (m <sup>3</sup> )	Q <sub>m(std)</sub> m <sup>3</sup> /min	V <sub>r(std)</sub> (m <sup>3</sup> )	Q <sub>r(std)</sub> m <sup>3</sup> /min	(Y)	(ΔY)	Q <sub>m(std/corr)</sub>	ΔH <sub>g</sub>	ΔΔH <sub>g</sub>	
0.157	0.010	0.155	0.010	0.991	-0.003	0.010	53.303	6.250	
0.154	0.015	0.152	0.015	0.989	-0.005	0.015	47.860	0.807	
0.176	0.022	0.175	0.022	0.993	-0.001	0.022	46.233	-0.820	
0.200	0.029	0.199	0.028	0.997	0.003	0.028	43.895	-3.158	
0.174	0.035	0.175	0.035	1.001	0.007	0.035	43.973	-3.080	

0.994 = Y Avg.

47.053 = 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>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

Approved By:

*Palpasu Chaisana*  
(Palpasu Chaisana)  
Service Manager

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WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Date: 28-Jun-24

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## Certificate of Calibration - Supplemental

METHOD 5 PRE-TEST CONSOLE CALIBRATION

### Nomenclature

P<sub>b</sub> - Barometric Pressure  
DGM - Dry Gas Meter  
K<sub>1</sub> - Constant based on standard temp and press  
Θ - Run time, in minutes  
P<sub>m</sub> - ΔH (Meter Pressure, gauge)  
V<sub>m</sub> - Volume collected by test meter, corrected for STP  
Q<sub>m(std)</sub> - Calculated flow rate of test meter  
K' - Critical orifice coefficient  
P<sub>w</sub> - Measured pressure of reference meter  
t<sub>w</sub> - Temperature measured in reference meter  
t<sub>m</sub> - Temperature measured in test meter  
Y - Ratio of volume collected from test meter and orifice  
sc - Scaling Factor  
Counts<sub>std</sub> - Number of pulse counts, standardized  
Counts<sub>total</sub> - Number of raw pulse counts of a calibration run

### Equations

$$V_{w(std)} = Y * K_1 \frac{V_w * (P_{bar} + \frac{P_{m(std)}}{13.6})}{T_w}$$

$$V_{m(std)} = Counts_{std} * Y_{sc(avg)}$$

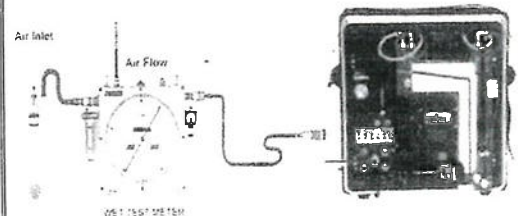
$$Counts_{std} = K_1 \frac{Counts_{total} * (P_{bar} + \frac{P_{m(std)}}{13.6})}{T_m}$$

$$Q_{w(std)} = \frac{V_{w(std)}}{\Theta} \quad Y_{sc} = \frac{V_{w(std)}}{Counts_{std}}$$

$$K_1 = \frac{T_{std}}{P_{std}} \quad Y = \frac{V_{w(std)}}{V_{m(std)}}$$

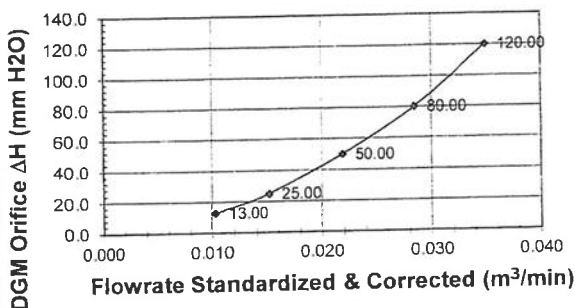
$$Metric \Delta H_g = \frac{P_{m(std)} - 0.0011609 * P_{bar} * \frac{1}{13.6}}{T_w * \Theta} \left( \frac{T_w * \Theta}{V_w * P_w} \right)^{-1}$$

### Calibration Train



### Calibration Graphs

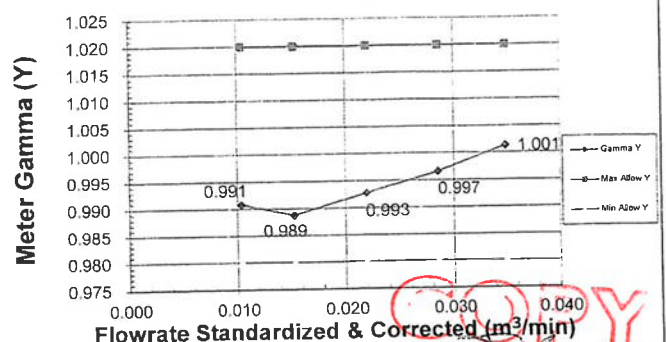
#### Meter Pressure vs Flowrate



Console Serial: 1110070

Console Model: XC-572-V

#### Meter Gamma vs Flowrate



Console Serial: 1110070

Console Model: XC-572-V

**Meter Console Information**

Console Model	XC-572-V
Console serial	1110070
Temp Indicator Model	ID-85
Temp Indicator Serial	

**Calibration Conditions**

Cal Date	28-Jun-24
Due Date	28-Jun-25
Cal Report No	WDS-SV0705007
Ambient Temp (°C)	25
Pressure (mm Hg)	758
Humidity (%)	60

**Reference Equipment**

Temp Meter Model	Fluke 714B
Serial No	60590035
Cal Date	07-Apr-24
Temp Meter Model	Fluke 179
Serial No	58620112
Cal Date	08-Feb-24

**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	39.0	-1.0
3	93.0	94.0	-1.0
4	149.0	150.0	-1.0
5	260.0	261.0	-1.0
6	371.0	372.0	-1.0
7	482.0	483.0	-1.0
8	593.0	593.0	0.0
9	816.0	815.0	1.0
10	1038.0	1038.0	0.0
Maximum			1.0

**Note**

\* For valid test results, the maximum difference between temperature readings should  $\leq 1.0^{\circ}\text{C}$  (EPA Method 5, Section 6.1.1.6).  
Perform all TC Channel calibrations Except meter (DGM) channel

PASS

**DGM Out Temperature Sensor Calibration**

Temperature point #	Ref Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
Ice	1.0	2.0	-1.0
Ambient	24.2	25.0	-0.8
Heat	110.5	111.0	-0.5
Difference Range			
Temp Difference	$\pm 2^{\circ}\text{F}$ or $\pm 1.1^{\circ}\text{C}$		PASS

**Note**

The temperatures of the thermocouple and reference thermometers shall agree to within  $\pm 2^{\circ}\text{F}$  (EPA Method 5, section 10.5)

Approved By :

*Patpasu Chaisana*  
( Patpasu Chaisana )  
Service Manager

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**DRY GAS METER MC-572-V**

**Serial No. : 1007055**



## Certificate Of Calibration

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

### Meter Console Information

Console Model : MC-572-V  
Console serial : 1007055  
DGM Model #: SK25EX  
DGM Serial #: 0009799

### Calibration Condition

Cal. Date: 04-Aug-24  
Due Date: 04-Aug-25  
Cal. Report No.: WDS-SV6707001  
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-5B WTM Cal. Due Date: Dec. 2024  
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	
		Initial	Final	Initial	Final	Initial	Final
a	P <sub>initial</sub>	V <sub>initial</sub>	V <sub>final</sub>	T <sub>initial</sub>	T <sub>final</sub>	V <sub>initial</sub>	V <sub>final</sub>
15.00	13.0	107.7550	107.9221	29	30	68.41024	68.57350
10.00	25.0	107.9308	108.0876	30	30	68.58202	68.73488
8.00	50.0	108.1027	108.2822	30	30	68.74958	68.92516
7.00	80.0	108.3029	108.5061	30	30	68.94550	69.14488
5.00	120.0	108.5139	108.6908	30	30	69.15251	69.32550

### 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>measured</sub> (m <sup>3</sup> )	Q <sub>measured</sub> m <sup>3</sup> /min	V <sub>corrected</sub> (m <sup>3</sup> )	Q <sub>corrected</sub> m <sup>3</sup> /min	(Y)	(ΔY)	Q <sub>measured/corr</sub>	ΔH <sub>sp</sub>	ΔH <sub>sc</sub>	
0.162	0.011	0.159	0.011	0.982	0.000	0.011	50.751	2.535	
0.152	0.015	0.149	0.015	0.982	0.001	0.015	49.300	1.084	
0.174	0.022	0.171	0.021	0.983	0.002	0.021	48.061	-0.155	
0.197	0.028	0.194	0.028	0.983	0.002	0.028	45.922	-2.293	
0.173	0.035	0.169	0.034	0.976	-0.005	0.034	47.046	-1.170	

0.981 = Y Avg

49.216 = 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>sp</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

Approved By:

*Patpasu Chaisana*

(Patpasu Chaisana)  
Service Manager

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WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Date: 04-Aug-24

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## Certificate of Calibration - Supplemental

METHOD 5 PRE-TEST CONSOLE CALIBRATION

### Nomenclature

P<sub>s</sub> - Barometric Pressure  
DGM - Dry Gas Meter  
K<sub>1</sub> - Constant based on standard temp and press  
O - Run time, in minutes  
P<sub>m</sub> - ΔH (Meter Pressure, gauge)  
V<sub>m</sub> - Volume collected by test meter, corrected for STP  
Q<sub>m(stp)</sub> - Calculated flow rate of test meter  
K' - Critical orifice coefficient  
P<sub>w</sub> - Measured pressure of reference meter  
T<sub>w</sub> - Temperature measured in reference meter  
T<sub>m</sub> - Temperature measured in test meter  
Y - Ratio of volume collected from test meter and orifice  
sc - Scaling Factor  
Counts<sub>std</sub> - Number of pulse counts, standardized  
C<sub>total</sub> - Number of raw pulse counts of a calibration run

### Equations

$$V_{m(std)} = Y * K_1 \frac{V_w * (P_{bar} + \frac{P_w}{1.315})}{T_w}$$

$$V_{m(std)} = Counts_{std} * Y_{sc(avg)}$$

$$Counts_{std} = K_1 \frac{C_{total} * (P_{bar} - \frac{P_w}{1.315})}{T_w}$$

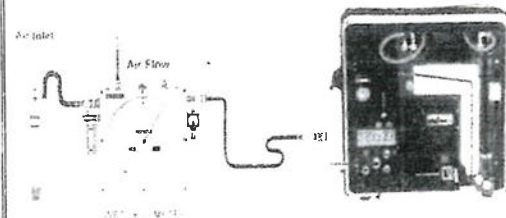
$$Q_{m(std)} = \frac{V_{m(std)}}{O}$$

$$Y_{sc} = \frac{V_{m(std)}}{Counts_{std}}$$

$$K_1 = \frac{T_{std}}{P_{std}}$$

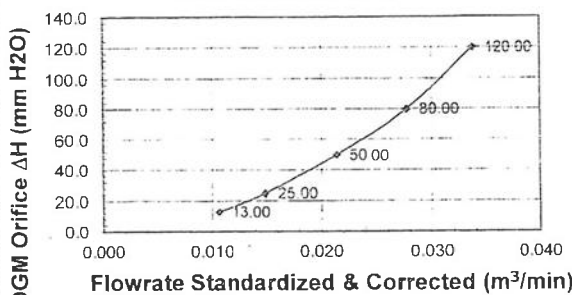
$$Metric \Delta H = \frac{P_w}{1.315} * \left( \frac{1.315}{P_w} \right)$$

### Calibration Train



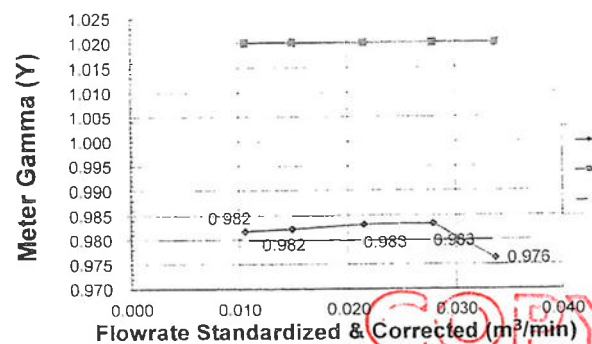
### Calibration Graphs

#### Meter Pressure vs Flowrate



Console Serial: 1007055 Console Model: MC-

#### Meter Gamma vs Flowrate



Console Serial: 1007055 Console Model: MC-572-V



WISDOM SCIENCE

TEMPERATURE DISPLAY CALIBRATION

Meter Console Information

Console Model MC-572-V  
Console serial 1007055  
Temp Indicator Model 765-KF  
Temp Indicator Serial JC17852

Calibration Conditions

Cal Date 04-Aug-24  
Due Date 04-Aug-25  
Cal Report No WDS-SV6707001  
Ambient Temp (°C) 25  
Pressure (mm Hg) 758  
Humidity (%) 60

Reference Equipment

Temp Meter Model Fluke 714B  
Serial No 60590035  
Cal Date 07-Apr-24  
Temp Meter Model Fluke 179  
Serial No 5820112  
Cal Date 06-Feb-24

Temperature Sensor Calibration

Reference Point #	Ref Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
1	-18.0	-18.0	0.0
2	38.0	38.0	0.0
3	93.0	94.0	-1.0
4	149.0	149.0	0.0
5	260.0	261.0	-1.0
6	371.0	372.0	-1.0
7	482.0	482.0	0.0
8	593.0	593.0	0.0
9	816.0	816.0	0.0
10	1038.0	1038.0	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 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
Ice	0.0	0.0	0.0
Ambient	26.9	27.0	-0.1
Heat	114.5	115.0	-0.5

Difference Range

Temp Difference  $\pm 2^{\circ}\text{F}$  or  $\pm 1^{\circ}\text{C}$

PASS

Note

The temperatures of the thermocouple and reference thermometers shall agree to within  $\pm 2^{\circ}\text{F}$  (EPA Method 5, section 10.5)

Approved By :

*Parth*

( Paipasu Chaisana )

Service Manager

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WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

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

**Serial No. : A2007510**



WISDOM SCIENCE

## Certificate Of Calibration

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

## Meter Console Information

Console Model : XC-572-V  
 Console Serial : A2007510  
 DGM Model #: SK25EX  
 DGM Serial #: 00005115

## Calibration Condition

Cal. Date: 30-Aug-24  
 Due Date: 30-Aug-25  
 Cal. Report No.: WDS-SV6708010  
 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-5B WTM Cal. Due Date: Dec. 2024  
 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	814.2810	814.4438	26	26	77.39845	77.56182	28	27
10.00	25.0	814.4657	814.6233	26	27	77.58371	77.74136	27	27
8.00	50.0	814.6427	814.8218	27	27	77.76069	77.93943	27	27
7.00	80.0	815.2310	815.4323	28	28	78.34575	78.54534	29	28
5.00	120.0	815.4512	815.6222	28	28	78.59461	78.73859	28	28

Standardized Data				Calibration Results				
Test Meter		Reference Meter		Correction Factor		Flow Rate		
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	0.0212 SCMM	Variation
V <sub>m(std)</sub> (m <sup>3</sup> )	Q <sub>m(std)</sub> m <sup>3</sup> /min	V <sub>r(std)</sub> (m <sup>3</sup> )	Q <sub>r(std)</sub> m <sup>3</sup> /min	(Y)	(ΔY)	Q <sub>m(std)corr</sub>	ΔH <sub>g</sub>	ΔΔH <sub>g</sub>
0.159	0.011	0.159	0.011	0.997	0.002	0.011	51.276	3.517
0.154	0.015	0.154	0.015	0.996	0.002	0.015	46.891	-0.868
0.175	0.022	0.174	0.022	0.994	-0.001	0.022	46.793	-0.966
0.197	0.028	0.193	0.028	0.982	-0.013	0.028	46.623	-1.136
0.168	0.034	0.169	0.034	1.005	0.010	0.034	47.211	-0.547
				0.995	= Y Avg		47.759	= ΔH <sub>g</sub> 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>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 ±0.2 inches (5.1mm) H<sub>2</sub>O

Approved By:   
 (Palpasu Chaisana)  
 Service Manager

Date: 30-Aug-24

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## Certificate of Calibration - Supplemental

METHOD 5 PRE-TEST CONSOLE CALIBRATION

## Nomenclature

P<sub>b</sub> - Barometric Pressure  
 DGM - Dry Gas Meter  
 K<sub>1</sub> - Constant based on standard temp and press  
 θ - Run time, in minutes  
 P<sub>m</sub> - ΔH (Meter Pressure, gauge)  
 V<sub>m</sub> - Volume collected by test meter, corrected for STP  
 Q<sub>m(std)</sub> - Calculated flow rate of test meter  
 K' - Critical orifice coefficient  
 P<sub>w</sub> - Measured pressure of reference meter  
 T<sub>m</sub> - Temperature measured in reference meter  
 T<sub>r</sub> - Temperature measured in test meter  
 Y - Ratio of volume collected from test meter and orifice  
 sc - Scaling Factor  
 Counts<sub>std</sub> - Number of pulse counts, standardized  
 C<sub>total</sub> - Number of raw pulse counts of a calibration run

## Equations

$$V_{w(std)} = Y * K_1 \frac{V_w * (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_w}$$

$$V_{m(std)} = Counts_{std} * Y_{sc(avg)}$$

$$Counts_{std} = K_1 \frac{C_{total} * (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_m}$$

$$Q_{w(std)} = \frac{V_{w(std)}}{\theta}$$

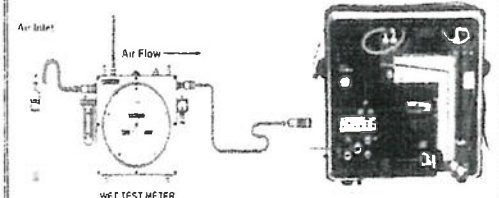
$$Y_{sc} = \frac{V_{w(std)}}{Counts_{std}}$$

$$K_1 = \frac{T_{std}}{P_{std}}$$

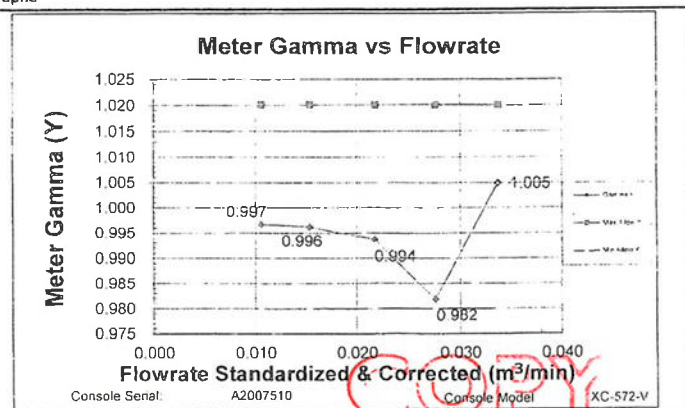
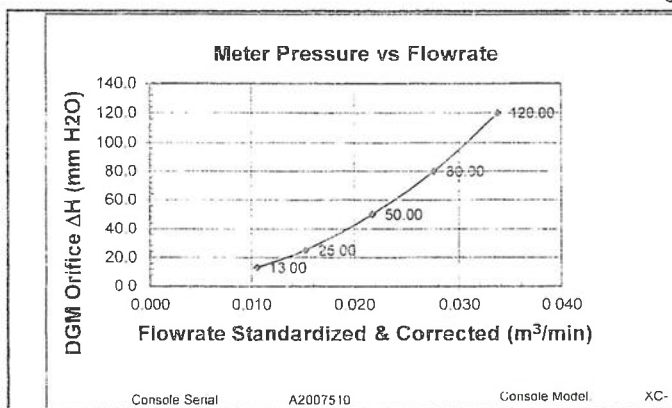
$$Y = \frac{V_{r(std)}}{V_{w(std)}}$$

$$Metric \Delta H_g = \frac{P_{bar} * 101325 * (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_{sc}} * \left( \frac{T_{sc} * \theta}{V_w * P_{bar}} \right)^2$$

## Calibration Train



## Calibration Graphs







## TEMPERATURE DISPLAY CALIBRATION

### Meter Console Information

Console Model	XC-572-V
Console serial	A2007510
Temp Indicator Model	785-KF
Temp Indicator Serial	JC17819

### Calibration Conditions

Cal Date	30-Aug-24
Due Date	30-Aug-25
Cal Report No.	WDS-SV708010
Ambient Temp (°C)	25
Pressure (mm Hg)	758
Humidity (%)	60

### Reference Equipment

Temp Meter Model	Fuke 714B
Serial No	60590035
Cal Date	07-Apr-24
Temp Meter Model	Fuke 179
Serial No	58620112
Cal Date	05-Feb-24

### Temperature Sensor Calibration

Reference Point #	Ref Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
1	-18.0	-18.0	0.0
2	38.0	38.0	0.0
3	93.0	93.0	0.0
4	149.0	149.0	0.0
5	260.0	260.0	0.0
6	371.0	372.0	-1.0
7	482.0	482.0	0.0
8	593.0	593.0	0.0
9	816.0	817.0	-1.0
10	1038.0	1039.0	-1.0
Maximum			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 all TC Channel calibrations. Except meter (DGM) channel

PASS

### DGM Out Temperature Sensor Calibration

Temperature Point #	Ref Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
Ice	0.0	0.0	0.0
Ambient	27.6	28.0	-0.4
Heat	116.3	116.0	0.3

### Difference Range

Temp. Difference  $\pm 2^{\circ}\text{F}$  or  $\pm 1.1^{\circ}\text{C}$

PASS

### Note

The temperatures of the thermocouple and reference thermometers shall agree to within  $\pm 2^{\circ}\text{F}$  (EPA Method 5, section 10.5)

Approved By :

( Patpasu Chaisana )

Service Manager

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**Flue gas Analyzer**

**Testo 350 New**

**Serial No. 63455616/0722**

**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 :**  
**Customer name :** Eastern Thai Consulting 1992 Company Limited  
**Customer address :** 683 Moo 11, Sukhapibarn 8 Road, Nongkham, Si Racha, Chon Buri 20280

**Total pages of certificate :** 3 Pages  
**Receiving no. :** L-243862  
**Receiving date. :** 03-Oct-24

**Parameter of calibration :** Gas Calibration (Oxygen 2.50, 10.04, 21.02 %Vol, Carbon Monoxide 80.18, 302, 1007 ppm, Nitrogen Dioxide 30.68, 81.8, 201.9 ppm, Nitric Oxide 30.0, 151.5, 322.5 ppm, Sulphur Dioxide 50.36, 100.8, 600.8 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 4B, Toongsonghong, Lakso, Bangkok 10210 THAILAND

**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 :** 09-Oct-24

*Kwanchai Khamdouring*  
Mr. Kwanchai Khamdouring  
Calibration Technician

*D. Wuttue*  
Mrs. Nongluck Wongsettee  
Technical Manager

## Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen ( O2 ) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen ( O2 ) 10.04 % Vol	CG-0153-21	Nimit	18-Nov-26
Oxygen ( O2 ) 21.02 % Vol	CG-0041-22	Nimit	10-Feb-27
Carbon monoxide ( CO ) 80.18 ppm	CG-0002-24	Linde	11-Jan-29
Carbon monoxide ( CO ) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide ( CO ) 1007 ppm	1870/24	Linde	17-Jun-26
Nitrogen Dioxide ( NO2 ) 30.68 ppm	2832/24	Linde	08-Sep-24
Nitrogen Dioxide ( NO2 ) 81.8 ppm	2330/24	Linde	01-Aug-26
Nitrogen Dioxide ( NO2 ) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide ( NO ) 30.0 ppm	CG-0065-24	Nimit	06-May-26
Nitric Oxide ( NO ) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide ( NO ) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide ( SO2 ) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide ( SO2 ) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide ( SO2 ) 600.8 ppm	2003/23	Linde	17-Jul-25

## Measured room conditions

Temperature : 22.9 °C Humidity : 66.4 %RH Pressure : 1011.5 mbar  
Calibration conditions  
Gas Temperature : 23 °C Flow rate : 1.300 ml/min Gas pressure : 1014.8 mbar

## Calibration Results (Before adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.50	2.43	-0.07	0.15
O2 (%Vol)	10.04	9.92	-0.12	0.20
O2 (%Vol)	21.02	21.11	0.09	0.30
CO (ppm)	80.18	74	-6.18	3.0
CO (ppm)	302	295	-7	6.0
CO (ppm)	1007	996	-11	12
NO2 (ppm)	30.68	32.2	1.52	8.0
NO2 (ppm)	81.8	81.5	-0.3	8.0
NO2 (ppm)	201.9	204.3	2.4	12
NO (ppm)	30.0	27	-3.0	8.0
NO (ppm)	151.5	146	-5.5	8.0
NO (ppm)	322.5	305	-17.5	12
SO2 (ppm)	50.36	48	-2.36	6.0
SO2 (ppm)	100.8	97	-3.8	6.0
SO2 (ppm)	600.8	591	-9.8	13



Calibration Results (After adjustment) (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty ( $\pm$ )
O2 (%Vol)	2.50	2.43	-0.70	0.15
O2 (%Vol)	10.04	9.92	-0.12	0.20
O2 (%Vol)	21.02	21.11	0.09	0.30
CO (ppm)	80.18	80	-0.18	3.0
CO (ppm)	302	303	1	6.0
CO (ppm)	1007	1008	1	12
NO2 (ppm)	30.68	32.2	1.52	8.0
NO2 (ppm)	81.8	81.5	-0.3	8.0
NO2 (ppm)	201.9	204.3	2.4	12
NO (ppm)	30.0	31	1.0	8.0
NO (ppm)	151.5	153	1.5	8.0
NO (ppm)	322.5	321	-1.5	12
SO2 (ppm)	50.36	51	0.64	6.0
SO2 (ppm)	100.8	102	1.2	6.0
SO2 (ppm)	600.8	604	3.2	13

**Remark:** 1 cmol/mol = 1 %vol, 1  $\mu$ mol/mol = 1 ppm.

## End of Report

ผู้  
เรียน ท่านผู้ใช้งานฝ่ายจัดซื้อทราบ

เนื่องจากเครื่องวัดวัดวิเคราะห์แก๊สที่ทางบริษัท เช็นเทค อินดัสทรีเอด โซลูชั่น จำกัด ได้จำหน่ายให้แก่ท่าอากาศยานได้ช่วย  
Sensor ที่รับส่งสัญญาณ Electrochemical หรือ วัดอุณหภูมิแก๊สได้นั้น Sensor ที่ติดตั้งในเครื่อง จึงสามารถ  
สื่อสารภาพ คณะอายุการใช้งานได้

บริษัท "ได้ตระหนักถึงความสำคัญ ในการใช้งานเครื่องมือของท่าน ซึ่งจำเป็นต้องใช้งานอย่างต่อเนื่องและต้องการความถูกต้องแม่นยำตลอดเวลา บริษัทฯ จึงได้จัดทำรายการห้ามรับตรวจสอบรายการใช้งานและระยะเวลา ที่จะเปลี่ยน Sensor ดังต่อไปนี้

## ใบรายงานอาการการใช้งานของ Gas Sensor

[illegible]

**Hot Air Oven**

**Model : UFE 500**

**Serial No. : G511.0182**



## CERTIFICATE OF CALIBRATION

Page 1 of 3

Certificate No. : 24-164691

Sample Code : 24-67405-001

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapibarn 8 Rd, Nongkham,  
Sirachha, 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 ID No. : LABE 17/4

Date of Receipt : 19 December 2024 Date of Calibration : 19 December 2024

## Condition of Calibration

1. Environment 1.1 Ambient temperature : Maximum 32.0 °C ; Minimum 31.0 °C  
1.2 Relative humidity : Maximum 48.5 % ; Minimum 43.5 %  
1.3 Line voltage supplied : Maximum 226.3 VAC ; Minimum 222.0 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-138 to RTD-146)	24-040191	07 April 2025

## 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. Nophanon Anusak

Approved by

(Mr. Somchai Neampunt)

Scientist

Signed for Director

Issue date

20 December 2024

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

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

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

361 Soi Ladprao 122, Ladprao Road,  
Phlabphla, Wang Thonglang, Bangkok 10310  
FM CL-114

TEL 02-516-2422  
FAX 02-516-6948  
Rev 01

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



## REPORT OF CALIBRATION

Page 2 of 3

Certificate No. : 24-164691

Sample Code : 24-67405-001

## Results of Calibration

Resolution : 0.5 °C

## 1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor k	
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8			# 9 <sup>ref</sup>
104	103.5	103.5	104.14	104.15	103.80	104.15	104.09	104.19	103.85	103.65	104.22	0.47	2.00

## 2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
104	0.07	0.63	0.69

## Notes

UUC\* = Unit Under Calibration

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NSC-TIS-71517025  
CALIBRATION 0152

Page 3 of 3

## REPORT OF CALIBRATION

Certificate No. : 24-164691

Sample Code : 24-67405-001

### 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 :  
 $W = 56 \text{ cm}$  ;  $D = 40 \text{ cm}$  ;  $H = 48 \text{ cm}$
3. Air valve or fresh air level : Off
4. Fan level : Open

5. The quoted uncertainty includes: Stability of chamber and loading effect in chamber at 20% of uniformity.

6. Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference

location which are observed at the same time.

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

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

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

10. Calibration results without adjustment.

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

- End of Report -

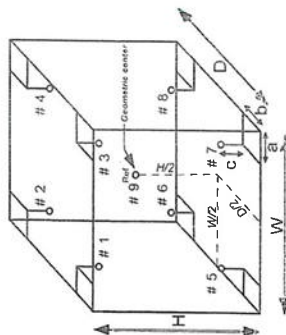


Figure: Example of sensor  
Installation Positions

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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  
513.467.9000  
877.283.7610 TOLL FREE  
513.467.9009 FAX

# ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

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

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

## DATA TABULATION

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

## CALCULATIONS

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

$$Qstd = Vstd / \text{Time}$$

$$Va = \text{Diff Vol} [(Pa - \text{Diff Hg}) / Pa]$$

$$Qa = Va / \text{Time}$$

For subsequent flow rate calculations:

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

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

**COPY**

**THERMO-HYGROMETER**

**Model : 608-H1**

**Serial No. : 45106737**





## CERTIFICATE OF CALIBRATION

Page 1 of 2

Certificate No. : 24-062442  
Sample Code : 24-25546-002

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapibarn 8 Rd., Nongkhnam,

Siracha, Chonburi 20230

Location 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 : 23 May 2024 Date of Calibration : 27-28 May 2024

## 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 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 401	LB-DP-03 & LB-DP-03 (DP)	TH-0064-23	07 August 2024
3.2 Digital Thermometer	Optidew 401	LB-DP-03 & LB-DP-03 (Temp.)	23-103423	03 September 2024
3.3 Digital Thermometer	34972A	LB-DA-07 with RTD-89	23-101374	05 September 2024

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 Lohabai

Approved by

(Mr. Somchai Neampunt)

Scientist

Signed for Director

Issue date 30 May 2024

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

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

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

361 Soi Ladprao 122, Ladprao Road,

Phlabphla, Wang Thonglang, Bangkok 10310

FM-CL-114

TEL 02-516-2422

FAX 02-516-6949

Rev 01

CONTACT @AMARC.CO.TH

WWW.AMARC.CO.TH

Effective Date 15/10/21



## REPORT OF CALIBRATION

Page 2 of 2

Certificate No. : 24-062442  
Sample Code : 24-25546-002

## 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	20.1	- 0.10	± 0.39
25	50	25.00	25.0	0.00	± 0.39
30	50	30.00	29.9	+ 0.10	± 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	25.02	45.10	48.4	- 3.30	± 1.3
60	25.01	60.07	63.4	- 3.33	± 1.5
75	25.01	75.15	78.5	- 3.35	± 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 GUM:2008.

- End of Report -

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**UV/VIS SPECTROPHOTOMETER**

**Model : UV-1800**

**Serial No. : A11635101643 CD**



**Bara Scientific Co., Ltd.**  
968 U Chu Liang Building Floor7 Rama4 Road  
Silom Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barascientific.com



# Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-146/24  
Equipment UV/Vis Spectrophotometer  
Model UV-1800  
Manufacturer Shimadzu  
Serial No. A11635101643 CD  
ID No. LABE 03/2  
Date of receipt 22 April 2024  
Date of calibration 22 April 2024  
Date of issue 29 April 2024  
Customer name Eastern Thai Consulting 1992 Co., Ltd.  
Address 683 Moo 11, Sukkaphibarn 8 Rd., Nongkham, Srirachha, Chonburi 20230

Temperature (22.9-24.1) °C (On site)  
Humidity (41.7-46.9) %RH (On site)  
Equipment condition Good Operation  
Calibration Location Analysis Department  
Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01  
Traceability Wavelength Accuracy is traceable to certificate No. 116614 and 116613  
Photometric Accuracy is traceable to certificate No. 116210 and 116224  
Stray Light is traceable to certificate No. 116616  
The above certificate are traceable to SI unit through Starna Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)  
Calibrated by Mr. Poomjai Korsawatvorakul

Approved by

**Mr. Sonthi Temboonsakdi**  
Service Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate  
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Silom Bangkok Bangkok Thailand 10500  
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www.barascientific.com



# Certificate of Calibration

Number of Page(s) 2 of 3

Certificate No. BSCC-UV-146/24

Calibration Results:

## 1. Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
287.71	287.75	0.04	0.18
445.82	445.89	0.07	0.18
536.52	536.50	-0.02	0.18
741.02	741.01	-0.01	0.18
879.41	879.33	-0.08	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
	0.7415	0.7387	-0.0028	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
	0.6406	0.6395	-0.0011	0.0075

\*CNR = Customer not request

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Silom Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barascientific.com



NSC-708-02 17025  
CALIBRATION

# Certificate of Calibration

Certificate No. BSCC-UV-146124 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 0.5715 0.7087 1.0987	0.0000 0.5729 0.7087 1.1005	0.0000 0.0014 0.0000 0.0018	0.0042 0.0042 0.0042 0.0042
440.0	0.0000 0.5561 0.6968 1.0757	0.0000 0.5578 0.6969 1.0774	0.0000 0.0017 0.0001 0.0017	0.0042 0.0042 0.0042 0.0042
465.0	CNR CNR CNR CNR	CNR CNR CNR CNR	CNR CNR CNR CNR	CNR CNR CNR CNR
546.1	0.0000 0.5193 0.6937 1.0411	0.0000 0.5213 0.6940 1.0428	0.0000 0.0020 0.0003 0.0017	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 0.5605 0.7579 1.1131	0.0000 0.5624 0.7583 1.1138	0.0000 0.0019 0.0004 0.0007	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)
201.33 $\pm$ 0.11nm	200.80	2.0111

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.30A

\*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.  
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced except in full, without written approval of the Bara Scientific Co., Ltd.

Bara Scientific Co., Ltd.

**SOUND LEVEL CALIBRATOR**

**MODEL : NC-75**

**SERIAL No. : 34802645**

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

451-451/1 Srinthorn Road, Bangburmu, Bangplud, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email : calibration@sithiporn.com



Cert. No. : ACC24043  
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-75  
Serial No.: 34802645  
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 : 09 SEPTEMBER 2024  
Calibration Date : 26 SEPTEMBER 2024  
Date of Issue : 26 SEPTEMBER 2024

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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SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

451-451/1 Srinthorn Road, Bangburmu, Bangplud, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email : calibration@sithiporn.com



Cert. No. : ACC24043  
Job No. : VC67AC0150  
Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

This equipment was calibrated by follow 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-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	33461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25
Audio Analyzer	AVR-3360A	V744B6069	EF-0009-24	09-FEB-25

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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Cert. No. : ACC24043  
Job No. : YC67AC0150  
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	93.97	-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 (%)
0.15	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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Signature: P. Petch



**SOUND LEVEL METER**

**MODEL : NL-52A**

**SERIAL No. : 01120950**

Cert No. : ACL25057  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RJON  
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25  
Serial No.: 01120950 / 22043 / 22339  
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 : 06 JANUARY 2025  
Calibration Date : 15 - 16 JANUARY 2025  
Date of Issue : 17 JANUARY 2025

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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Calibration Procedure : CP-AC-01

### Calibration Method :

This equipment was calibrated by follow 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-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EELBP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EELBP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EELBP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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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Cert. No. : ACL25057  
Job No. : VC68AC0048  
Pages : 3 of 8

Cert. No. : ACL25057  
Job No. : VC68AC0048  
Page : 4 of 8

Summary of Measurement Result :

Parameter	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	0.3	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

Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.94)	94.0	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
13.4

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

Frequency Weighting	Weighting ( dB )
A - weight	9.9
C - weight	16.4
Flat	21.9

## 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	0.4	0.4	0.4
1000	0.2	0.2	0.2
8000	0.5	0.5	0.5
			Acceptance Limits
			± 1.0
			± 0.7
			+ 1.5, - 2.5

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Job No. : VC68AC0048  
Pages : 5 of 8

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Job No. : VC68AC0048  
Pages : 6 of 8

#### 4. Electrical signal tests of frequency weightings

Weighing network response with relative to 1 kHz.

Frequency ( Hz )	Deviation from various frequency weighing response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±1.0
125	0.0	0.1	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.1	0.0	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	-1.2	+ 2.5, -16.0

#### 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	± 0.1

#### 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	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	53.9	-0.1	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	38.9	-0.1	±0.8
34.0	33.9	-0.1	±0.8
30.0	30.0	0.0	±0.8
29.0	28.9	-0.1	±0.8
28.0	28.0	0.0	±0.8
27.0	26.9	-0.1	±0.8
26.0	26.0	0.0	±0.8
25.0	25.0	0.0	±0.8

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Job No. : VC68AC0048

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)
130	94.0	94.0	0.0	±0.8

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.9	-0.1	±0.8

## 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	1.0 ; -3.0
	2	8	117.0	117.0	0.0	1.0 ; -1.5
	200	800	134.0	134.1	0.1	±0.5
Slow	2	8	108.0	108.0	0.0	1.0 ; -3.0
	200	800	127.6	127.6	0.0	±0.5
SEL	0.25	1	99.0	98.9	-0.1	1.0 ; -3.0
	2	8	108.0	108.0	0.0	1.0 ; -1.5
	200	800	128.0	128.0	0.0	±0.5

## 10. Peak C sound level

Cert. No. : ACL25057

Job No. : VC68AC0048

Pages : 8 of 8

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±2.0
One	133.4	133.3	-0.1	±2.0

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	±1.0
Positive half cycle	135.4	135.2	-0.2	±1.0
Negative half cycle	135.4	135.2	-0.2	±1.0

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.5
89.6	89.6		

## 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	±0.1

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

T. Petcha-

T. Petcha-

**SOUND LEVEL METER**

**MODEL : NL-52A**

**SERIAL No. : 01120952**



Cert. No. : ACL25058  
Pages : 1 of 8

Cert. No. : ACL25058  
Job No. : VC68AC0048  
Pages : 2 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25  
Serial No.: 01120952 / 22709 / 22427  
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 : 06 JANUARY 2025  
Calibration Date : 15 - 16 JANUARY 2025  
Date of Issue : 17 JANUARY 2025

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.

Calibration Procedure : CP-AC-01

### Calibration Method :

This equipment was calibrated by follow 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-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL.BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL.BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL.BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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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Cert. No. : ACL25058  
Job No. : VC68AC0048  
Pages : 3 of 8

Cert. No. : ACL25058  
Job No. : VC68AC0048  
Page : 4 of 8

**Summary of Measurement Result :**

Parameter	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	0.3	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

**Result of calibration :**

**1. Absolute sensitivity**

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.94)	94.0	0.0	±0.3

**2. Self-generated noise**

2.1 Normal test

Measured Value ( dB )
14.2

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

Frequency Weighting	Weighting ( dB )
A - weight	10.8
C - weight	15.8
Flat	21.4

**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	0.3	0.3	0.3
1000	0.3	0.3	0.3
8000	0.8	0.8	0.8
			Acceptance Limits
			± 1.0
			± 0.7
			+ 1.5, - 2.5

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Job No. : VC68AC0048  
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#### 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	0.0	0.0
125	0.0	0.0	-0.1
250	0.0	-0.1	-0.1
500	0.0	0.0	-0.1
1000	0.0	0.0	0.0
2000	0.0	0.0	0.0
4000	0.0	0.0	0.0
8000	0.0	0.0	0.1
16000	0.0	-1.2	-1.2

#### 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	$\pm 0.1$

#### 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	$\pm 0.8$
136.0	136.0	0.0	$\pm 0.8$
135.0	135.0	0.0	$\pm 0.8$
134.0	134.0	0.0	$\pm 0.8$
133.0	132.9	-0.1	$\pm 0.8$
132.0	131.9	-0.1	$\pm 0.8$
131.0	130.9	-0.1	$\pm 0.8$
129.0	129.0	0.0	$\pm 0.8$
124.0	124.0	0.0	$\pm 0.8$
119.0	119.0	0.0	$\pm 0.8$
114.0	114.0	0.0	$\pm 0.8$
109.0	109.0	0.0	$\pm 0.8$
104.0	104.0	0.0	$\pm 0.8$
99.0	99.0	0.0	$\pm 0.8$
94.0	94.0	0.0	$\pm 0.8$
89.0	89.0	0.0	$\pm 0.8$
84.0	84.0	0.0	$\pm 0.8$
79.0	79.0	0.0	$\pm 0.8$
74.0	74.0	0.0	$\pm 0.8$
69.0	69.0	0.0	$\pm 0.8$
64.0	64.0	0.0	$\pm 0.8$
59.0	59.0	0.0	$\pm 0.8$
54.0	54.0	0.0	$\pm 0.8$
49.0	49.0	0.0	$\pm 0.8$
44.0	44.0	0.0	$\pm 0.8$
39.0	39.0	0.0	$\pm 0.8$
34.0	34.0	0.0	$\pm 0.8$
30.0	30.0	0.0	$\pm 0.8$
29.0	29.0	0.0	$\pm 0.8$
28.0	28.0	0.0	$\pm 0.8$
27.0	27.0	0.0	$\pm 0.8$
26.0	26.0	0.0	$\pm 0.8$
25.0	25.0	0.0	$\pm 0.8$

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Job No. : VC68AC0048

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Cert. No. : ACL25058

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## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±0.8

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.9	-0.1	±0.8

## 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	1.0 ; -3.0
	2	8	117.0	117.0	0.0	1.0 ; -1.5
	200	800	134.0	134.0	0.0	±0.5
Slow	2	8	108.0	108.0	0.0	1.0 ; -3.0
	200	800	127.6	127.6	0.0	±0.5
SEL	0.25	1	99.0	98.9	-0.1	1.0 ; -3.0
	2	8	108.0	108.0	0.0	1.0 ; -1.5
	200	800	128.0	128.0	0.0	±0.5

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±2.0
One	133.4	133.4	0.0	±2.0

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	±1.0
Positive half cycle	135.4	135.2	-0.2	±1.0
Negative half cycle	135.4	135.2	-0.2	±1.0

## 11. Overload indication

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

## 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	±0.1

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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T. Retehn.

**SOUND LEVEL METER**

**MODEL : NL-42A**

**SERIAL No. : 00322753**

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00322753 / 196476 / 15485  
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 : 29 APRIL 2024  
Calibration Date : 13-17 MAY 2024  
Date of Issue : 20 MAY 2024

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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Cert. No. : ACL24140  
Pages : 1 of 8

Calibration Procedure : CP-AC-01

### Calibration Method :

This equipment was calibrated by follow 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-0009-4	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL.BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL.BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL.BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KA1	34560495	AA-3001-24	05-FEB-25

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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Summary of Measurement Result :

Parameter	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

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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	11.3
C - weight	17.6
Flat	23.3

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	0.0	0.1
1000	0.0	0.0	0.0
3000	1.5	1.6	1.6

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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	0.0	0.0	+0.1
125	0.0	0.0	0.0
250	0.0	0.0	0.0
500	0.0	0.1	0.0
1000	0.0	0.0	0.0
2000	0.0	0.1	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	89.0	0.0	$\pm 1.1$
84.0	84.0	0.0	$\pm 1.1$
79.0	79.0	0.0	$\pm 1.1$
74.0	74.0	0.0	$\pm 1.1$
69.0	69.0	0.0	$\pm 1.1$
64.0	64.0	0.0	$\pm 1.1$
59.0	59.0	0.0	$\pm 1.1$
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	27.1	0.1	$\pm 1.1$
26.0	26.1	0.1	$\pm 1.1$
25.0	25.0	0.0	$\pm 1.1$

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## 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	134.1	0.1	±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, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.7	-0.7	±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

## 11. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle		
89.5	89.6	0.1
		±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 %

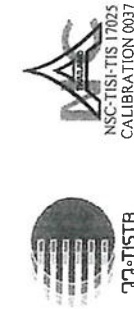
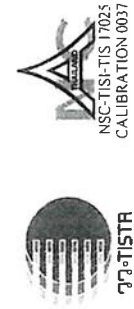
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**SOUND LEVEL METER**

**MODEL : NL-42A**

**SERIAL No. : 00222594**



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. EEL. BP. 10/0267

Request No. 21-67/0252

MTC No. EEL. BP. 10/0267

## 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	Temperature	: (23 ± 3) °C
Manufacturer	: Rion	Relative Humidity	: (50 ± 15) %
Model	: NL-42A	Ambient Pressure	: (101.325±1.5) kPa

### Ambient Environment

Serial No. : 00222594

Microphone : UC-52 No.195906

Preamplifier : NH-24 No.15426

### Standards used :

1. Band Pass Filter Wavetek 752A S/N 90010494.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 5 Feb. 2024

Date of Calibration : 1 Mar. 2024

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FM.BLMTC.002 Rev.

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Date of Calibration : 1 Mar. 2024

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Fax. (66) 0 2579 8592  
E-mail : sumalee@tistr.or.th

FM.BLMTC.002 Rev.

Request No. 21-67/0252

MTC No. EEL. BP. 10/0267

Request No. 21-67/0252

MTC No. EEL. BP. 10/0267

### 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				
113.92	114.1	113.9	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)
25.1	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	11.6	0.10	N/A
C-Weight	17.2	0.10	N/A
Flat	22.7	0.10	N/A

Date of Calibration : 1 Mar. 2024

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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	Flat			
125	0.3	0.4	0.4	1.5	0.45	0.6
1 000	-0.1	-0.1	-0.1	1.0	0.45	0.6
8 000	0.3	0.4	0.2	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	Flat			
63	0.0	0.0	0.0	2.0	0.20	0.6
125	0.0	0.1	0.0	1.5	0.20	0.6
250	0.0	0.1	0.0	1.5	0.20	0.6
500	0.0	0.1	0.0	1.5	0.20	0.6
1 000	0.0	0.0	0.0	1.0	0.20	0.6
2 000	-0.2	-0.1	-0.1	2.0	0.20	0.6
4 000	-0.3	-0.3	-0.3	3.0	0.20	0.6
8 000	0.0	0.0	-0.1	5.0	0.20	0.7

Date of Calibration : 1 Mar. 2024

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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	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 value (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 value (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 : 1 Mar. 2024

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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)
137	137.1	0.1	1.1	0.30	0.3
136	136.1	0.1	1.1	0.30	0.3
135	135.1	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	119.1	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	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	74.0	0.0	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

Date of Calibration : 1 Mar. 2024

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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)
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	43.9	-0.1	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	26.9	-0.1	1.1	0.30	0.3
26	25.9	-0.1	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)
30-130	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 1 Mar. 2024

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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)
30-130	35	35.0	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	126.0	0.0	±1.0	0.20	0.3
	2	108.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	99.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	119.5	-0.1	±1.0	0.20	0.3
	2	99.9	-0.1	+1.0; -5.0	0.20	0.3
SEL	200	120.0	0.0	±1.0	0.20	0.3
	2	100.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	90.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 1 Mar. 2024

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NSC-TISI-TIS 17025  
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. EEL. BP. 10/0267

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	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 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle	value (dB)	limit class 2 (±dB)	(±dB)	of measurement (±dB)
136.5	136.5	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	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by :

*Wittawat Supanich*

(Mr. Wittawat Supanich)

Approved by :

*Prasit Kluaypa*  
(Mr. Prasit Kluaypa)  
Director

Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 1 Mar. 2024

Date of Issue : 4 Mar. 2024

Ref : 2011267020500503002

End of Certificate

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FM.BLMTC.002 Rev.1



**SOUND LEVEL METER**

**MODEL : NL-42A**

**SERIAL No. : 00322756**

Cert. No. : ACL24142  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00322756 / 196480 / 15488  
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 : 29 APRIL 2024  
Calibration Date : 13-17 MAY 2024  
Date of Issue : 20 MAY 2024

Calibrated by : Nathakorn Pisutpaian

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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Cert. No. : ACL24142  
Job No. : VC67AC0083  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

### Calibration Method :

This equipment was calibrated by follow 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-0009-4	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KA1	34560495	AA-3001-24	05-FEB-25

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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Summary of Measurement Result :

Parameter	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

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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 )
13.9

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

Frequency Weighting	Measured value ( dB )
A - weight	12.5
C - weight	18.6
Flat	24.1

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	0.3	0.3
1000	-0.1	-0.1	-0.1
8000	0.1	0.1	0.2

Acceptance Limits

± 1.5

± 1.0

± 5.0

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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	0.0	-0.1
125	0.0	0.0	0.0
250	0.0	0.0	0.0
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	± 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	54.0	0.0	± 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	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

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 Job No. : VC67AC0083  
 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, T <sub>b</sub> (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	134.1	0.1	±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>oc</sub> peak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.3	-0.1	±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

Cert. No. : ACL24142  
 Job No. : VC67AC0083  
 Pages : 8 of 8

#### 11. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	89.6	±1.5
Negative one-half cycle	89.6	±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-42A**

**SERIAL No. : 00322746**



Cert. No. : ACL24229  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00322746 / 196469 / 15478  
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 JULY 2024  
Calibration Date : 10 - 11 JULY 2024  
Date of Issue : 15 JULY 2024

Calibrated by : Nathakorn Pisupaisan

Approved by :  
( Thanakul Petchurai )

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Cert. No. : ACL24229  
Job No. : VC67AC0117  
Pages : 2 of 8  
Calibration Procedure : CP-AC-01

### Calibration Method :

This equipment was calibrated by follow 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-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL.BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL.BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL.BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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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Summary of Measurement Result :

Parameter	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

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Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	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	Weighting (dB)
A - weight	10.8
C - weight	17.0
Flat	22.9

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	-0.8	-0.8	-0.8
1000	0.0	0.0	0.0
8000	0.5	0.6	0.6

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#### 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	-0.1
250	0.0	0.0	-0.1
500	0.0	0.0	-0.1
1000	0.0	0.0	0.0
2000	0.0	0.0	0.0
4000	0.0	0.0	0.0
8000	0.0	0.0	0.0

#### 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	137.1	0.1	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 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	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 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	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	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

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**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	135.3	-1.1	±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	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

**11. Overload indication**

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle		
89.5	89.6	0.1
		±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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*g. Petch*

**SOUND LEVEL METER**

**MODEL : NL-42A**

**SERIAL No. : 00322757**



Request No. 21-67/0252

MTC No. EEL. BP. 13/0267

## CALIBRATION CERTIFICATE

**Submitted by** : Eastern Thai Consulting 1992 Co., Ltd.  
**Address** : 683 Moo 11, Sukhapiarn 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 :**

<b>Description</b>	: Sound Level Meter	<b>Ambient Environment</b>	Temperature	: (23 ± 3) °C
<b>Manufacturer</b>	: Rion	Relative Humidity		: (50 ± 15) %
<b>Model</b>	: NL-42A	Ambient Pressure		: (101.325±1.5) kPa

Serial No. : 00322757

Microphone : UC-52 No.196481

Preamplifier : NH-24 No.15489

**Standards used :**

1. Band Pass Filter Wavetek 752A S/N 90010494.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

**Date of Receipt** : 5 Feb. 2024**Date of Calibration** : 6 Mar. 2024

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Request No. 21-67/0252

MTC No. EEL. BP. 13/0267

9. Power Amplifier Brüel&amp;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 Tanagawa 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** : 6 Mar. 2024

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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				
113.92	114.0	113.9	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)
15.6	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			
A-Weight	12.1	0.10	N/A
C-Weight	17.6	0.10	N/A
Flat	23.3	0.10	N/A

Date of Calibration : 6 Mar. 2024

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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	Flat			
125	0.1	0.2	0.1	1.5	0.45	0.6
1 000	-0.2	-0.2	-0.1	1.0	0.45	0.6
8 000	-0.1	-0.2	-0.3	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	Flat			
63	0.0	0.1	0.1	2.0	0.20	0.6
125	-0.1	0.1	0.1	1.5	0.20	0.6
250	-0.1	0.1	0.1	1.5	0.20	0.6
500	-0.1	0.1	0.1	1.5	0.20	0.6
1 000	0.0	0.0	0.0	1.0	0.20	0.6
2 000	-0.2	-0.2	-0.2	2.0	0.20	0.6
4 000	-0.3	-0.3	-0.2	3.0	0.20	0.6
8 000	-0.1	0.0	0.0	5.0	0.20	0.7

Date of Calibration : 6 Mar. 2024

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MTC No. EEL. BP. 13/0267

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	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 value (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 value (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 : 6 Mar. 2024

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Request No. 21-67/0252

MTC No. EEL. BP. 13/0267

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)
137	137.0	0.0	1.1	0.30	0.3
136	136.0	0.0	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	89.0	0.0	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	64.0	0.0	1.1	0.30	0.3

Date of Calibration : 6 Mar. 2024

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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)
59	59.0	0.0	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	44.0	0.0	1.1	0.30	0.3
39	38.9	-0.1	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	25.9	-0.1	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)
30-130	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 6 Mar. 2024

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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)
30-130	35	35.0	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	126.0	0.0	±1.0	0.20	0.3
	2	108.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	99.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	119.5	-0.1	±1.0	0.20	0.3
	2	99.9	-0.1	+1.0; -5.0	0.20	0.3
	200	120.0	0.0	±1.0	0.20	0.3
SEL	2	100.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	90.9	-0.1	+1.5; -5.0	0.20	0.3

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Request No. 21-67/0252

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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	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(±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle	value (dB)	limit class 2(±dB)	(±dB)	of measurement (±dB)
136.6	136.6	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	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by : *Wittawat Supanich*  
(Mr. Wittawat Supanich)

Approved by : *Prasit Kuanpa*  
(Mr. Prasit Kuanpa)  
Director

77°TISTR  
Electrical and Electronics Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 6 Mar. 2024  
Date of Issue : 6 Mar. 2024

Ref : 2011267020500503005

End of Certificate

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**SOUND LEVEL METER**

**MODEL : NL-42A**

**SERIAL No. : 00322748**





Cert. No. : ACL24136  
Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42A / Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00322748 / 196471 / 15480  
**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 :** 29 APRIL 2024  
**Calibration Date :** 13-17 MAY 2024  
**Date of Issue :** 20 MAY 2024

**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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Cert. No. : ACL24136  
Job No. : VC67AC0083  
Pages : 2 of 8

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

### Calibration Method :

This equipment was calibrated by follow 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-0009-4	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL_BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL_BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL_BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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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Cert. No. : ACL24136  
Job No. : VC67AC0083  
Pages : 3 of 8**Summary of Measurement Result :**

Parameter	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

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Cert. No. : ACL24136  
Job No. : VC67AC0083  
Pages : 4 of 8**Result of calibration :****1. Absolute sensitivity**

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (91.98)	93.9	0.0	±0.3

**2. Self-generated noise****2.1 Normal test**

Measured Value (dB)
15.1

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

Frequency Weighting	Measured value (dB)
A - weight	13.2
C - weight	19.3
Flat	24.0

**3. Acoustical signal tests of frequency weightings**

Meter free-field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.0	0.1	0.1
1000	-0.1	-0.1	-0.1
8000	0.6	0.7	0.7

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#### 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	0.0	-0.1	-0.1
125	0.0	0.0	0.0
250	0.0	0.0	-0.1
500	0.0	0.0	-0.1
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	131.9	-0.1	$\pm 1.1$
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	89.0	0.0	$\pm 1.1$
84.0	84.0	0.0	$\pm 1.1$
79.0	79.0	0.0	$\pm 1.1$
74.0	74.0	0.0	$\pm 1.1$
69.0	69.0	0.0	$\pm 1.1$
64.0	64.0	0.0	$\pm 1.1$
59.0	59.0	0.0	$\pm 1.1$
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	26.0	0.0	$\pm 1.1$
25.0	25.0	0.0	$\pm 1.1$

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Cert. No. : ACL24136  
 Job No. : VC67AC0083  
 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, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.4	0.0	±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	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

Cert. No. : ACL24136  
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**11. Overload indication**

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle		
89.6	89.5	-0.1
		±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**

**COPY**

*Y. Petcha*

**SOUND LEVEL METER**

**MODEL : NL-42A**

**SERIAL No. : 00222592**

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00222592 / 195904 / 15424  
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 : 29 APRIL 2024  
Calibration Date : 13-17 MAY 2024  
Date of Issue : 20 MAY 2024

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.

Cert. No. : ACL24132  
Pages : 1 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow 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-0009-4	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAJ	34560495	AA-3001-24	05-FEB-25

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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**Summary of Measurement Result :**

Parameter	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

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*T. Petch.*

**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)
14.4

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

Frequency Weighting	Measured value (dB)
A - weight	12.5
C - weight	19.0
Flat	24.5

**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	0.0	± 1.5
1000	-0.1	-0.1	± 1.0
8000	1.4	1.5	±5.0

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*T. Petch.*



## 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	0.0	-0.1	-0.1
125	0.0	0.0	0.0
250	0.0	0.0	-0.1
500	0.0	0.0	-0.1
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	132.9	-0.1	$\pm 1.1$
132.0	131.9	-0.1	$\pm 1.1$
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	89.0	0.0	$\pm 1.1$
84.0	84.0	0.0	$\pm 1.1$
79.0	79.0	0.0	$\pm 1.1$
74.0	74.0	0.0	$\pm 1.1$
69.0	69.0	0.0	$\pm 1.1$
64.0	64.0	0.0	$\pm 1.1$
59.0	59.0	0.0	$\pm 1.1$
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	26.0	0.0	$\pm 1.1$
25.0	24.9	-0.1	$\pm 1.1$

## 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	$\pm 0.3$

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**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	136.1	-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	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

**11. Overload indication**

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.1	±1.5
89.5	89.6		

**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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*Y. Rethin*

**SOUND LEVEL METER**

**MODEL : NL-42A**

**SERIAL No. : 00222593**



Cert No. : ACL24133  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NI-42A / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00222593 / 195905 / 15425  
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 : 29 APRIL 2024  
Calibration Date : 13-17 MAY 2024  
Date of Issue : 20 MAY 2024

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.

Cert No. : ACL24133  
Job No. : VC67AC0083  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

### Calibration Method :

This equipment was calibrated by follow 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-0009-4	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL.BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL.BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL.BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0408-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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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9. Petchurai

Summary of Measurement Result :

Parameter	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

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P. Petcha.

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 )
14.2

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

Frequency Weighting	Measured value ( dB )
A - weight	12.0
C - weight	18.5
Flat	24.0

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	0.1
1000	-0.1	-0.1	-0.1
8000	0.5	0.6	0.6
Acceptance Limits			±1.5
			±1.0
			±5.0

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P. Petcha.

## 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	0.0	-0.1
125	0.0	0.1	0.0
250	0.0	0.0	0.0
500	0.0	0.1	0.0
1000	0.0	0.0	0.0
2000	0.0	0.1	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	89.0	0.0	$\pm 1.1$
84.0	84.0	0.0	$\pm 1.1$
79.0	79.0	0.0	$\pm 1.1$
74.0	74.0	0.0	$\pm 1.1$
69.0	69.0	0.0	$\pm 1.1$
64.0	64.0	0.0	$\pm 1.1$
59.0	59.0	0.0	$\pm 1.1$
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	29.9	-0.1	$\pm 1.1$
29.0	28.9	-0.1	$\pm 1.1$
28.0	27.9	-0.1	$\pm 1.1$
27.0	26.9	-0.1	$\pm 1.1$
26.0	25.9	-0.1	$\pm 1.1$
25.0	24.9	-0.1	$\pm 1.1$

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**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	134.1	0.1	±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)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.8	-0.6	±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

**11. Overload indication**

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	89.7	0.1
Negative one-half cycle	89.6	±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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