

สำเนาเอกสารสอบเทียบเครื่องมือวัด

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# AMARC

ASIA MEDICAL AND  
AGRICULTURAL LABORATORY  
AND RESEARCH CENTER



Page 1 of 4

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

## CERTIFICATE OF CALIBRATION

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

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

Equipment : ELECTRONIC BALANCE

Manufacturer : METTLER TOLEDO

Model : XS205DU

Serial No. : 1126323724

ID No. : LABE 05/1

Date of Receipt : 20 January 2023

Date of Calibration : 20 January 2023

Calibrated by Mr. Thanadol Pholthep  
Scientist

Approved by

(Mr. Somchai Neampunt)  
Signed for Director

Issue date 25 January 2023

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

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

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

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

## REPORT OF CALIBRATION

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

### Result of Calibration

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

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

Unit : g	Range : 80	<input type="checkbox"/> Before adjustment		<input type="checkbox"/> After adjustment	
		40	80		
<input checked="" type="checkbox"/> No adjustment	Nominal value				
<input type="checkbox"/> Adjustment	Standard weight	40.000042	80.000045		
	Average reading of indicator	40.00015	80.00019		
	Standard deviation	0.000004	0.000007		

Unit : g	Range : 200	<input type="checkbox"/> Before adjustment		<input type="checkbox"/> After adjustment	
		100	200		
<input checked="" type="checkbox"/> No adjustment	Nominal value				
<input type="checkbox"/> Adjustment	Standard weight	100.000022	200.000199		
	Average reading of indicator	100.0001	200.0004		
	Standard deviation	0.00004	0.00008		

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

## REPORT OF CALIBRATION

### Result of Calibration

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

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

Unit : g

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

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

Unit : g

Nominal Value	Standard Value	Average Reading of Indicator	Correction Value	Expanded Uncertainty	Coverage Factor (k)
Unload	0.0000000	0.00000	0.00000	0.0000090	2.01
0.01	0.0100036	0.01000	0.00000	0.0000093	2.01
0.1	0.1000062	0.10000	0.00001	0.000012	2.00
1	1.0000036	1.00001	-0.00001	0.000014	2.00
5	5.0000044	5.00003	-0.00003	0.000020	2.00
10	10.0000000	10.00007	-0.00007	0.000032	2.00
20	20.000016	20.00011	-0.00009	0.000036	2.00
50	50.000029	50.00013	-0.00010	0.000067	2.00
100	100.000022	100.0001	-0.0001	0.00016	2.00
150	150.000051	150.0001	0.0000	0.00023	2.00
200	200.000199	200.0003	-0.0001	0.00028	2.00

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

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

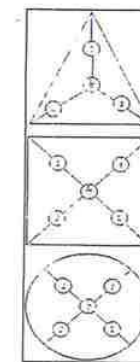
## REPORT OF CALIBRATION

### Result of Calibration :

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

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

Weighing pan	Circle	Triangular	Rectangular	Test weight : 50 and 100
Range	80	200	Unit : g	
Position	Reading of indicator	Reading of indicator		
1	50.00014	100.0001		
2	50.00014	99.9998		
3	50.00006	100.0000		
4	50.00010	100.0001		
5	50.00017	100.0001		
6	50.00014	100.0001		
Maximum difference	0.00008	0.0003		



#### Condition of Calibration

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

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

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

- End of Report -

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MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD  
214 Bangwack Rd. Bangpai Bangkae Bangkok 10160  
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 http://www.mit.in.th



## CALIBRATION CERTIFICATE

Certificate No. : AD2205-163-0001

Date Issued : 20-May-22

**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** : 12-May-22

**Date Calibrated** : 20-May-22

**Calibrated by** : Mr. Saruth Srichutikul

### Calibration Method or Calibration Procedure Used

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

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

### Result of Calibration

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

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Approved by:



(Mr. Nathapong Krudaum)



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Certificate No : AD2205-163-0001

**Environment** Ambient Temperature :  $(25 \pm 2)^{\circ}\text{C}$   
Relative Humidity :  $(50 \pm 15)\%\text{RH}$

STD Reading hPa	UUC Reading (hPa) Before Adjusted	UUC Reading (hPa) After Adjusted	UUC Error hPa	Uncertainty $\pm$ hPa
990.00	990.0	*	0.00	0.59
1000.00	1000.0	*	0.00	0.59
1010.00	1010.0	*	0.00	0.59
1020.00	1020.0	*	0.00	0.59
1030.00	1030.0	*	0.00	0.59

STD = Standard

UUC = Unit Under Calibration

**Calibrated condition :** Pressure Medium Air : Density =  $1.19 \text{ kg/m}^3$  @  $20^{\circ}\text{C}$ , 1 bar  
Mounting Position Vertical  
Reference Level at center of its dial

<b>Description of UUC :</b>	Range	955 - 1075	hPa Absolute
	Calibration Range	990 - 1030	hPa Absolute
	Scale Interval	1	hPa
	Resolution	0.5	hPa Absolute

Condition As-Received : Used Item

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

**Measurement Standards Used & Traceability :**

The International System of Units (SI) through

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

End of Certificate

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NSC-TISI-TIS17025  
CALIBRATION 0152

Page 1 of 3

## CERTIFICATE OF CALIBRATION

Certificate No. : 23-006679  
Sample Code : 23-02820-002Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapiban 8 Rd., Nongkham,  
Sriracha, Chonburi 20230Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.  
(Hot Lab)

Equipment : Temperature controlled enclosures (Hot air oven)

Manufacturer : Memmert

Serial No. : G511.0182

Date of Receipt : 20 January 2023

Model : UFE 500

ID No. : LABE 17/4

Date of Calibration : 20 January 2023

## Condition of Calibration

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

## 2. Calibration method

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

## 3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-Prt100)	LB-DA-11 (RTD-138 to RTD-146)	22-040309	21 April 2023

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

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

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

## 6. Condition of calibration item : Normal

Calibrated by

Mr. Sarawoot Thammo

Scientist

Issue date

24 January 2023

Approved by

(Mr. Somchai Neampunt)

Signed for Director

The uncertainties are for a confidence probability of approximately 95%

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only  
This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC)361 Soi Ladprao 122, Ladprao Road,  
Mueang Thonglang, Bangkok 10310TEL 02-516-2422  
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WWW.AMARC.CO.  
Effective Date 15/10/21NSC-TISI-TIS17025  
CALIBRATION 0152

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## REPORT OF CALIBRATION

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

## Results of Calibration

Resolution : 0.5 °C

## 1. Reporting of Temperature

Calibration point (°C)	UUC* 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	104.10	104.08	103.87	103.99	104.08	104.08	103.96	104.01	103.84	0.47	2.00

## 2. Characterization results

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

## Notes

- UUC\* = Unit Under Calibration

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Effective Date 15/10/21



## REPORT OF CALIBRATION

Certificate No. : 23-006679

Sample Code : 23-02820-002

## Results of Calibration

## Notes

## 1. Sensor installation locations

- 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
- 1.2 The reference sensor is preferably located of the geometric center of the chamber.

## 2. Interior dimensions approx of chamber :

W = 56 cm ; D = 40 cm ; H = 48 cm

## 3. Air valve or fresh air level : Off

## 4. Fan level : Open

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

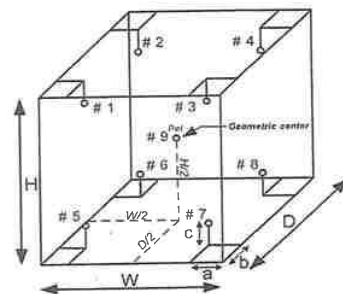
## 6. Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

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

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

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

## 10. Calibration results without adjustment.

Figure: Example of sensor  
installation Positions

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 M3

- End of Report -

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TISCH ENVIRONMENTAL, INC.  
145 SOUTH MIAMI AVE  
VILLAGE OF CLEVELAND, OH  
45002  
513.467.9000  
877.253.7810 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)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	1.3400	3.2	2.00
2	NA	NA	1.00	0.9510	6.3	4.00
3	NA	NA	1.00	0.8510	7.8	5.00
4	NA	NA	1.00	0.8130	8.6	5.50
5	NA	NA	1.00	0.6690	12.6	8.00

## DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
0.9832	0.7337	1.4054	0.9957	0.7430	0.8911
0.9791	1.0296	1.9875	0.9915	1.0426	1.2603
0.9770	1.1481	2.2221	0.9894	1.1626	1.4090
0.9760	1.2006	2.3305	0.9884	1.2157	1.4778
0.9707	1.4510	2.8107	0.9830	1.4694	1.7823

Qstd slope (m) = 1.96262  
intercept (b) = -0.03249  
coefficient (r) = 0.99993

Qa slope (m) = 1.22896  
intercept (b) = -0.02060  
coefficient (r) = 0.99993

y axis = SQRT[H2O(Pa/760) (298/Ta)]

y axis = SQRT[H2O(Ta/Pa)]

## CALCULATIONS

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

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

For subsequent flow rate calculations:

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

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NSC-TISI-TIS17025  
CALIBRATION 0152

Page 1 of 2

## CERTIFICATE OF CALIBRATION

Certificate No. : 22-068062  
Sample Code : 22-24591-002

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapiban 8 Rd., Nongkham,

Sriracha, Chonburi 20230

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

Equipment : Digital thermo-hygrometer

Manufacturer : testo

Model : 608-H1

Serial No. : 45106737

ID No. : LABE 09/7

Date of Receipt : 22 June 2022

Date of Calibration : 24 June 2022

## 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 Vision	LB-DP-01 & LB-DP-01 (DP)	TH-0014-22	16 February 2023
3.2 Digital Thermometer	Optidew Vision	LB-DP-01 & LB-DP-01 (Temp.)	22-029549	14 March 2023
3.3 Digital Thermometer	34972A	LB-DA-07 with RTD-B9	21-072473	13 September 2022

## 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

Scientist

Issue date 27 June 2022

(Mr. Somchai Neampunt)

Signed for Director

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

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

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

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CALIBRATION 0152

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## REPORT OF CALIBRATION

Certificate No. : 22-068062  
Sample Code : 22-24591-002

## 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	20.2	- 0.20	± 0.39
25	50	25.00	24.9	+ 0.10	± 0.39
30	50	30.00	29.8	+ 0.20	± 0.39

## Humidity measurement

Resolution : 0.1 %RH

Range : 10 %RH to 95 %RH

Calibration point %RH	Average of standard reading		Unit under calibration		Expanded uncertainty %RH
	Air temperature °C	Calculated humidity %RH	Average reading %RH	Correction value %RH	
45	25.00	45.13	51.4	- 6.27	± 1.3
60	25.00	60.03	66.5	- 6.47	± 1.5
75	25.00	75.20	81.5	- 6.30	± 1.7

## Notes

- Calibration results without adjustment.

The result expanded uncertainty of measurement  $U$  is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3000.

- End of Report -

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Effective Date 15/10/21

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Rev 09

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E04NI99E15ACX9C Reference Number: 82-401135335-1  
Cylinder Number: EB0062815 Cylinder Volume: 144.4 CF  
Laboratory: 124 - Riverton (SAP) - NJ Cylinder Pressure: 2015 PSIG  
PGVP Number: B52018 Valve Outlet: 660  
Gas Code: CO,NO,NOX,SO2,BALN 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. 0.7 megapascals.

#### ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	50.00 PPM	50.55 PPM	G1	+/- 1.4% NIST Traceable	03/06/2018, 03/13/2018
NITRIC OXIDE	50.00 PPM	50.50 PPM	G1	+/- 1.4% NIST Traceable	03/06/2018, 03/13/2018
SULFUR DIOXIDE	50.00 PPM	51.01 PPM	G1	+/- 1.0% NIST Traceable	03/06/2018, 03/13/2018
CARBON MONOXIDE	2000 PPM	1977 PPM	G1	+/- 1.0% NIST Traceable	03/06/2018
NITROGEN	Balance				

#### CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	16060607	CC442564	50.42 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Jun 27, 2020
PRM	12367	APEX1099237	9.82 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Jun 02, 2017
GMS	0315201604	CC503358	4.975 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%	Mar 15, 2019
NTRM	16011025	CC473218	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 07, 2022
NTRM	12060735	CC356192	2498 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Dec 14, 2026

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 values 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

Approved for Release

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Page 1 of 82-401135335-1



# Test Calibrated Report

## Sulphur Dioxide Analyzer

Date : March 08, 2023 Time : 13:00  
 Model: API M100E Serial Number : 3139  
 Standard Gas : 51.65 PPM

### Instrument Status

RANG ( PPB )	500	DARK PMT ( <50 mV )	24.6
STABIL ( < 1 PPB )	2.661	DARK LAMP ( < 50 mV )	-1.500
SAMP PRESS ( Ambient $\pm$ 2 in-HG-A )	29.6	SLOPE (1.0 $\pm$ 0.3 )	0.967
SAMPLE FLOW ( 650 $\pm$ 10 cc/min )	646.0	OFFSET ( <100 mV )	25.0
PMT SIGNAL ( 0 $\pm$ 100 mV )	48.5	HVPS ( 400-900 V )	778.0
NORM PMT ( 0 $\pm$ 100 mV )	54.2	RCELL TEMP ( 50 C $\pm$ 1 )	50.0
UV LAMP ( 3500-4000nmV )	3266.2	BOX TEMP ( Ambient $\pm$ 5 )	35.8
UV LAMP RATIO ( % )	96.4	PMT TEMP ( 7 C $\pm$ 2 )	8.3
STR. LGT ( <60 PPB )	12.073		
ETEST PMT Reading	OK		
SO2 Reading	OK		
OTEST PMT Reading	OK		
SO2 Reading	OK		

### Calibrated Setting

Initial Reading ( Before Adj. )		Final Reading ( After Adj. )	
Span Set	Concentration ( PPB )	Analyzer Response ( PPB )	Error %
Point			
Zero	0.0	-1.45	-
Span	400.0	392.5	-0.05

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## Test Calibrated Report

## Nitrogen Oxide Analyzer

Date : January 14, 2023 Time : 9:00  
 Model APL T200 Serial Number : 6757  
 Standard Gas : 50.31 PPM

## Instrument Status

Auto-Zero (-70 to 150 mV) 76.5 NO<sub>x</sub> Offset (mV) -4.3  
 Box Temp.(Ambient Temp.plus 3-7) 32.3 NO<sub>x</sub> Slope 0.917  
 HVPS ( 400 to 900 V. ) 595 NO<sub>x</sub> Stability ( PPB to PPM ) 0.05  
 Moly Temp. ( 315 +/-5 ) 314 O<sub>2</sub> Flow ( 80 +/-15 ) 75.0  
 NO Norm Offset ( mV ) -6.3 PMT Signal ( mV ) 95.7  
 NO Slope 0.921 PMT Temp. ( 7 +/-2 ) 7.1  
 NO Stability ( PPB to PPM ) 0.04 R<sub>g</sub> Cell Press ( 2-10 in-Hg-A ) 7.1  
 NO<sub>x</sub> Stability ( PPB to PPM ) 0.04 R<sub>g</sub> Cell Temp. ( 50 +/- 1 ) 50.00  
 Norm PMT ( mV ) 0.7 Sample Flow ( 500 +/- 50 ) 492  
 Sample Press ( in-Hg-A, Ambient ) 28.6

## PMT Reading

OK

## ETEST

NO Conc Reading

OK

## OPTIC TEST

NO<sub>x</sub> Conc Reading

OK

## PMT Reading

OK

## OTEST

NO Conc Reading

OK

NO<sub>x</sub> Conc Reading

OK

## Calibrated Setting

Initial Reading ( Before Adj. )		Final Reading ( After Adj. )	
Span Set	Concentration	Analyzer Response	Error
Point	( PPB )	( PPB )	%
Zero NO	0	-2.69	-
Zero NO <sub>x</sub>	0	-2.40	-
Span NO	400	404.9	-0.05
Span NO <sub>x</sub>	401	402.2	0.18

Calibrated By :

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## Test Calibrated Report

### Sulphur Dioxide Analyzer

Date : March 25, 2023

Time : 13:00

Model : APSA-370

Serial Number : 3XLWFYVJ

Standard Gas : 51.65 PPM

#### Instrument Status

Conc. Signal	13.5 mV
Light intensity	354.3 mV
Cell Temp	34.2 C
5 V Power	5.0 V
24 V Power	24.0 V
Sample Flow Rate	700 cc/min
Pump Pressure	46.1 kPa
Atmospheric Pressure	101.2 kPa

#### Calibrated Setting

Initial Reading ( Before Adj. )			Final Reading ( After Adj. )	
Span Set Point	Concentration ( PPB )	Analyzer Response ( PPB )	Analyzer Response ( PPB )	Error %
Zero	0.0	0.14	0.0	-
Span	400.0	393.8	400.3	0.08

Span SO2

0.94552

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Calibrated By :





## Test Calibrated Report

## Nitrogen Oxide Analyzer

Date : March 25, 2023

Time : 13:00

Model: APVA-370

Serial Number : XXSSJ4FM

Standard Gas : 50.31 PPM

## Instrument Status

NOx Signal	9.2 mV
NO Signal	1.8 mV
Detector Temp.	40.8 C
5 V Power	5.0 V
24 V Power	23.7 V
Sample Flow Rate	700 cc/min
Pump Pressure	81.7 kPa
Atmospheric Pressure	101.0 kPa

## Calibrated Setting

Initial Reading ( Before Adj. )			Final Reading ( After Adj. )	
Span Set Point	Concentration ( PPB )	Analyzer Response ( PPB )	Analyzer Response ( PPB )	Error %
Zero NO	0.0	1.2	0.0	-
Zero NOx	0.0	2.3	0.0	-
Span NO	400	410.1	400.0	0.00
Span NOx	401	400.1	401.1	0.02

Span NO

1.1960

Span NOx

1.2167

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Calibrated By





## Test Calibrated Report

### Sulphur Dioxide Analyzer

Date : March 27, 2023 Time : 13:00  
 Model: API, T100 Serial Number : 6457  
 Standard Gas : 51.65 PPM

#### Instrument Status

Rang ( PPB )	500	PMT Signal ( 0+/-100 mV )	15.8
Box Temp. ( Ambient +/- 5 )	35.3	PMT Temp. ( 7 C +/-2 )	8.3
Dark Lamp ( < 50 mV )	-0.1	Pressure ( Ambient +/-2 in-HG-A )	27.2
Dark PMT ( <50 mV )	17.1	RCell Temp. ( 50 C +/-1 )	50.0
HVPS ( 400-900 V )	573.0	Sample Flow ( 650+/-10 cc/min )	666.2
UV Lamp Ratio ( % )	88.5	SLOPE ( 1.0 +/-0.3 )	0.977
Norm Offset	10.5	Stability ( < 1 PPB )	0.08
Norm PMT ( 0+/-100 mV )	20.2	Stray. Light ( <60 PPB )	5.1
Offset ( <100 mV )	0.042	UV Lamp ( 3500-4000mV )	2039.0

ETEST	PMT Reading	OK
	SO2 Reading	OK
OTEST	PMT Reading	OK
	SO2 Reading	OK

#### Calibrated Setting

Initial Reading ( Before Adj. )			Final Reading ( After Adj. )	
Span Set	Concentration ( PPB )	Analyzer Response ( PPB )	Analyzer Response ( PPB )	Error %
Point				
Zero	0.0		0.0	-
Span	400.0		406.1	0.05

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Calibrated By : XXXXXXXXXX

## Nitrogen Oxide Analyzer

Time : 9:00

**Serial Number : 7355**

## Instrument Status

Airbo-Zero (-20 to 150 mV )	17.6	NO <sub>x</sub> Offset ( mV )	11.2
Box Temp.(Ambient Temp.plus 3-7;	33.7	NO <sub>x</sub> Slope	1.145
HVPS ( 400 to 900 V. )	634	Nox Stability ( PPB to PPM )	0.18
Moly Temp. ( 315 +/-5 )	315	O <sub>2</sub> Flow ( 80 +/-15 )	90.0
NO Norm Offset ( mV )	9.0	PMT Signal ( mV )	18.1
NO Slope	1.144	PMT Temp. ( 7 +/-2 )	6.9
NO Stability ( PPB to PPM )	0.08	R <sub>a</sub> Cell Press ( 2-10 in-Hg-A )	3.6
NO <sub>2</sub> Stability ( PPB to PPM )	0.08	R <sub>a</sub> Cell Temp. ( 50 +/-1 )	50.00
Norm PMT ( mV )	34.8	Sampe Flow ( 500 +/- 50 )	479
Sampe Press ( in-Hg-A, Ambient )	28.7		

OK



OK

OK

OK

OK

## Calibrated Setting

Initial Reading ( Before Adj. )			Final Reading ( After Adj. )	
Span Set Point	Concentration ( PPB )	Analyzer Response ( PPB )	Analyzer Response ( PPB )	Error %
Zero NO	0	0.00	0.00	-
Zero NOx	0	0.00	0.00	-
Span NO	400	393.2	399.4	-0.14
Span NOx	401	391.6	400.5	-0.12

Calibrated By :

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

## CERTIFICATE OF CALIBRATION

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

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

Equipment : ELECTRONIC BALANCE

Manufacturer : METTLER TOLEDO

Model : XS205DU

Serial No. : 1126323724

ID No. : LABE 05/1

Date of Receipt : 20 January 2023

Date of Calibration : 20 January 2023

Calibrated by : Mr. Thanadol Pholthep  
Scientist

Approved by

(Mr. Somchai Neampunt)  
Signed for Director

Issue date : 25 January 2023

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

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

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



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

## REPORT OF CALIBRATION

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

### Result of Calibration

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

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

Unit : g	Range : 80	<input type="checkbox"/> Before adjustment	<input type="checkbox"/> After adjustment
<input checked="" type="checkbox"/> No adjustment	Nominal value	40	80
<input type="checkbox"/> Adjustment	Standard weight	40.000042	80.000045
	Average reading of indicator	40.000015	80.000019
	Standard deviation	0.000004	0.000007

Unit : g	Range : 200	<input type="checkbox"/> Before adjustment	<input type="checkbox"/> After adjustment
<input checked="" type="checkbox"/> No adjustment	Nominal value	100	200
<input type="checkbox"/> Adjustment	Standard weight	100.000022	200.000019
	Average reading of indicator	100.00001	200.00004
	Standard deviation	0.000004	0.000008

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

## REPORT OF CALIBRATION

### Result of Calibration

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

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

Unit : g

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

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

Unit : g

Nominal Value	Standard Value	Average Reading of Indicator	Correction Value	Expanded Uncertainty	Coverage Factor (k)
Unload	0.0000000	0.00000	0.00000	0.0000090	2.01
0.01	0.0100036	0.01000	0.00000	0.0000093	2.01
0.1	0.1000062	0.10000	0.00001	0.000012	2.00
1	1.0000036	1.00001	-0.00001	0.000014	2.00
5	5.0000044	5.00003	-0.00003	0.000020	2.00
10	10.0000000	10.00007	-0.00007	0.000032	2.00
20	20.000016	20.00011	-0.00009	0.000036	2.00
50	50.000029	50.00013	-0.00010	0.000067	2.00
100	100.000022	100.0001	-0.0001	0.00016	2.00
150	150.000051	150.0001	0.0000	0.00023	2.00
200	200.000199	200.0003	-0.0001	0.00028	2.00

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

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

## REPORT OF CALIBRATION

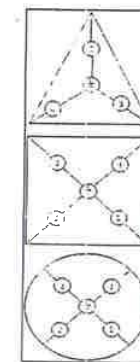
### Result of Calibration :

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

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

- ☐ Circle  
☐ Triangular  
☒ Rectangular

Range	80	200
Position	Reading of indicator	Reading of indicator
1	50.00014	100.0001
2	50.00014	99.9998
3	50.00006	100.0000
4	50.00010	100.0001
5	50.00017	100.0001
6	50.00014	100.0001
Maximum difference	0.00008	0.0003



### Condition of Calibration

- Calibration Method : WI-CL-004 base on UKAS LAB 14: 2019
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibration item: Normal
- This certification is traceable to the International System of Unit maintained at : -

Through the reference standard laboratory of Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (Instrument number 1).

#### 5. Reference standard instrument :

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

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

- End of Report -



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

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E03NI99E15AC0U4      Reference Number: 160-402242242-1  
Cylinder Number: EB0145030      Cylinder Volume: 144.4 CF  
Laboratory: 124 - Plumsteadville - PA      Cylinder Pressure: 2015 PSIG  
PGVP Number: A12021      Valve Outlet: 350  
Gas Code: CH4,PPN,BALN      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 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 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	Assay Dates
METHANE	180.0 PPM	177.0 PPM	G1	+/- 1.0% NIST Traceable	10/15/2021
PROPANE	185.0 PPM	187.0 PPM	G1	+/- 1.0% NIST Traceable	10/15/2021
NITROGEN	Balance				

#### CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08011503	K002564	246.7 PPM METHANE/AIR	+/- 0.6%	May 15, 2025
NTRM	200602-06	6162860Y	243.3 PPM PROPANE/AIR	+/- 0.5%	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# 5221004851



Approved for Release



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### Calibration Conditions

FactorialConversions	
Sid Temp (°K)	298
Sid Press. (mm Hg)	760
K <sub>1</sub>	0.392

WTM Model:	W-NK0Ds-6B	WTM Serial:	646321
WTM Cal. Due:	Mar-23	Gamma:	1.0000

WTM Model: ETN0000000 WTM Serial: 000021  
WTM Cal. Due: Mar-23 Gamma: 1.0000  
WTM Thermometer: Internal

Run Time (minutes)	Griggs, 64 (mm H <sub>2</sub> O)	Metering Cassette				Collection Meter				Outlet Temp	
		Volume (ml)		Outlet Temperature (°C)		Volume (ml)		Outlet Temp			
		Initial	Final	Initial	Final	Initial	Final	Initial	Final		
(60)	(P-2)	(V-1)	(V-2)	(L-1)	(L-2)	(W-1)	(W-2)	(I-1)	(I-2)		
mm	mm H <sub>2</sub> O	m <sup>3</sup>	m <sup>3</sup>	°C	°C	m <sup>3</sup>	m <sup>3</sup>	°C	°C		
15.00	13.0	397.7244	397.9056	25	25	269.68767	269.76842	25	25		
10.00	23.0	397.9235	398.0984	25	26	268.79207	269.65964	25	25		
8.00	398.1192	398.4056	398.5495	28	28	289.97335	290.16549	25	25		
7.00	398.3356	398.5495	398.5495	28	28	290.19812	290.40517	25	25		
5.00	120.0	398.6593	398.7513	26	27	290.42762	290.60905	25	25		

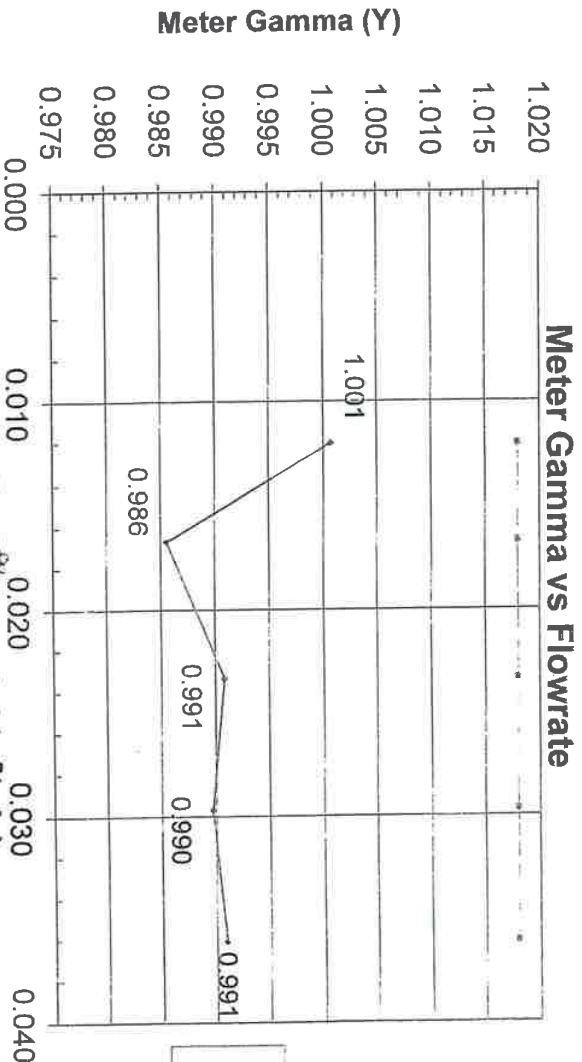
Standardized Data									
Test Material	Reference Material			Calibration Factor		Chemical Reaction			
	$[V_{\text{actual}}]$ mV	$[C_{\text{actual}}]$ m/min	$[W_{\text{actual}}]$ m <sup>2</sup>	Value	Variation (ΔV)	Primary Sig & Conc m/min	ΔH from N2O (J/mol SiO2)	Validation (J/mol SiO2)	Variation (J/mol SiO2)
0.180	0.012	0.181	0.012	1.001	0.009	0.012	41.008	-0.731	
0.169	0.017	0.167	0.017	0.998	-0.006	0.017	41.188	-0.570	
0.189	0.024	0.187	0.023	0.991	-0.001	0.023	41.986	0.168	
0.210	0.030	0.208	0.030		-0.002	0.030	41.881	0.112	
0.182	0.026	0.180	0.026	0.991	-0.001	0.026	42.759	0.991	
Average							41.798		ΔH = Average

บริษัท ฐิตกรคอม โซลูชั่นส์ จำกัด แอพลิเคชั่น เซอร์วิส กรุ๊ป จำกัด

**Parasuraman, Service Engineer**

WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Pass/Fail Result:	Pass
Date	12/06/2022



- Gamma Y
- Max Allow Y
- Min Allow Y

5.0

Flowrate Standardized & Corrected ( $\text{m}^3/\text{min}$ )

Console Serial: 1110070

Console Model: XC-572V

WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

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**W SDOM**  
บริษัท วิสโดม ไซนซ์ เซลล์ แอนด์ เซอร์วิส กรุ๊ป จำกัด  
WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

**THERMOCOUPLES SYSTEM CALIBRATION**

Sampling System Equipment Information	
Console Model Number	XC-572V
Console Serial Number	1110070
Meter Box Model Number	JENCO 765
Meter Box Serial Number	JC02484

Calibration Conditions		
Calibration Reference No.	WDS-SV650004	
Ambient Temp	25.4	°C
Barometric Pressure	756	mm Hg
Relative Humidity	55	%
Reference Thermometer	FLUKE 714	
Serial Number	9038005	

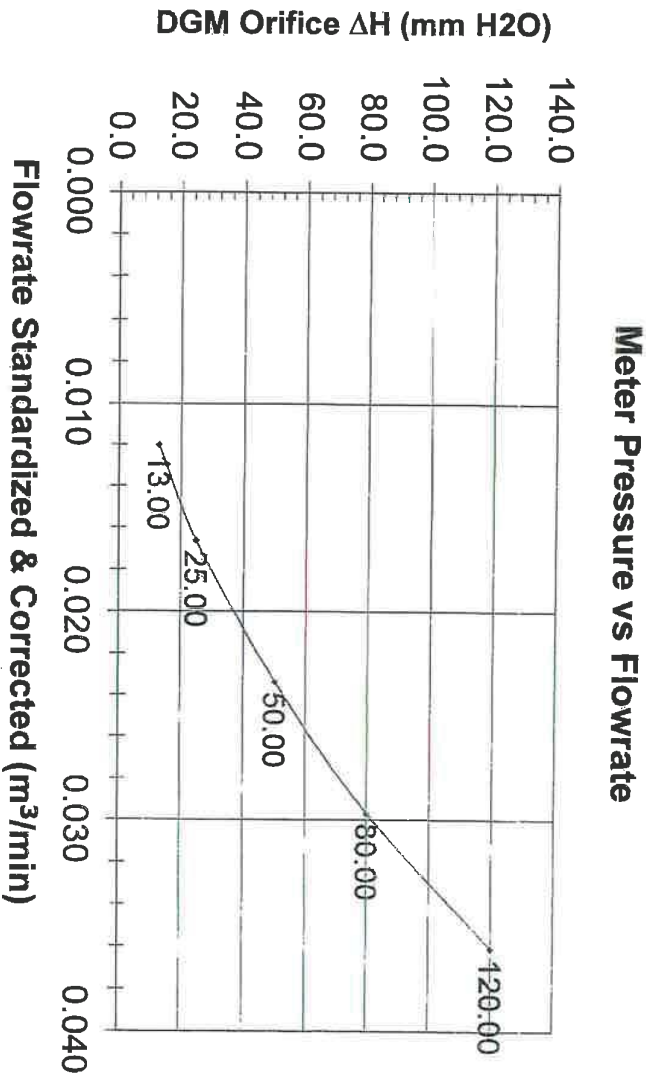
Results											
Console Thermocouple Simulator											
Channal and test point	Temperature Reading ( °C )										
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	1038.0
Stack	-18	24	37	92	150	261	373	485	596	821	1045
Probe	-18	24	37	92	150						
Filter	-18	24	37	92	150						
Aux	-18	24	37	92	150						
Exit	-18	24	37								

Tolerance Range		
Stack	± 1.50% Absolute	Meter ± 3.0 °C
Probe	± 3.0 °C	Exit ± 2.0 °C
Filter	± 3.0 °C	

Signature \_\_\_\_\_  
 ( Patpasu Chaisana )  
 Service Engineer



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Console Serial: 1110070  
  
 บริษัท วิสโดม ไซนซ์ เซลล์ แอนด์ เซอร์วิส กรุ๊ป จำกัด  
 WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

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Console Model: XC-572V

W SDOM

## Certificate of Calibration

Method: 5 Pre-Test Controls Calibration - Cubic meter (m<sup>3</sup>)After Three Validated Readings with MC-572V  
WISDOM SCIENCE SCALE AND SERVICE GROUP COMPANY LIMITED

## Meter Console Information

Model #: MC-572V Calibration Date: 27/07/2022  
 Serial #: 1007055 Calibration Ref.: WDS-SV090005  
 DGM Model #: SK23EX Ambient Temp (°C): 23.5  
 DGM Serial #: 00009432 Pressure (mm Hg): 756  
 Relative Humidity (%): 60

## Factors/Conversion

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

## Reference Equipment

WTM Model: W-INKCD-5B TM Cal. Due Date: Feb. 2022  
 WTM Serial: 540258 Gamma: 0.9980

## LUT Meter (DGM)

Run Time (min:sec)	DGM Office (mm H <sub>2</sub> O)	Volume		Outlet Temp		Reference Meter (WTM)	
		Initial V <sub>ini</sub>	Final V <sub>fin</sub>	Initial T <sub>ini</sub>	Final T <sub>fin</sub>	Initial V <sub>ini</sub>	Final V <sub>fin</sub>
15:00	13.0	0.0025	0.1686	25	25	307.83244	307.96516
10:00	25.0	0.1810	0.3499	25	25	308.00127	308.15957
8:00	50.0	0.3711	0.5509	25	25	308.16244	308.34119
7:00	80.0	0.5844	0.7961	25	25	308.34877	308.56037
5:00	120.0	0.8310	1.0074	25	25	308.59261	309.77072

## Standardized Data

Test Meter			Reference Meter			Correction Factor			Calibration Results		
Std. Volume V <sub>std</sub> (m <sup>3</sup> )	Std. Flow Rate Q <sub>std</sub> m <sup>3</sup> /min	Std. Volume V <sub>ref</sub> (m <sup>3</sup> )	Std. Flow Rate Q <sub>ref</sub> m <sup>3</sup> /min	Gamma* (γ)	Variation (ΔV)	Flow Rate Std & Corr	ΔH <sub>0</sub> (mm H <sub>2</sub> O)	Variation	Flow Rate	ΔH <sub>0</sub> (mm H <sub>2</sub> O)	Variation
0.183	0.011	0.160	0.011	0.883	-0.005	0.011	50.685	3.735	0.0212 SCMH	ΔH <sub>0</sub> g	ΔH <sub>0</sub> g
0.168	0.016	0.154	0.015	0.986	-0.002	0.015	46.980	0.030	46.834	-0.098	
0.177	0.022	0.174	0.022	0.987	-0.001	0.022	45.366	-1.664	44.824	-2.108	
0.189	0.028	0.187	0.028	0.980	0.001	0.028	44.824		46.930		
0.175	0.035	0.174	0.035	0.986	0.008	0.035	46.930		ΔH <sub>0</sub> Avg		

Pass

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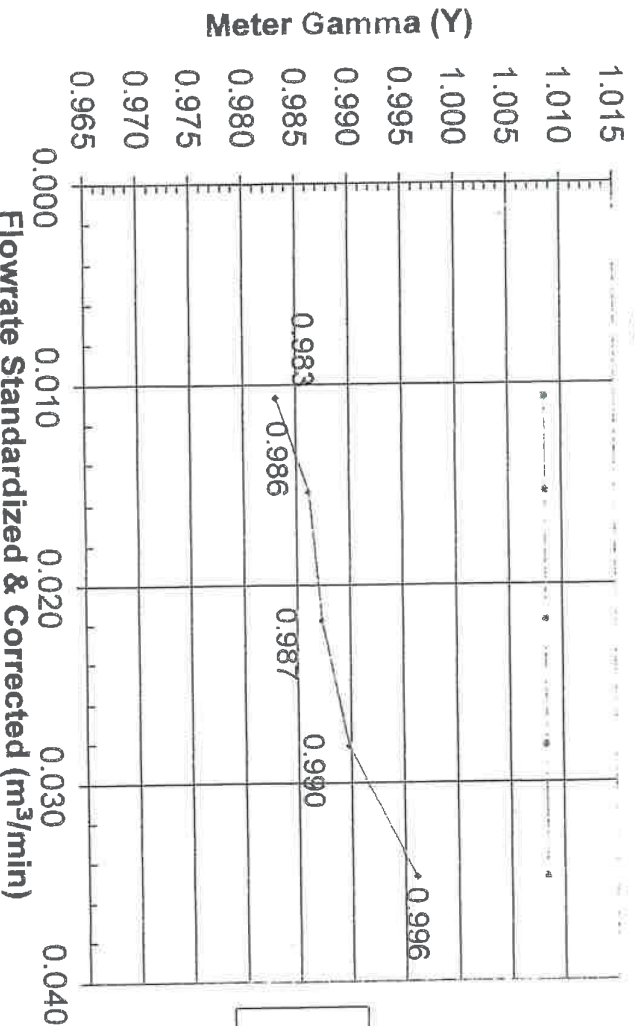
Signature

(Pragade Chaitanya)  
Service EngineerAfter Three Validated Readings with MC-572V  
WISDOM SCIENCE SCALE AND SERVICE GROUP COMPANY LIMITED

Date 27/07/2022

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## Meter Gamma vs Flowrate



→ Gamma Y  
 → Max Allow Y  
 Min Allow Y

Console Serial:

1007055

Console Model:

MC-572V

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WSDOM

WSDOM SERVICE ENGINEER AND SERVICE GROUP COMPANY LIMITED

THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information	
Console Model Number	MC-572V
Console Serial Number	1007055
Meter Box Model Number	DIGICON
Meter Box Serial Number	N/A

Calibration Conditions			
Date	Time	27/07/2022	9:30 AM
Calibration Reference No.	WDS-SV650005		
Barometric Pressure	756	mm Hg	
Reference Thermometer	FLUKE 714		
Serial Number	9038005		

Results											
Console Thermocouple Simulator											
Channel and test point	Meter Box Channel Temperature Reading (°C)										
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	1038.0
Stack	-18	25	38	93	150	261	373	485	596	821	1045
Probe	-18	25	38	92	150						
Filter	-18	25	38	92	150						
Aux	-18	25	38	92	150						
Exit	-18	25	38								

Accuracy Range

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

Meter ± 3.0 °C  
Exit ± 2.0 °C

Signature \_\_\_\_\_  
(Palpasu Chaisana)  
Service Engineer

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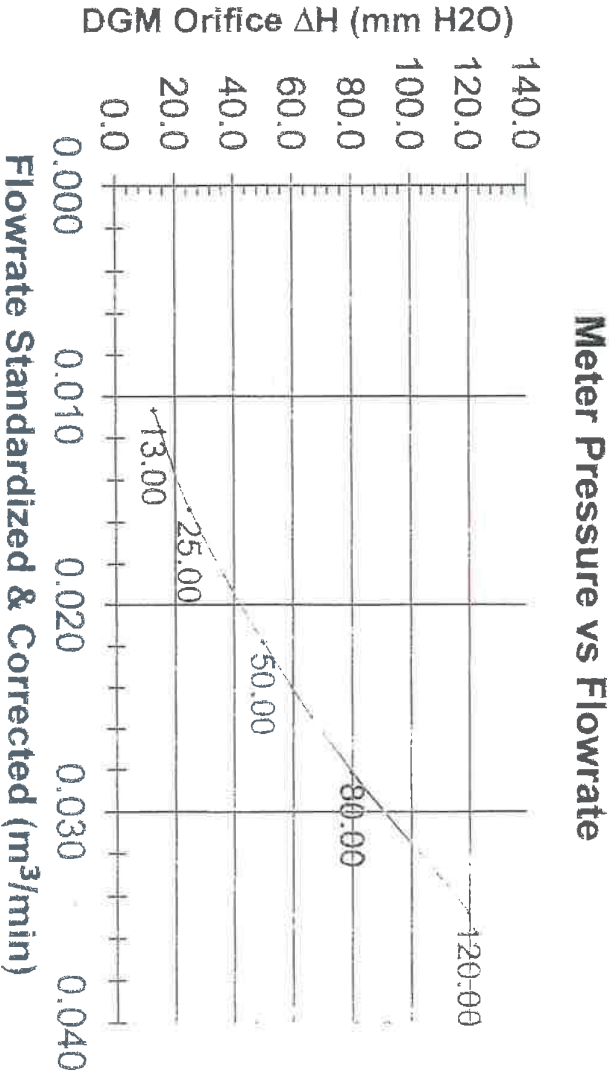
Console Serial:

1007055

Console Model:

MC-572V

COPY



## Certificate of Calibration

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

**Meter Console Information**  
 Console Model: MCG72V  
 Console Serial #: 0504003  
 DGM Model #: SK25EX  
 DGM Serial #: 0009854

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

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

**Reference Equipment**  
 WTM Model: W-NK024 5B  
 WTM Serial: 600245  
 WTM Cal. Due Date: Nov. 2022  
 Gamma: 1.0000

DUT Meter (DGM)				Reference Meter (WTM)			
Volume		Outlet Temp		Volume		Outlet Temp	
Run Time (minutes)	DGM Orifice (mm H <sub>2</sub> O)	Initial V <sub>in</sub>	Final V <sub>in</sub>	Initial V <sub>in</sub>	Final V <sub>in</sub>	Initial T <sub>in</sub>	Final T <sub>in</sub>
15.00	13.0	2.1249	2.2813	11.24924	11.40853	25	25
10.00	25.0	1.9384	2.0984	11.06645	11.22136	25	25
8.00	50.0	1.7294	1.9105	10.86093	11.03905	25	25
7.00	80.0	1.4887	1.6821	10.62322	10.82407	25	25
5.00	120.0	1.1950	1.3736	10.33100	10.50914	25	25

Standardized Data				Calibration Results			
Test Meter		Reference Meter		Flow Rate		ΔH@ (mm H <sub>2</sub> O)	
Std Volume V <sub>std</sub> (m <sup>3</sup> )	Std Flow Rate Q <sub>std</sub> (m <sup>3</sup> /min)	Std Volume V <sub>ref</sub> (m <sup>3</sup> )	Std Flow Rate Q <sub>ref</sub> (m <sup>3</sup> /min)	Std & Corr Q <sub>std</sub> (m <sup>3</sup> /min)	ΔH@ (mm H <sub>2</sub> O)	Variation ΔH@ (mm H <sub>2</sub> O)	
0.150	0.011	0.156	0.010	0.010	52.990	5.531	
0.155	0.015	0.152	0.015	0.015	47.999	0.540	
0.178	0.022	0.175	0.022	0.022	46.686	-0.763	
0.200	0.029	0.197	0.028	0.028	45.249	-2.210	
0.177	0.035	0.175	0.035	0.035	44.361	-3.098	
				Y Avg	47.459		
				Y Avg	47.459		

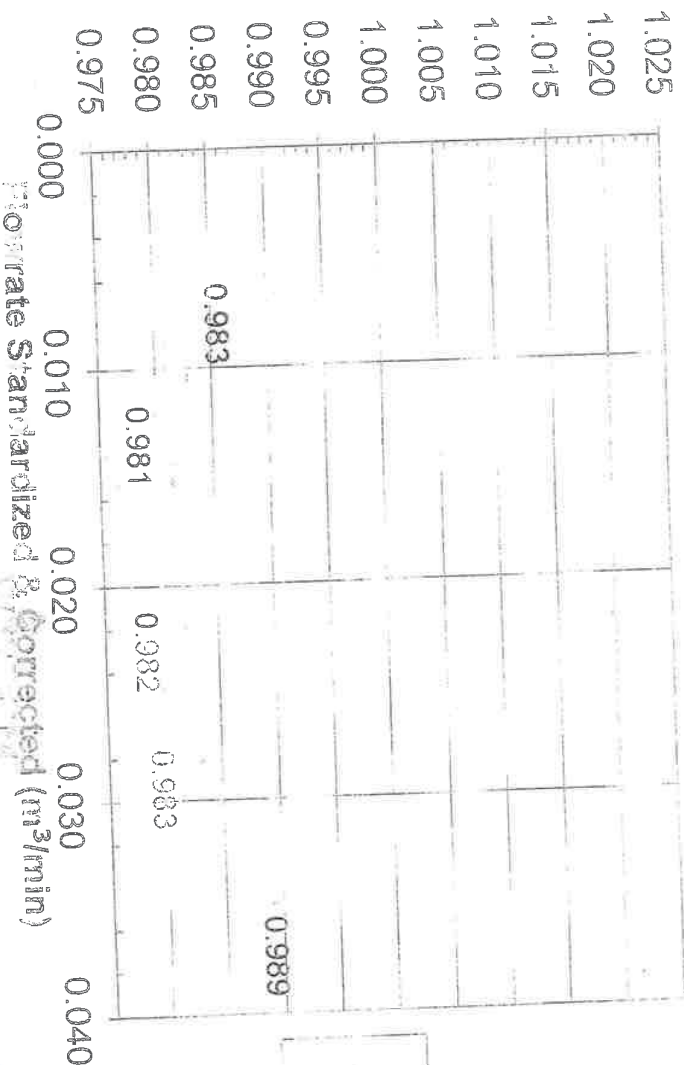
Pass/Fail Result: **Pass**

36: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter acceptance value. The acceptance value is the average of individual values from the average to 20 inches (51 mm) H<sub>2</sub>O.  
 36: For ΔH<sub>50</sub>, orifice pressure differential that equates to 0.75 cfm (0.0212 m<sup>3</sup>/min) at standard temperature and pressure. Acceptance value is the average of individual values from the average to 20 inches (51 mm) H<sub>2</sub>O.

Approved By: [Redacted]  
 (Palpatu Chasman)  
 Service Manager

Date: 3-Apr-23

## Meter Gamma vs Flowrate



Gamma Y  
 Max Allow Y  
 Min Allow Y

Console Serial

0504003

Console Model

MCG72V

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TEMPERATURE DISPLAY CALIBRATION

Meter Console Information

Console Model :	MC572V
Console serial :	0504003
Temp. Indicator Model :	765-KF
Temp. Indicator Serial :	JC17852

Calibration Conditions

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

Reference Equipment

Temp. Simulator Model :	FLUKE 714B
Serial No. :	60590035

Temperature Sensor Calibration

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

Maximum 1.0  
PASS

**Note**  
1 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	Temperature	Temperature	Temperature
#	°C	°C	°C
Ambient	26.5	26.0	0.5
Heat	100.5	102.0	-1.5

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

Approved By :  
(Signature)  
Service Manager

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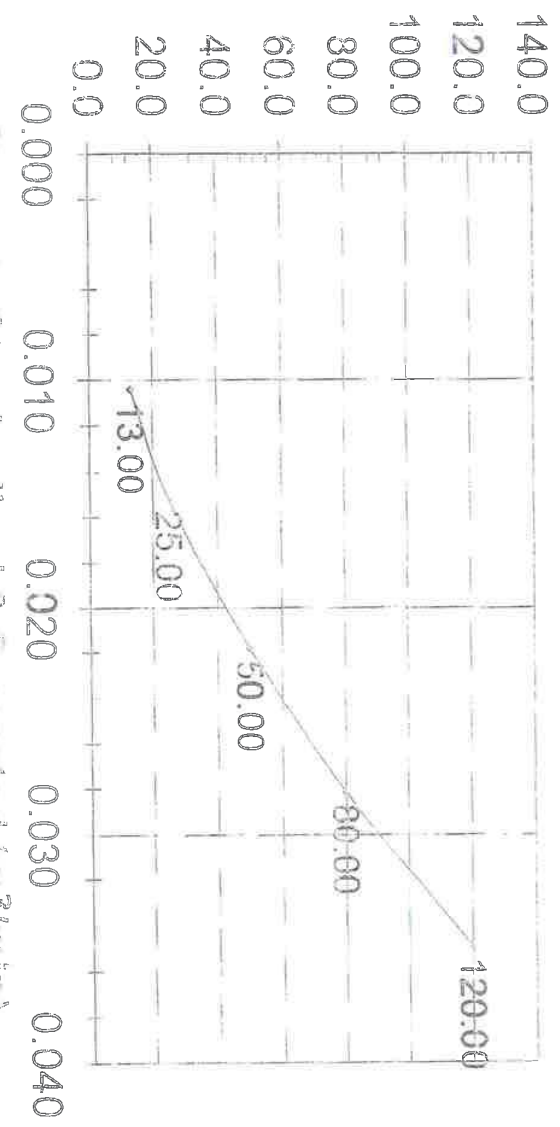
Console Serial: 0504003

WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Console Model: MC572V

COPY

DGM Orifice  $\Delta H$  (mm H2O)



Meter Pressure vs Flowrate

Certificate No: G 650383  
Date of issue: 15-Jun-22

Certificate No.: G 650383

**Instrument description** : Flue gas Analyzer  
**Instrument model** : Testo 350XL  
**Instrument serial no.** : 01807527  
**ID no. or control no.** :  
**Manufacturer** : Testo SE & Co. KGaA  
**Probe description** :  
**Probe model** :  
**Probe serial** :  
**Customer name** : Eastern Thai Consulting 1992 Company Limited  
**Customer address** : 683 Moo 11, Sukhapibarn 8 Road, Nongkham, Si Racha, Chon Buri 20280

**Total pages of certificate** : 3 Pages  
**Receiving no.** : L-222062  
**Receiving date.** : 09-Jun-22  
**Parameter of calibration** : Gas Calibration(Oxygen 2.498,10.00,21.00 %vol, Carbon Monoxide 80.97,309.9,1003 ppm, Nitrogen Dioxide 10.19,80.62,202.2 ppm, Nitric Oxide 10.08,150.9,320.6 ppm, Sulphur Dioxide 50.04,100.9,601.1 ppm)  
**Condition of UUC.** : Used  
**Ambient condition** : All of the Measurement were carried out the stabilized laboratory  
Temperature : 23 ±5 °C  
Humidity : 55 ± 15 %RH  
**Calibration place** : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210  
**Calibration procedure no. :** 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.  
This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).

**Date of calibration** : 15-Jun-22

Mr. Sedlawut Nueathong  
Calibration Technician

Mrs. Nongluck Wongsettee  
Technical Manager

COPY  
Issued Date 26/02/16

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen ( O2 ) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen ( O2 ) 10.00 % Vol	2453/19	Linde	18-Jul-23
Oxygen ( O2 ) 21.00 % Vol	2426/19	Linde	16-Jul-23
Carbon monoxide ( CO ) 80.97 ppm	2842/21	Linde	24-Jun-23
Carbon monoxide ( CO ) 309.9 ppm	2803/21	Linde	22-Jun-23
Carbon monoxide ( CO ) 1003 ppm	2829/21	Linde	23-Apr-23
Nitrogen Dioxide ( NO2 ) 10.19 ppm	3372/21	Linde	02-Aug-23
Nitrogen Dioxide ( NO2 ) 80.62 ppm	3240/21	Linde	25-Jul-23
Nitrogen Dioxide ( NO2 ) 202.2 ppm	3239/21	Linde	20-Jul-23
Nitric Oxide ( NO ) 10.08 ppm	3241/21	Linde	25-Jul-23
Nitric Oxide ( NO ) 150.9 ppm	2857/21	Linde	27-Jun-23
Nitric Oxide ( NO ) 320.6 ppm	2944/21	Linde	02-Jul-23
Sulphur Dioxide ( SO2 ) 50.04 ppm	3205/21	Linde	25-Jul-23
Sulphur Dioxide ( SO2 ) 100.9 ppm	4942/20	Linde	20-Nov-22
Sulphur Dioxide ( SO2 ) 601.1 ppm	3204/21	Linde	20-Jul-23

Measured room conditions

Temperature : 25.1 °C Humidity : 51.8 %RH Pressure : 1011.5 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,000 ml/min Gas pressure : 1021.9 mbar

Calibration Results Before Adjustment (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.498	2.53	0.032	0.20
O2 (%Vol)	10.00	10.01	0.01	0.40
O2 (%Vol)	21.00	21.14	0.14	0.80
CO (ppm)	80.97	83	2.03	2.8
CO (ppm)	309.9	323	13.1	11
CO (ppm)	1003	1050	47	34
NO2 (ppm)	10.19	9.2	-0.99	1.5
NO2 (ppm)	80.62	77.5	-3.12	5.0
NO2 (ppm)	202.2	194.6	-7.6	5.0
NO (ppm)	10.08	8	-2.08	6.0
NO (ppm)	150.9	148	-2.9	5.0
NO (ppm)	320.6	312	-8.6	10
SO2 (ppm)	50.04	46	-4.04	5.0
SO2 (ppm)	100.9	98	-2.9	5.0
SO2 (ppm)	601.1	598	-3.1	14

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Calibration Results After Adjustment (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty ( $\pm$ )
O <sub>2</sub> (%Vol)	2.498	2.53	0.032	0.20
O <sub>2</sub> (%Vol)	10.00	10.01	0.01	0.40
O <sub>2</sub> (%Vol)	21.00	21.14	0.14	0.80
CO (ppm)	80.97	81	0.03	2.8
CO (ppm)	309.9	310	0.1	11
CO (ppm)	1003	1005	2	34
NO <sub>2</sub> (ppm)	10.19	9.2	-0.99	1.5
NO <sub>2</sub> (ppm)	80.62	77.5	-3.12	5.0
NO <sub>2</sub> (ppm)	202.2	194.6	-7.6	5.0
NO (ppm)	10.08	8	-2.08	6.0
NO (ppm)	150.9	148	-2.9	5.0
NO (ppm)	320.6	312	-8.6	10
SO <sub>2</sub> (ppm)	50.04	46	-4.04	5.0
SO <sub>2</sub> (ppm)	100.9	98	-2.9	5.0
SO <sub>2</sub> (ppm)	601.1	598	-3.1	14

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

End of Report

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NSC-TISI-TIS17025  
CALIBRATION 0152

Page 1 of 3

## CERTIFICATE OF CALIBRATION

Certificate No. : 23-006679  
Sample Code : 23-02820-002Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapiban 8 Rd., Nongkham,  
Sriracha, Chonburi 20230Location 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 : 20 January 2023

Date of Calibration : 20 January 2023

## Condition of Calibration

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

## 2. Calibration method

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

## 3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-Pt100)	LB-DA-11 (RTD-138 to RTD-146)	22-040309	21 April 2023

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

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

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

## 6. Condition of calibration item : Normal

Calibrated by

Mr. Sarawoot Thammo

Approved by

Scientist

Issue date

24 January 2023

The uncertainties are for a confidence probability of approximately 95%

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

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

361 Soi Ladprao 122, Ladprao Road,  
Phlabphla, Wang Thonglang, Bangkok 10310TEL 02-516-2422  
FAX 02-516-6949CONTACT@AMARC.CO.TH  
WWW.AMARC.CO.TH  
Effective Date 15/10/NSC-TISI-TIS17025  
CALIBRATION 0152

Page 2 of 3

## REPORT OF CALIBRATION

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

## Results of Calibration

Resolution : 0.5 °C

## 1. Reporting of Temperature

Calibration point (°C)	UUC* 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	104.10	104.08	103.87	103.99	104.08	104.08	103.96	104.01	103.84	0.47	2.00

## 2. Characterization results

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

## Notes

\* UUC\* = Unit Under Calibration

(Mr. Somchai Neampunt)

Signed for Director

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361 Soi Ladprao 122, Ladprao Road,  
Phlabphla, Wang Thonglang, Bangkok 10310TEL 02-516-2422  
FAX 02-516-6949CONTACT@AMARC.CO.TH  
WWW.AMARC.CO.TH  
Effective Date 15/10/21



## REPORT OF CALIBRATION

Certificate No. : 23-006679

Sample Code : 23-02820-002

## Results of Calibration

## Notes

## 1. Sensor installation locations

- 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
- 1.2 The reference sensor is preferably located of the geometric center of the chamber.

## 2. Interior dimensions approx of chamber :

W = 56 cm ; D = 40 cm ; H = 48 cm

## 3. Air valve or fresh air level : Off

## 4. Fan level : Open

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

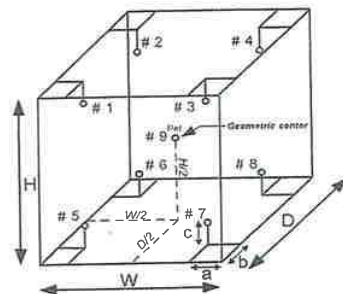
## 6. Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

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

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

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

## 10. Calibration results without adjustment.

Figure: Example of sensor  
installation Positions

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 M300.

- End of Report -

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**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-167/22  
**Equipment** UV/Vis Spectrophotometer  
**Model** UV-1800  
**Manufacturer** Shimadzu  
**Serial No.** A11635101643 CD  
**ID No.** LABE 03/2  
**Date of receipt** 18 May 2022  
**Date of calibration** 18 May 2022  
**Date of issue** 25 May 2022

**Customer name** Eastern Thai Consulting 1992 Co., Ltd.

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

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

**Equipment condition** Good Operation

**Calibration Location** Analysis Department.

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

**Traceability** Wavelength Accuracy is traceable to certificate No. 96367 and 96366  
Photometric Accuracy is traceable to certificate No. 99925 and 100147  
Stray Light is traceable to certificate No. 96346  
The above certificate are traceable to SI unit through Silara Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)

**Calibrated by** Mr.Kanchit Choothep

Approved by

Mr.Kanchit Choothep  
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
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FM-UV-706-02 Rev.01 (23/01/63)



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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

**Certificate No.** BSCC-UV-167/22

Number of Page(s) 2 of 3

**Calibration Results:**  
1.Wavelength Accuracy

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

2.Photometric Accuracy (UV)

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

\*CNR = Customer not request

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FM-UV-706-02 Rev.01 (23/01/63)



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www.barascientific.com



## Certificate of Calibration

Certificate No. BSCC-UV-167/22

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	0.0000	0.0000	0.0042
	0.5472	0.5481	0.0009	0.0042
	0.7637	0.7636	-0.0001	0.0042
	1.0480	1.0487	0.0017	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5371	0.5377	0.0006	0.0042
	0.7457	0.7451	-0.0006	0.0042
	1.0233	1.0240	0.0016	0.0042
465.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
546.1	0.0000	0.0000	0.0000	0.0042
	0.5006	0.5006	0.0000	0.0042
	0.6961	0.6944	-0.0017	0.0042
	0.9563	0.9550	-0.0013	0.0042
590.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
635.0	0.0000	0.0000	0.0000	0.0042
	0.5137	0.5137	0.0000	0.0042
	0.6907	0.6891	-0.0016	0.0042
	0.9533	0.9519	-0.0014	0.0042

\*CNR = Customer not request

#### 4. Stray Light\*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)		
	Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.91 $\pm$ 0.11nm	201.10	0.9543	2.0204

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

\*Stray Light not NSC-ONSC Accredited.

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

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

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MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

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



## CALIBRATION CERTIFICATE

Certificate No. : AD2207-309-0002

Date Issued : 03-Aug-22

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

**Equipment** : Area Heat Stress Monitor

**Manufacturer** : TSI  
**Model** : QUESTemp 34

**Serial No.** : TEU080011

**ID No./Tag No.** : NO.10

**Date Received** : 27-Jul-22

**Date Calibrated** : 31-Jul-22

**Calibrated by** : Mr. Apiwat Peanrungrat

### Calibration Method or Calibration Procedure Used

In-house method : CP-19 by comparing against Standard Digital Humidity / Temperature Meter

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

### Result of Calibration

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

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Approved by:

( Mr. Nathapong Krudaum)



Page 1 of 2

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Certificate No. : AD2207-309-0002

Environment : Ambient Temperature :  $(25 \pm 2) ^\circ\text{C}$

Relative Humidity :  $(50 \pm 15)\%RH$

STD Reading ( $^\circ\text{C}$ )	UUC Reading ( $^\circ\text{C}$ )		UUC Error ( $^\circ\text{C}$ )	Measurement Uncertainty ( $\pm^\circ\text{C}$ )
	Before Adjusted	After Adjusted		
38.00	WET 38.1	-	0.10	0.35
38.00	DRY 37.9	-	-0.10	0.35
38.00	GLOBE 37.9	-	-0.10	0.35
44.98	WET 45.0	-	0.02	0.35
44.98	DRY 44.7	-	-0.28	0.35
44.98	GLOBE 45.0	-	0.02	0.35

STD = Standard

UUC = Unit Under Calibration

Description of UUC : Range (-5) to 100  $^\circ\text{C}$   
Resolution 0.1  $^\circ\text{C}$

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

MIT Certificate No. AD2111-077-0001 for Digital Thermometer with Probe (Fluke) Serial No. 5856603, Due 11-Nov-22

End of Certificate

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Tel.: 0-2865-4647-8 Fax: 0-2865-4649 http://www.mit.in.th



## CALIBRATION CERTIFICATE

Certificate No. : AD2207-309-0003

Date Issued : 03-Aug-22

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

**Equipment** : Area Heat Stress Monitor

**Manufacturer** : TSI

**Model** : QUESTemp 34

**Serial No.** : TEU080012

**ID No./Tag No.** : NO.11

**Date Received** : 27-Jul-22

**Date Calibrated** : 31-Jul-22

**Calibrated by** : Mr. Apiwat Peanrungrat

### Calibration Method or Calibration Procedure Used

In-house method : CP-19 by comparing against Standard Digital Humidity / Temperature Meter

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

### Result of Calibration

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

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Approved by:



(Mr. Nathapong Krudaum)



Page 1 of 2

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Certificate No. : AD2207-309-0003

Environment : Ambient Temperature :  $(25 \pm 2) ^\circ\text{C}$

Relative Humidity :  $(50 \pm 15)\%\text{RH}$

STD	UUC Reading ( $^\circ\text{C}$ )		UUC Error	Measurement
Reading ( $^\circ\text{C}$ )	Before Adjusted	After Adjusted	( $^\circ\text{C}$ )	Uncertainty ( $\pm^\circ\text{C}$ )
38.00	WET 38.1	*	0.10	0.35
38.00	DRY 38.1	*	0.10	0.35
38.00	GLOBE 37.9	*	-0.10	0.35
44.98	WET 45.2	*	0.22	0.35
44.98	DRY 45.2	*	0.22	0.35
44.98	GLOBE 44.9	*	-0.08	0.35

Marked \* are not included in the NSC-ONSC accreditation schedule for our laboratory.

STD = Standard

UUC = Unit Under Calibration

Description of UUC : Range  $(-5) \text{ to } 100 ^\circ\text{C}$   
Resolution 0.1  $^\circ\text{C}$

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

MIT Certificate No. AD2111-077-0001 for Digital Thermometer with Probe (Fluke) Serial No. 5856603, Due 11-Nov-22

End of Certificate

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## CALIBRATION CERTIFICATE

Certificate No. : L202208158-001

Date Issued : 19-Aug-22

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

**Equipment** : Area Heat Stress Monitor

**Manufacturer** : TSI

**Model** : QUESTEMP 34

**Serial No.** : TEU080014

**ID No./Tag No.** : No.13

**Date Received** : 15-Aug-22

**Date Calibrated** : 18-Aug-22

**Calibrated by** : Mr. Apiwat Peanrungrat

### Calibration Method or Calibration Procedure Used

In-house method : CP-19 by comparing against Standard Digital Humidity / Temperature Meter

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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Certificate No. : L202208158-001

**Environment** : Ambient Temperature :  $(25 \pm 2) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 15)\% \text{RH}$

STD Reading ( $^\circ\text{C}$ )	UUC Reading ( $^\circ\text{C}$ )		UUC Error ( $^\circ\text{C}$ )	Measurement Uncertainty ( $\pm ^\circ\text{C}$ )
	Before Adjusted	After Adjusted		
37.99	WET 38.1	-	0.11	0.35
37.99	DRY 38.0	-	0.01	0.35
37.99	GLOBE 38.1	-	0.11	0.35
44.98	WET 45.0	-	0.02	0.35
44.98	DRY 44.9	-	-0.08	0.35
44.98	GLOBE 45.0	-	0.02	0.35

STD = Standard

UUC = Unit Under Calibration

**Description of UUC :** Range (-5) to 100  $^\circ\text{C}$   
Resolution 0.1  $^\circ\text{C}$

Condition As-Received : Used Item

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

**Measurement Standards Used & Traceability :**

The International System of Units (SI) through

MIT Certificate No. AD2111-077-0001 for Digital Thermometer with Probe (Fluke) Serial No. 5856603, Due 11-Nov-22

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## CALIBRATION CERTIFICATE

Certificate No. : AD2207-309-0002

Date Issued : 03-Aug-22

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

**Equipment** : Area Heat Stress Monitor

**Manufacturer** : TSI

**Model** : QUESTemp 34

**Serial No.** : TEU080011

**ID No./Tag No.** : NO.10

**Date Received** : 27-Jul-22

**Date Calibrated** : 31-Jul-22

**Calibrated by** : Mr. Apiwat Peanrungrot

### Calibration Method or Calibration Procedure Used

In-house method : CP-19 by comparing against Standard Digital Humidity / Temperature Meter

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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Certificate No. : AD2207-309-0002

**Environment** : Ambient Temperature :  $(25 \pm 2) ^\circ\text{C}$

Relative Humidity :  $(50 \pm 15)\%RH$

STD Reading ( $^\circ\text{C}$ )	UUC Reading ( $^\circ\text{C}$ )		UUC Error ( $^\circ\text{C}$ )	Measurement Uncertainty ( $\pm^\circ\text{C}$ )
	Before Adjusted	After Adjusted		
38.00	WET 38.1	-	0.10	0.35
38.00	DRY 37.9	-	-0.10	0.35
38.00	GLOBE 37.9	-	-0.10	0.35
44.98	WET 45.0	-	0.02	0.35
44.98	DRY 44.7	-	-0.28	0.35
44.98	GLOBE 45.0	-	0.02	0.35

STD = Standard

UUC = Unit Under Calibration

Description of UUC : Range  $(-5) \text{ to } 100 ^\circ\text{C}$   
Resolution 0.1  $^\circ\text{C}$

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

MIT Certificate No. AD2111-077-0001 for Digital Thermometer with Probe (Fluke) Serial No. 5856603. Due 11-Nov-22

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## CALIBRATION CERTIFICATE

Certificate No. : AD2207-309-0003

Date Issued : 03-Aug-22

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

Equipment : Area Heat Stress Monitor

Manufacturer : TSI

Model : QUESTemp 34

Serial No. : TEU080012

ID No./Tag No. : NO.11

Date Received : 27-Jul-22

Date Calibrated : 31-Jul-22

Calibrated by : Mr. Apiwat Peanrungrat

### Calibration Method or Calibration Procedure Used

In-house method : CP-19 by comparing against Standard Digital Humidity / Temperature Meter

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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Certificate No. : AD2207-309-0003

Environment : Ambient Temperature :  $(25 \pm 2) ^\circ\text{C}$

Relative Humidity :  $(50 \pm 15)\% \text{RH}$

STD Reading ( $^\circ\text{C}$ )	UUC Reading ( $^\circ\text{C}$ )		UUC Error ( $^\circ\text{C}$ )	Measurement Uncertainty ( $\pm^\circ\text{C}$ )
	Before Adjusted	After Adjusted		
38.00	WET 38.1	-	0.10	0.35
38.00	DRY 38.1	-	0.10	0.35
38.00	GLOBE 37.9	-	-0.10	0.35
44.98	WET 45.2	-	0.22	0.35
44.98	DRY 45.2	-	0.22	0.35
44.98	GLOBE 44.9	-	-0.08	0.35

Marked \* are not included in the NSC-ONSC accreditation schedule for our laboratory.

STD = Standard

UUC = Unit Under Calibration

Description of UUC : Range (-5) to 100  $^\circ\text{C}$   
Resolution 0.1  $^\circ\text{C}$

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

MIT Certificate No. AD2111-077-0001 for Digital Thermometer with Probe (Fluke) Serial No. 5856603, Due 11-Nov-22

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## CALIBRATION CERTIFICATE

Certificate No. : AD2206-362-0001

Date Issued : 06-Jul-22

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

**Equipment** : Area Heat Stress Monitor

**Manufacturer** : TSI

**Model** : Questemp 34

**Serial No.** : TEU 080013

**ID No./Tag No.** : No.12

**Date Received** : 30-Jun-22

**Date Calibrated** : 04-Jul-22

**Calibrated by** : Mr. Apiwat Peanrungrot

### Calibration Method or Calibration Procedure Used

In-house method : CP-19 by comparing against Standard Digital Humidity / Temperature Meter

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

### Result of Calibration

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

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Approved by:



(Mr. Nathapong Krudaum)



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Certificate No. : AD2206-362-0001

Environment : Ambient Temperature :  $(25 \pm 2) ^\circ\text{C}$

Relative Humidity :  $(50 \pm 15)\% \text{RH}$

STD Reading ( $^\circ\text{C}$ )	UUC Reading ( $^\circ\text{C}$ )		UUC Error ( $^\circ\text{C}$ )	Measurement Uncertainty ( $\pm^\circ\text{C}$ )
	Before Adjusted	After Adjusted		
37.97	WET 37.9	-	-0.07	0.35
37.97	DRY 37.8	-	-0.17	0.35
37.97	GLOBE 38.1	-	0.13	0.35
44.97	WET 44.9	-	-0.07	0.35
44.97	DRY 44.8	-	-0.17	0.35
44.97	GLOBE 45.2	-	0.23	0.35

STD = Standard

UUC = Unit Under Calibration

Description of UUC : Range 0 to 100  $^\circ\text{C}$   
Resolution 0.1  $^\circ\text{C}$

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

MIT Certificate No. AD2111-077-0001 for Digital Thermometer with Probe (Fluke) Serial No. 5856603, Due 11-Nov-22

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0021

MTC No. EEL. BP. 35/1065

## CALIBRATION CERTIFICATE

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

Address : 683 Moo 11 Sukaphibal8 Rd., Nongkham, Sriracha, Chonburi 20230.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.  
: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

### Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : Rion

Model : NC-75

Serial No. : 34802645

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.

7. Condenser Microphone B&K 4180 S/N 2633526.

### Ambient Environment

Temperature :  $(23 \pm 3) ^\circ\text{C}$

Relative Humidity :  $(50 \pm 15) \%$

Ambient Pressure :  $(101.325 \pm 1.500) \text{ kPa}$

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 10 Oct. 2022

Date of Calibration : 18 Oct. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0021

MTC No. EEL. BP. 35/1065

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

Nominal Output of Unit Under Test = 94 dB re 20 $\mu$ Pa at 1000 Hz

Acoustic Output in dB re 20 $\mu$ Pa, Corrected to Reference Conditions : 101.325 kPa, 23.0 $^\circ\text{C}$  and 50 %RH

### 1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.98	-0.02	$\pm 0.10$	$\pm 0.40 \text{ dB}$

### 2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1000.0	0.0	$\pm 1.5$	$\pm 1.0\%$

### 3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	0.30	$\pm 0.50$	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Deechaiyae)

Approved by :

(Mr. Phawadee Kiatayapa)

**TISTR**

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 18 Oct. 2022

Date of Issue : 19 Oct. 2022

Ref : 2011265101004372001

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0322

MTC No. EEL. BP. 119/0266

## CALIBRATION CERTIFICATE

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

### Instrument Calibrated :

**Description** : Sound Level Meter  
**Manufacturer** : Cirrus  
**Model** : CR-172A  
**Serial No.** : G301039 (No.30)  
**Microphone** : Cirrus MK216 No.412988E  
**Preamplifier** : No.10403F

### Ambient Environment

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

### Standards used :

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

**Date of Receipt** : 20 Feb. 2023  
**Date of Calibration** : 13-17 Mar. 2023

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 Amphoe Muang, Changwat Samutprakan 10280, Thailand  
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 Fax. (66) 0 2323 9165  
 E-mail : mtr@tistr.or.th

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 E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0322

MTC No. EEL. BP. 119/0266

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

### Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

**Date of Calibration** : 13-17 Mar. 2023

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

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FM.BL.MTC.002 Rev.4

### 1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
93.96	93.3	93.7	-0.3	1.0	0.30	N/A

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

### 2. Self-generated noise

#### 2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20.9	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	under-range	-	N/A
C-Weight	19.1	0.10	N/A
Flat	29.1	0.10	N/A

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

Date of Calibration : 13-17 Mar. 2023

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

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FM.BL.MTC.002 Rev

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

### 3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.5	0.3	0.2	1.5	0.45	0.6
1 000	-0.3	-0.3	-0.2	1.0	0.45	0.6
8 000	-3.5	-3.3	-3.2	5.0	0.45	0.7

### 4. Electrical signal test of frequency weightings

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

Date of Calibration : 13-17 Mar. 2023

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### 5. Long-term stability

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

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

#### 6.1 Frequency weightings at 1 kHz

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

#### 6.2 Time weightings at 1 kHz

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

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

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
140	140.0	0.0	1.1	0.30	0.3
139	139.0	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	83.9	-0.1	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3
59	59.0	0.0	1.1	0.30	0.3
54	54.0	0.0	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	39.1	0.1	1.1	0.30	0.3

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

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
34	34.4	0.4	1.1	0.30	0.3
29	29.4	0.4	1.1	0.30	0.3
24	24.7	0.7	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 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
20-140	114.0	114.0	0.0	1.1	0.30	0.3

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

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

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
20-140	25	25.1	0.1	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 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
Fast	200	136.0	0.0	$\pm 1.0$	0.20	0.3
	2	119.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	109.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	129.5	-0.1	$\pm 1.0$	0.20	0.3
	2	110.0	0.0	+1.0; -5.0	0.20	0.3
SEL	200	109.9	0.0	$\pm 1.0$	0.20	0.3
	2	129.5	0.0	+1.0; -2.5	0.20	0.3
	0.25	110.0	-0.1	+1.5; -5.0	0.20	0.3

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#### 10. Peak C sound level

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

#### 11. Overload indication

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

#### 12. High-level stability

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

Calibrated by :



(Mr. Pannasit Phasingsri)

Approved by :



(Mr. Prawat Kimsaipa)



Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Ref : 2011266022000726001

Date of Calibration : 13-17 Mar. 2023

Date of Issue : 17 Mar. 2023

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL. BP. 121/0266

Request No. 21-66/0322

## CALIBRATION CERTIFICATE

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

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

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

### Instrument Calibrated :

Description : Sound Level Meter

Manufacturer : Cirrus

Model : CR:172A

Serial No. : G301638 (No.33)

Microphone : Cirrus MK216 No.412753E

Preamplifier : No.10402F

### Ambient Environment

Temperature :  $(23 \pm 3) ^\circ\text{C}$

Relative Humidity :  $(50 \pm 15) \%$

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

### Standards used :

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

Date of Receipt : 20 Feb. 2023

Date of Calibration : 13-17 Mar. 2023

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MTC No. EEL. BP. 121/0266

Request No. 21-66/0322

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

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

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

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

### Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

Date of Calibration : 13-17 Mar. 2023

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### 1. Absolute Sensitivity

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

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

### 2. Self-generated noise

#### 2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20.9	0.10	N/A

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

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

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

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### 3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.4	0.2	0.2	1.5	0.45	0.6
1 000	0.3	0.3	0.3	1.0	0.45	0.6
8 000	-4.8	-4.6	-4.9	5.0	0.45	0.7

### 4. Electrical signal test of frequency weightings

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

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### 5. Long-term stability

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

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

#### 6.1 Frequency weightings at 1 kHz

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

#### 6.2 Time weightings at 1 kHz

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

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL. BP. 121/0266

Request No. 21-66/0322

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

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

Date of Calibration : 13-17 Mar. 2023

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FM.BL.MTC.002 Rev.4

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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 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
34	33.7	-0.3	1.1	0.30	0.3
29	28.7	-0.3	1.1	0.30	0.3
24	23.7	-0.3	1.1	0.30	0.3

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

At reference sound level on the reference level range

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

Date of Calibration : 13-17 Mar. 2023

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

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

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

### 9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
Fast	200	136.0	0.0	$\pm 1.0$	0.20	0.3
	2	119.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	109.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	129.6	0.0	$\pm 1.0$	0.20	0.3
	2	110.0	0.0	+1.0; -5.0	0.20	0.3
SEL	200	109.9	0.0	$\pm 1.0$	0.20	0.3
	2	129.6	0.0	+1.0; -2.5	0.20	0.3
	0.25	110.0	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 13-17 Mar. 2023

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MTC No. EEL BP. 121/0266

Request No. 21-66/0322

#### 10. Peak C sound level

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

#### 11. Overload indication

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

#### 12. High-level stability

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

Calibrated by :



(Mr. Pannasit Phasingsri)

Approved by :



(Mr. Prawate Klaiyap)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011266022000726003

Date of Calibration : 13-17 Mar. 2023

Date of Issue : 17 Mar. 2023

End of Certificate

COPY 9/9

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0181

MTC No. EEL. BP. 5/0166

## CALIBRATION CERTIFICATE

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

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

**Calibrated at** : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

### Instrument Calibrated :

Description : Sound Level Meter

Manufacturer : Cirrus

Model : CR-172A

Serial No. : G301660

Microphone : MK216 PM2 No.414171B

Preamplifier : PA40 No.10093F

### Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

### Ambient Environment

Temperature :  $(23 \pm 3) ^\circ\text{C}$

Relative Humidity :  $(50 \pm 15) \%$

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

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

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

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL. BP. 5/0166

Request No. 21-66/0181

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

### Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

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

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FM.BL.MTC.002 Rev.

### 1. Absolute Sensitivity

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

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

### 2. Self-generated noise

#### 2.1 Normal test

Measured value (dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
20.6	0.10	N/A

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

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

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

Date of Calibration : 16-19 Jan. 2023

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### 3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
	A-weight	C-weight	Flat			
125	0.3	0.1	0.0	1.5	0.45	0.6
1 000	-0.3	-0.3	-0.3	1.0	0.45	0.6
8 000	-1.2	-1.1	-1.1	5.0	0.45	0.7

### 4. Electrical signal test of frequency weightings

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

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Request No. 21-66/0181

MTC No. EEL. BP. 5/0166

### 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

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Request No. 21-66/0181

MTC No. EEL. BP. 5/0166

### 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)
139	139.1	0.1	1.1	0.30	0.3
134	134.0	0.0	1.1	0.30	0.3
129	129.0	0.0	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	93.9	-0.1	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	83.9	-0.1	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	68.9	-0.1	1.1	0.30	0.3
64	63.9	-0.1	1.1	0.30	0.3
59	58.9	-0.1	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3
49	48.9	-0.1	1.1	0.30	0.3
44	43.9	-0.1	1.1	0.30	0.3

Date of Calibration : 16-19 Jan. 2023

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

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

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

At reference sound level on the reference level range

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

Date of Calibration : 16-19 Jan. 2023

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

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

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

### 9. Tone burst response

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

Date of Calibration : 16-19 Jan. 2023

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MTC No. EEL. BP. 5/0166

Request No. 21-66/0181

#### 10. Peak C sound level

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

#### 11. Overload indication

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

#### 12. High-level stability

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

Calibrated by :

(Mr. Pannasit Phasingsri)

Approved by :

(Mr. Pannasit Phasingsri)

Director

Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 16-19 Jan. 2023

Date of Issue : 25 Jan. 2023

Ref : 2011265122805497003

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0140

MTC No. EEL-BP. 27/1265

## CALIBRATION CERTIFICATE

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

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

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre,  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A-Muang, Samutprakan 10280.

### Instrument Calibrated :

Description : Sound Level Meter

Manufacturer : Cirrus

Model : CR-172A

Serial No. : G300957 (No.28)

Microphone : MK216 No.4124158

Preamplifier : 9371F

### Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

### Ambient Environment

Temperature :  $(23 \pm 3) ^\circ\text{C}$

Relative Humidity :  $(50 \pm 15) \%$

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

Date of Receipt : 7 Dec, 2022

Date of Calibration : 23 Dec, 2022

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Request No. 21-66/0140

MTC No. EEL-BP. 27/1265

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

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

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

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

### Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

Date of Calibration : 23 Dec, 2022

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### 1. Absolute Sensitivity

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

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

### 2. Self-generated noise

#### 2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
15.9	0.10	N/A

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

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

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

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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	-0.3	-0.3	±1.5	0.45	0.6
1 000	0.0	0.1	0.0	±1.0	0.45	0.6
8 000	-1.7	-1.7	-1.4	±5.0	0.45	0.7

### 4. Electrical signal test of frequency weightings

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

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MTC No. EEL-BP-27/1265

### 5. Long-term stability

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

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

#### 6.1 Frequency weightings at 1 kHz

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

#### 6.2 Time weightings at 1 kHz

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

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

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

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

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

## 8. Level linearity including the level range control

At reference sound level on the reference level range

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

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## 8. Level linearity including the level range control

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

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

## 9. Tone burst response

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

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Request No. 21-66/0140

MTC No. EEL. BP. 27/1265

10. Peak C sound level

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

11. Overload indication

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

12. High-level stability

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

Calibrated by

(Mr. Wittawat Supanich)

Approved by



Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 23 Dec. 2022

Date of Issue : 23 Dec. 2022

Ref : 2011265120705238001

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0774

MTC No. EEL. BP. 43/0965

## CALIBRATION CERTIFICATE

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

### Instrument Calibrated :

**Description** : Sound Level Meter  
**Manufacturer** : Cirrus  
**Model** : CR:172A  
**Serial No.** : G301635  
**Microphone** : Cirrus MK216 No.413415B  
**Preamplifier** : No.10085F

### Ambient Environment

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

### Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2633526.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

**Date of Receipt** : 19 Sep. 2022

**Date of Calibration** : 6-7 Oct. 2022

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Request No. 21-65/0774

MTC No. EEL. BP. 43/0965

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

### Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

**Date of Calibration** : 6-7 Oct. 2022

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

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
93.87	94.3	93.7	-0.2	1.0	0.30	N/A

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

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
18.2	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	under-range	-	N/A
C-Weight	19.2	0.10	N/A
Flat	30.4	0.10	N/A

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

Date of Calibration : 6-7 Oct. 2022

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.3	0.0	0.0	±1.5	0.45	0.6
1 000	-0.3	-0.3	-0.3	±1.0	0.45	0.6
8 000	-1.5	-1.4	-1.2	±5.0	0.45	0.7

4. Electrical signal test of frequency weightings

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

Date of Calibration : 6-7 Oct. 2022

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Request No. 21-65/0774

MTC No. EEL. BP. 43/0965

### 5. Long-term stability

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

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

#### 6.1 Frequency weightings at 1 kHz

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

#### 6.2 Time weightings at 1 kHz

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

Date of Calibration : 6-7 Oct. 2022

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Request No. 21-65/0774

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

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
140	140.0	0.0	0.8	0.30	0.3
139	139.0	0.0	0.8	0.30	0.3
134	134.0	0.0	0.8	0.30	0.3
129	129.0	0.0	0.8	0.30	0.3
124	124.0	0.0	0.8	0.30	0.3
119	119.0	0.0	0.8	0.30	0.3
114	114.0	0.0	0.8	0.30	0.3
109	109.0	0.0	0.8	0.30	0.3
104	104.0	0.0	0.8	0.30	0.3
99	99.0	0.0	0.8	0.30	0.3
94	94.0	0.0	0.8	0.30	0.3
49	49.0	0.0	0.8	0.30	0.3
44	43.9	-0.1	0.8	0.30	0.3
39	39.0	0.0	0.8	0.30	0.3
34	34.0	0.0	0.8	0.30	0.3
29	29.0	0.0	0.8	0.30	0.3
24	24.1	0.1	0.8	0.30	0.3

Date of Calibration : 6-7 Oct. 2022

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8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20-140	114.0	114.0	0.0	0.8	0.30	0.3

8. Level linearity including the level range control

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

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20-140	25	115.0	90.0	0.8	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	136.0	0.0	±1.0	0.20	0.3
	2	119.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	109.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	129.6	0.0	±1.0	0.20	0.3
	2	110.0	0.0	+1.0; -5.0	0.20	0.3
SEL	200	130.0	0.0	±1.0	0.20	0.3
	2	110.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	100.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 6-7 Oct. 2022

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#### 10. Peak C sound level

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

#### 11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle				
139.1	139.1	0.0	2.0	0.20	0.25

#### 12. High-level stability

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

Calibrated by

(Mr. Pannasit Phasingsri)

Approved by



Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 6-7 Oct. 2022

Date of Issue : 7 Oct. 2022

Ref : 2011265091904119001

End of Certificate

9 / 9

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Page 1 of 4

Certificate No. : 23-006683  
Sample Code : 23-02820-006**CERTIFICATE OF CALIBRATION**Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapiban 8 Rd., Nongkham,  
Sriracha, Chonburi 20230Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.  
(Analytical Balance Room)

Equipment : ELECTRONIC BALANCE

Manufacturer : METTLER TOLEDO

Model : XS205DU

Serial No. : 1126323724

ID No. : LABE 05/1

Date of Receipt : 20 January 2023

Date of Calibration : 20 January 2023

Calibrated by Mr. Thanadol Pholthep  
ScientistApproved by (Mr. Somchai Neampunt)  
Signed for Director

Issue date 25 January 2023

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

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

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

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Page 2 of 4

Certificate No. : 23-006683  
Sample Code : 23-02820-006**REPORT OF CALIBRATION**Equipment : ELECTRONIC BALANCE  
Manufacturer : METTLER TOLEDO  
Model : XS205DU  
Capacity : Max 81 g / 220 g  
Resolution : 0.01 mg / 0.1 mg  
Serial No. : 1126323724  
ID No. : LABE 05/1**Result of Calibration****1. Test weight and repeatability of reading**

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

Unit : g	Range : 80	<input type="checkbox"/> Before adjustment	<input type="checkbox"/> After adjustment
<input checked="" type="checkbox"/> No adjustment	Nominal value	40	30
<input type="checkbox"/> Adjustment	Standard weight	40.000042	60.000045
	Average reading of indicator	40.00015	90.00019
	Standard deviation	0.000004	0.000007

Unit : g	Range : 200	<input type="checkbox"/> Before adjustment	<input type="checkbox"/> After adjustment
<input checked="" type="checkbox"/> No adjustment	Nominal value	100	200
<input type="checkbox"/> Adjustment	Standard weight	100.000022	200.000199
	Average reading of indicator	100.0001	200.0004
	Standard deviation	0.00004	0.00008

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

## REPORT OF CALIBRATION

### Result of Calibration

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

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

Unit : g

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

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

Unit : g

Nominal Value	Standard Value	Average Reading of Indicator	Correction Value	Expanded Uncertainty	Coverage Factor (k)
Unload	0.0000000	0.00000	0.00000	0.0000090	2.01
0.01	0.0100036	0.01000	0.00000	0.0000093	2.01
0.1	0.1000062	0.10000	0.00001	0.000012	2.00
1	1.0000036	1.00001	-0.00001	0.000014	2.00
5	5.0000044	5.00003	-0.00003	0.000020	2.00
10	10.0000000	10.00007	-0.00007	0.000032	2.00
20	20.000016	20.00011	-0.00009	0.000036	2.00
50	50.000029	50.00013	-0.00010	0.000067	2.00
100	100.000022	100.0001	-0.0001	0.00016	2.00
150	150.000051	150.0001	0.0000	0.00023	2.00
200	200.000199	200.0003	-0.0001	0.00028	2.00

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

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

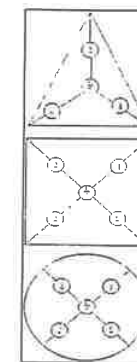
## REPORT OF CALIBRATION

### Result of Calibration :

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

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

Weighing pan	<input type="radio"/> Circle <input type="radio"/> Triangular <input checked="" type="radio"/> Rectangular	Test weight : 50 and 100 Unit : g
Range	80	200
Position	Reading of indicator	Reading of indicator
1	50.00014	100.0001
2	50.00014	99.9998
3	50.00006	100.0000
4	50.00010	100.0001
5	50.00017	100.0001
6	50.00014	100.0001
Maximum difference	0.00008	0.0003



### Condition of Calibration

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

3. Condition of Calibration item: Normal

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

- Through the reference standard laboratory of Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (Instrument number 1).

5. Reference standard instrument :

Instrument	Class	ID No.	Certificate No.	Due Date
1) STANDARD WEIGHT 1 mg to 1 kg	E2	LB-WE-57	22-080639	27 June 2023

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

- End of Report -



Certificate No. : 23-006682  
Sample Code : 23-02820-005

## CERTIFICATE OF CALIBRATION

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

Date of Calibration : 20 January 2023

Calibrated by : Mr. Thanadol Pholthep  
Scientist

Approved by

(Mr. Somchai Neampunt)

Signed for Director

Issue date : 25 January 2023

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

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

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



Certificate No. : 23-006682  
Sample Code : 23-02820-005

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

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



Certificate No. : 23-006682  
Sample Code : 23-02820-005

## REPORT OF CALIBRATION

## Result of Calibration

## 2. Sensitivity or value of a scale division

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

Unit : g

Range : 220

Test Point	Sensitivity, S
0	0.9980
100	0.9980
200	0.9980

Range :

Test Point	Sensitivity, S
------------	----------------

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

Unit : g

Nominal Value	Standard Value	Average Reading of Indicator	Correction Value	Expanded Uncertainty	Coverage Factor (k)
Unload	0.0000000	0.0000	0.0000	0.00011	2.04
0.01	0.0100036	0.0100	0.0000	0.00011	2.04
0.1	0.1000062	0.1000	0.0000	0.00011	2.04
1	1.0000036	1.0000	0.0000	0.00011	2.04
2	2.0000128	2.0000	0.0000	0.00011	2.04
5	5.0000044	5.0000	0.0000	0.00011	2.04
10	10.0000000	10.0000	0.0000	0.00011	2.03
20	20.000016	20.0000	0.0000	0.00012	2.03
50	50.000029	50.0000	0.0000	0.00013	2.02
100	100.000022	99.9998	0.0002	0.00017	2.01
200	200.000199	200.0000	0.0002	0.00028	2.00

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



Certificate No. : 23-006682  
Sample Code : 23-02820-005

## REPORT OF CALIBRATION

## Result of Calibration :

## 4. Eccentric or off-centre loading

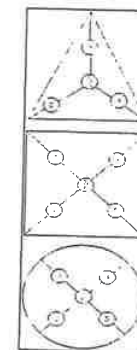
Deviation of the measurement value through off - center (eccentric) loading. The corner load increases with the weight of the load and its removal from the center of the pan support.

Weighing pan ☒ Circle  
☐ Triangular  
☐ Rectangular

Test weight : 100

Unit : g

Range	Position	Reading of indicator	Reading of indicator
220			
	1	99.9998	
	2	100.0001	
	3	99.9997	
	4	99.9998	
	5	99.9998	
	6	99.9998	
Maximum difference		0.0003	



## Condition of Calibration

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

- Condition of Calibration item: Normal

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

- Through the reference standard laboratory of Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (Instrument number 1).

- Reference standard instrument :

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

6. Ambient conditions	Min	Max
Temperature (°C)	21.2	22.5
Relative Humidity (%Rh)	37.1	44.3
Air pressure (hPa)	1012.1	1013.0

- End of Report -



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## CERTIFICATE OF CALIBRATION

Certificate No. : 22-136844

Sample Code : 22-51164-006

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

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

Equipment : Temperature controlled enclosures (Incubator)

Manufacturer : N/A Model : N/A

Serial No. : S540040277 ID No. : LABE 19/2

Date of Receipt : 21 December 2022 Date of Calibration : 21 December 2022

## Condition of Calibration

1. Environment
- |                           |         |           |         |           |
|---------------------------|---------|-----------|---------|-----------|
| 1.1 Ambient temperature   | Maximum | 25.1 °C   | Minimum | 24.3 °C   |
| 1.2 Relative humidity     | Maximum | 52.3 %    | Minimum | 48.5 %    |
| 1.3 Line voltage supplied | Maximum | 223.6 VAC | Minimum | 221.9 VAC |

## 2. Calibration method

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

## 3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-Pt100)	LB-DA-11 (RTD-148 to RTD-155, RTD-227)	22-040308	24 April 2023

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

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

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

## 6. Condition of calibration item : Normal

Calibrated by : Mr. Natthan Phosri  
Scientist

Approved by

(Mr. Somchai Neampunt)  
Signed for Director

Issue date : 26 December 2022

The uncertainties are for a confidence probability of approximately 95%

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

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

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Effective Date: 15/10/21

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## REPORT OF CALIBRATION

Certificate No. : 22-136844

Sample Code : 22-51164-006

## Results of Calibration

Resolution : 0.1 °C

## 1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)									Uncertainty ± (°C)	Coverage factor k
			#1	#2	#3	#4	#5	#6	#7	#8	#9 <sup>Ref</sup>		
20	20.0	20.0	19.65	19.56	19.47	19.29	20.96	20.47	20.23	20.58	20.29	0.35	2.00

## 2. Characterization results

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

## Notes

- UUC\* = Unit Under Calibration



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Effective Date: 15/10/21



## REPORT OF CALIBRATION

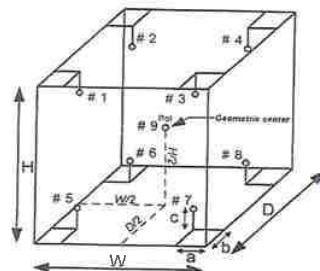
Certificate No. : 22-136844

Sample Code : 22-51164-006

## Results of Calibration

## Notes

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

Figure: Example of sensor  
installation Positions

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

- End of Report -

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## CERTIFICATE OF CALIBRATION

Certificate No. : 23-040768  
Sample Code : 23-16178-002

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

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

Equipment : Temperature controlled enclosures (Incubator)

Manufacturer : Lovibond Model : Tc445S

Serial No. : 0520/005227 ID No. : LABE 19/5

Date of Receipt : 21 April 2023 Date of Calibration : 21 April 2023

## Condition of Calibration

1. Environment
- |                           |           |           |           |           |
|---------------------------|-----------|-----------|-----------|-----------|
| 1.1 Ambient temperature   | : Maximum | 36.1 °C   | : Minimum | 34.5 °C   |
| 1.2 Relative humidity     | : Maximum | 51.8 %    | : Minimum | 49.3 %    |
| 1.3 Line voltage supplied | : Maximum | 224.7 VAC | : Minimum | 221.9 VAC |

## 2. Calibration method

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

## 3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-Pt100)	LB-DA-08 (RTD-239 to RTD-247)	22-077888	09 August 2023

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

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

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

## 6. Condition of calibration item : Normal

Calibrated by : Mr. Sarawoot Thammo

Scientist

Issue date : 24 April 2023

Approved by

(Mr. Somchai Neampunt)

Signed for Director

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

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

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(Effective Date: 15/10/21)



Page 2 of 3

## REPORT OF CALIBRATION

Certificate No. : 23-040768  
Sample Code : 23-16178-002

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

## 2. Characterization results

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

## Notes

- UUC\* = Unit Under Calibration

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## REPORT OF CALIBRATION

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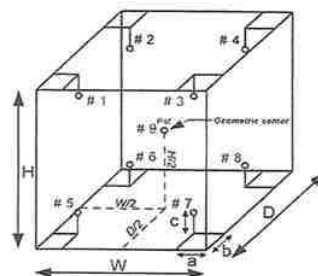
Certificate No. : 23-040768

Sample Code : 23-16178-002

## Results of Calibration

## Notes

1. Sensor installation locations
  - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
  - 1.2 The reference sensor is preferably located of the geometric center of the chamber.
2. Interior dimensions approx of chamber :  
W = 60 cm ; D = 56 cm ; H = 146 cm
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes" Stability of chamber and loading effect in chamber at 20% of uniformity ".
6. Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC\* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

Figure-Example of sensor  
installation Positions

The result expanded uncertainty of measurement  $U$  is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3000.

• End of Report •

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CALIBRATION 0152

Page 1 of 3

## CERTIFICATE OF CALIBRATION

Certificate No. : 23-018635

Sample Code : 23-07651-001

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapiban 8 Rd., Nongkham,

Sriracha, Chonburi 20230

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

(Hot Lab)

Equipment : Temperature controlled enclosures (Hot air oven)

Manufacturer : Memmert

Model : UM 400

Serial No. : 900982

ID No. : LABE 17/1

Date of Receipt : 21 February 2023

Date of Calibration : 21 February 2023

## Condition of Calibration

1. Environment
- |                           |         |           |         |           |
|---------------------------|---------|-----------|---------|-----------|
| 1.1 Ambient temperature   | Maximum | 31.2 °C   | Minimum | 28.7 °C   |
| 1.2 Relative humidity     | Maximum | 50.2 %    | Minimum | 40.1 %    |
| 1.3 Line voltage supplied | Maximum | 223.9 VAC | Minimum | 221.5 VAC |

## 2. Calibration method

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

## 3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data acquisition with sensor (RTD-Pt100)	LB-DA-12 (RTD-158 to RTD-166)	22-040312	02 May 2023

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

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

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

## 6. Condition of calibration item : Normal

Calibrated by : Mr. Sarawoot Thammo

Scientist

Approved by

(Mr. Somchai Neampunt)

Signed for Director

Issue date : 24 February 2023

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

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

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

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CALIBRATION 0152

Page 2 of 3

## REPORT OF CALIBRATION

Certificate No. : 23-018635

Sample Code : 23-07651-001

## Results of Calibration

Resolution : 0.1 °C

## 1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)									Uncertainty ± (°C)	Coverage factor k
			#1	#2	#3	#4	#5	#6	#7	#8	#9 <sup>Ref</sup>		
85	85.0	85.0	85.18	85.04	84.62	84.82	85.03	85.04	85.00	84.96	85.08	0.25	2.00

## 2. Characterization results

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

## Notes

\* UUC\* = Unit Under Calibration



## REPORT OF CALIBRATION

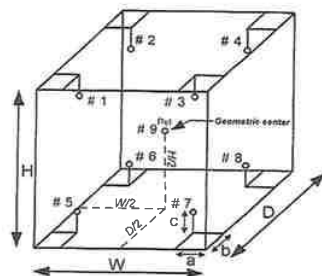
Certificate No. : 23-018635

Sample Code : 23-07651-001

## Results of Calibration

## Notes

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

Figure: Example of sensor  
installation positions

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

- End of Report -

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## Calibration Certificate

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

Page 1 of 3

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

**Calibrated by** Mr.Nuttapol Niyomchat  
 Specialist

**Approved by**

( Mr.Pheraphat Tuanjit )

Manager, Division of Calibration Laboratory

Responsible for the Technical Management Team

**Date of Issue:** 18 November 2022

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65



## Calibration Report

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

Page 2 of 3

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

### Condition of this results of Calibration:

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

### 2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
BLACK STACK THERMOMETER	1560/2560	A39258/A39719	PSL-T 0674/6S	7-Jun-23	TISTR
Platinum Resistance Thermometer (PRT)	5615	808926			

Support Equipment : - Ice point Unit, ID No.: ๓๓๓. 614/21

- Low Temperature Bath (Deep Well Compact Bath), Model: 7381, S/N: 853496.
- Low Temperature Bath (Deep Well Compact Bath), Model: 7341, S/N: A5A084.
- High Temperature Bath (Deep Well Compact Bath), Model: 6331, S/N: A5A087.

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

F-CS-012 Revision: 01 Date: 20-04-65





Foundation for Industrial Development National Food Institute  
Food Industrial Laboratory Service Center

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Foundation for Industrial Development National Food Institute  
Food Industrial Laboratory Service Center



## Calibration Report

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

**Date of Calibration:** 15 November 2022

Page 3 of 3

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

**Calibration result:**

### Reporting of Ice-point or reference point

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

### Reporting of temperature calibration point

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

### Note

\* UUC\* : Unit Under Calibration

**COPY**

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

----- End -----



NSC-TISI-TIS17025  
CALIBRATION 0152

Page 1 of 3

## CERTIFICATE OF CALIBRATION

Certificate No. : 23-011524

Sample Code : 23-04833-001

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

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

Equipment : pH Meter  
Manufacturer : METTLER TOLEDO Model : SevenCompact S220  
Serial No. : B448305208 ID No. : LABE 11/4  
Date of Receipt : 01 February 2023 Date of Calibration : 01 February 2023

## Condition of Calibration

## 1. Environment

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

## 2. Calibration method

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

## 3. Reference standard / Certified reference material

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

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

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

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

## 6. Condition of calibration item : Normal

Calibrated by Mr.Anupong Lakawin  
Scientist

Approved by

(Ms. Pawana Pan-on)

Signed for Director

Issue date 03 February 2023

The uncertainties are for a confidence probability of approximately 95%

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

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

NSC-TISI-TIS17025  
CALIBRATION 0152

Page 2 of 3

## REPORT OF CALIBRATION

Certificate No. : 23-011524

Sample Code : 23-04833-001

Equipment : pH Meter Resolution : 0.01 pH ; 0.1 mV ; 0.1 °C  
Manufacturer : METTLER TOLEDO Model : SevenCompact S220  
Serial No. : B448305208 ID No. : LABE 11/4  
Range : -2.000 pH to 20.000 pH ; ± 2000.0 mV ; -5.0 °C to 130.0 °C

## Results of Calibration

## Part 1. DC Voltage measurement

pH Meter Serial No. : B448305208

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

## Part 2. Performance of Electrode system

Electrode Manufacturer : METTLER TOLEDO Model : InLab Expert Pro-ISM

Electrode Serial No. : 2365921

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

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

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

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NSC-TISI-TIS17025  
CALIBRATION 0152  
Page 3 of 3

## REPORT OF CALIBRATION

Certificate No. : 23-011524

Sample Code : 23-04833-001

Equipment : pH Meter (Digital Thermometer with sensor)

## Thermometer readout

Manufacturer : METTLER TOLEDO Model : SevenCompact S220  
Serial No. : B448305208 ID No. : LABE 11/4  
Resolution : 0.1 °C Range : -5.0 °C to 130.0 °C

## Thermometer sensor

Manufacturer : METTLER TOLEDO Model : InLab Expert Pro-ISM  
Serial No. : 2365921 ID No. : N/A

## Condition of Calibration

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

## 2. Calibration method

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

## 3. Reference standard instrument

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

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

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

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

6. Condition of Calibration item : Normal

## Results of Calibration

Calibration point °C	Average of standard reading °C	Unit under calibration			Expanded uncertainty °C	Coverage factor k
		Immersion depth mm	Average reading °C	Correction value °C		
25	25.002	120	25.0	+ 0.002	± 0.13	2.00

## Notes

- Calibration results without adjustment

The result expanded uncertainty of measurement  $U$  is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M700.

- End of report -

COPY

NSC-TIS1-TIS17025  
CALIBRATION 0152

Page 1 of 3

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

## CERTIFICATE OF CALIBRATION

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

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

Equipment : Standard Weight 50 g

Manufacturer : METTLER TOLEDO

Class : F1

Serial No. : N/A

ID No. : LABE 10/1

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee

Scientist

Approved by

( Mr. Somchai Neampunt )

Signed for Director

Issue date : 31 May 2022

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

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

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

NSC-TIS1-TIS17025  
CALIBRATION 0152

Page 2 of 3

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

## REPORT OF CALIBRATION

Equipment : Standard Weight 50 g  
Manufacturer : METTLER TOLEDO  
Class : F1  
Serial No. : N/A  
ID No. : LABE 10/1

### Result of Calibration :

☒ Without adjustment

☐ Adjustment

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

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

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

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Certificate No. : 22-052238

Sample Code : 22-19150-003

Page 3 of 3

## REPORT OF CALIBRATION

### Condition of Calibration

1. Ambient Conditions : Temperature  $20^{\circ}\text{C} \pm 1.5^{\circ}\text{C}$ , Relative humidity  $50\% \pm 10\%$  and air density  $1.20 \text{ kg/m}^3$ 

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

3. Reference standard instrument

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

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

( Instrument number 1).

5. Condition of Calibration item: Normal

### 6. Description of Calibrated Item :

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

- End of Report -

**COPY**



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

## CERTIFICATE OF CALIBRATION

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

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

Equipment : Standard Weight 100 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/2

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by Mr. Somwang Sangdee  
Scientist

Issue date 31 May 2022

Approved by ( Mr. Somchai Neampunt )  
Signed for Director

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

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

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



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

## REPORT OF CALIBRATION

Equipment : Standard Weight 100 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/2

### Result of Calibration :

☒ Without adjustment

☐ Adjustment

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

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

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

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

Page 3 of 3

## REPORT OF CALIBRATION

## Condition of Calibration

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

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

3. Reference standard instrument

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

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

( Instrument number 1).

5. Condition of Calibration item: Normal

## 6. Description of Calibrated Item :

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

- End of Report -

COPY



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

## CERTIFICATE OF CALIBRATION

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

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

Equipment : Standard Weight 50 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/4

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by Mr. Somwang Sangdee

Scientist

Approved by

( Mr. Somchai Neampunt )

Signed for Director

Issue date 31 May 2022

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

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

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



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

## REPORT OF CALIBRATION

Equipment : Standard Weight 50 g  
Manufacturer : N/A  
Class : N/A  
Serial No. : N/A  
ID No. : LABE 10/4

### Result of Calibration :

☒ Without adjustment

☐ Adjustment

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

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

The result expanded uncertainty of measurement  $U$  is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2.0$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M30

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

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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  $1.18 \text{ kg/m}^3$

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

3. Reference standard instrument

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

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

( Instrument number 1).

5. Condition of Calibration item: Normal

### 6. Description of Calibrated Item :

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

- End of Report -

COPY



**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-152/23  
**Equipment** UV/Vis Spectrophotometer  
**Model** UV-1800  
**Manufacturer** Shimadzu  
**Serial No.** A11635101643 CD  
**ID No.** N/A  
**Date of receipt** 25 April 2023  
**Date of calibration** 25 April 2023  
**Date of issue** 27 April 2023

**Customer name** Eastern Thai Consulting 1992 Co.,Ltd

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

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

**Equipment condition** Good Operation

**Calibration Location** Analysis Department

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

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

**Calibrated by** Mr.Pannaphong Phanmekakul

Approved by



**Mr.Kanchit Choothep**  
Technical Manager

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.**  
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

**Certificate No.** BSCC-UV-152/23

Number of Page(s)

2 of 3

## Calibration Results:

### 1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty ( $\pm$ nm)
287.71	287.65	-0.06	0.18
445.82	445.80	-0.02	0.18
536.52	536.35	-0.17	0.18
741.02	740.99	-0.03	0.18
879.41	879.27	-0.14	0.18

### 2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty ( $\pm$ A)
235	0.0000 0.7311	0.0000 0.7313	0.0000 0.0002	0.0075 0.0075
257	CNR CNR	CNR CNR	CNR CNR	CNR CNR
313	CNR CNR	CNR CNR	CNR CNR	CNR CNR
350	0.0000 0.6306	0.0000 0.6314	0.0000 0.0008	0.0075 0.0075

\*CNR = Customer not request

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

Certificate No. **BSCC-UV-152/23**

Number of Page(s) **3 of 3**

## Calibration Results:

### 3. Photometric Accuracy (Visible)

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

\*CNR = Customer not request

### 4. Stray Light\*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)		
	Wavelength (nm)	Transmission (%)	Absorbance (A)
200.75 $\pm$ 0.11nm	200.72	0.9630	2.0164

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

\*Stray Light not NSC-ONSC Accredited.

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

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

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
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.

# CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 13 February 2023 CERTIFICATE NUMBER 187451

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

Page 1 of 2

Approved signatory  
R. Thomas  
Electronically signed:

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

### Instrument information

Manufacturer: Cirrus Research plc  
Model: CK:110A  
Serial number: CB1500  
Firmware version: 5.4

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

### Test summary

Date of calibration: 10 February 2023

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.  
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.

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

### Test equipment

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

### Notes

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

# CERTIFICATE OF CALIBRATION

Certificate Number.

187451

Page 2 of 2

### Environmental conditions

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

Before	Pressure: 102.25 kPa	Temperature: 22.7 °C	Humidity: 37.1 %
After	Pressure: 102.24 kPa	Temperature: 22.6 °C	Humidity: 37.4 %

### Test results summary

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

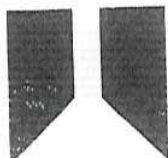
COPY

COPY

# CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 13 February 2023 CERTIFICATE NUMBER 187449



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

Page 1 of 2

Approved signatory  
R.Thomas  
Electronically signed:



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

## Instrument Information

Manufacturer: Cirrus Research plc  
Model: CR:110A  
Serial number: CB1499  
Firmware version: 5.4

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

## Test summary

Date of calibration: 10 February 2023

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.  
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.

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

## Test equipment

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

## Notes

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# CERTIFICATE OF CALIBRATION

Certificate Number:

187449

Page 2 of 2

## Environmental conditions

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

Before	Pressure: 102.26 kPa	Temperature: 22.4 °C	Humidity: 37.0 %
After	Pressure: 102.25 kPa	Temperature: 22.6 °C	Humidity: 36.6 %

## Test results summary

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

COPY

# CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 12 January 2023 CERTIFICATE NUMBER 185807

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

Page 1 of 2

Approved signatory  
N.Smith  
Electronically signed:

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

### Instrument information

Manufacturer: Cirrus Research plc  
Model: CR:110A  
Serial number: CB0644  
Firmware version: 5.4

Notes:

### Test summary

Date of calibration: 11 January 2023

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

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

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

### Test equipment

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

### Notes

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

# CERTIFICATE OF CALIBRATION

Certificate Number:

185807

Page 2 of 2

### Environmental conditions

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

Before Pressure: 99.14 kPa Temperature: 22.5 °C Humidity: 43.1 %  
After Pressure: 99.13 kPa Temperature: 22.5 °C Humidity: 43.6 %

### Test results summary

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

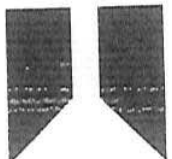
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# CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 13 February 2023 CERTIFICATE NUMBER 187450



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

Page 1 of 2

Approved signatory  
R.Thomas  
Electronically signed:



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

## Instrument Information

Manufacturer: Cirrus Research plc  
Model: CR:110A  
Serial number: CB1498  
Firmware version: 5.4

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

## Test summary

Date of calibration: 10 February 2023

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.  
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.

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

## Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33511B	MY58001553
Attenuator	Cirrus Research	ZE:952	64370
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	40088

## Notes

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# CERTIFICATE OF CALIBRATION

Certificate Number:

187450

Page 2 of 2

## Environmental conditions

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

Before	Pressure: 102.25 kPa	Temperature: 22.4 °C	Humidity: 36.9 %
After	Pressure: 102.24 kPa	Temperature: 22.7 °C	Humidity: 36.6 %

## Test results summary

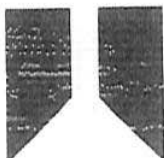
Test	Result
Absolute Acoustic Sensitivity	Complies
Linearity	Complies
Short Duration	Complies
Overload Latching	Complies
Frequency weighting	Complies

COPY

# CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 13 February 2023 CERTIFICATE NUMBER 187452



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

Page 1 of 2

Approved signatory  
R.Thomas  
Electronically signed:



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

## Instrument Information

Manufacturer: Cirrus Research plc  
Model: CR:110A  
Serial number: CB1497  
Firmware version: 5.4

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

## Test summary

Date of calibration: 10 February 2023

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.  
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.

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

## Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33511B	MY58001553
Attenuator	Cirrus Research	ZE:952	64370
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	40088

## Notes

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# CERTIFICATE OF CALIBRATION

Certificate Number:  
187452

Page 2 of 2

## Environmental conditions

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

Before	Pressure: 102.28 kPa	Temperature: 22.6 °C	Humidity: 36.4 %
After	Pressure: 102.28 kPa	Temperature: 22.6 °C	Humidity: 36.7 %

## Test results summary

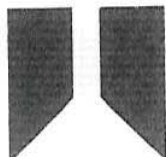
Test	Result
Absolute Acoustic Sensitivity	Complies
Linearity	Complies
Short Duration	Complies
Overload Latching	Complies
Frequency weighting	Complies

COPY

# CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 10 February 2023 CERTIFICATE NUMBER 187443



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

Page 1 of 2

Approved signatory  
R. Thomas  
Electronically signed:



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

## Instrument information

Manufacturer: Cirrus Research plc  
Model: CR:110A  
Serial number: CB1365  
Firmware version: 5.4

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

## Test summary

Date of calibration: 10 February 2023

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.  
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.

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

## Test equipment

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

## Notes

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# CERTIFICATE OF CALIBRATION

Certificate Number:

187443

Page 2 of 2

## Environmental conditions

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

Before Pressure: 102.28 kPa Temperature: 22.6 °C Humidity: 36.4 %  
After Pressure: 102.28 kPa Temperature: 22.5 °C Humidity: 36.7 %

## Test results summary

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

COPY



## THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0021

MTC No. EEL. BP. 35/1065

## CALIBRATION CERTIFICATE

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

Address : 683 Moo 11 Sukaphibal8 Rd., Nongkham, Sriracha, Chonburi 20230.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.  
: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

## Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : Rion

Model : NC-75

Serial No. : 34802645

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.

7. Condenser Microphone B&amp;K 4180 S/N 2633526.

## Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 10 Oct. 2022

Date of Calibration : 18 Oct. 2022

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

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

FM.BL.MTC.002 Rev

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : rumalai@tistr.or.th Website:www.tistr.or.thOffice/Laboratory  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
Fax. (66) 0 2323 9165  
E-mail : mtc@tistr.or.thOffice  
196 Phahonyothin Road, Chatuchak, Bangkok 10901  
Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 8592  
E-mail : sumalee@tistr.or.th

## THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0021

MTC No. EEL. BP. 35/1065

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

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

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

## 1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.98	-0.02	± 0.10	±0.40 dB

## 2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1000.0	0.0	± 1.5	±1.0%

## 3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	0.30	± 0.50	±3.0%

Note : 1. No adjustment.


2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

  
(Mr. Weerachai Deechaiyae)

Approved by :

  
(Mr. Praveen Klonypa)

TISTR

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 18 Oct. 2022

Date of Issue : 19 Oct. 2022

Ref : 2011265101004372001

End of Certificate

2 / 2

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

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

FM.BL.MTC.002 Rev

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35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
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E-mail : rumalai@tistr.or.th Website:www.tistr.or.thOffice/Laboratory  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
Fax. (66) 0 2323 9165  
E-mail : mtc@tistr.or.thOffice  
196 Phahonyothin Road, Chatuchak, Bangkok 10901  
Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 8592  
E-mail : sumalee@tistr.or.th

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL22128  
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 : 17 MAY 2022  
Calibration Date : 06-08 JUNE 2022  
Date of Issue : 13 JUNE 2022

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.

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22128  
Job No. : VC65AC0058  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

### Calibration Method :

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

### Condition of this result of calibration :

#### 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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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QF-TS12-04-04-020664

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22128  
Job No. : VC65AC0058  
Pages : 3 of 8

Summary of Measurement Result :

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

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22128  
Job No. : VC65AC0058  
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value ( dB )
14.8

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

Frequency Weighting	Measured value ( dB )
A - weight	10.8
C - weight	16.8
Flat	22.5

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	Acceptance Limits
125	0.4	0.5	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.6	0.7	0.7	±5.0

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22128  
Job No. : VC65AC0058  
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22128  
Job No. : VC65AC0058  
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	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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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
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	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	-
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	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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11. Overload indication

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