

ภาคผนวก ค : เอกสารสอบเทียบความถูกต้อง  
ของเครื่องมือเก็บตัวอย่าง

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP)	Thermo Scientific	G25A 158M	Jiranatee Associates Co., Ltd.	COF-001-66	14 Jul 23	13 Jul 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	24P1251	11 Apr 24	10 Apr 25	-
3	Aneroid Barometer	Total Suspended Particulate (TSP)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1860	2 Jun 23	1 Jun 24	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1201	5 Jun 23	5 Jun 24	-
5	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0113	Thai Meteorological Department	390/23	1 Nov 23	31 Oct 24	-
6	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV36 107224	Innovative Instrument Co.,Ltd.	23-ACT-117	4 Aug 23	3 Aug 24	-
7	Sound Level Meter	$L_{Aeq, 24\text{ hrs}}$ $L_{Amax}$ $L_{A90}$ $L_{A10}$ ระดับการรบกวน	Cube, France	Cube 11070	Electrical And Electronics Institute Foundation For Industrial Development	CP20230293EA	4 Aug 23	3 Aug 24	-
8	Sound Level Meter	$L_{Aeq, 24\text{ hrs}}$ $L_{Amax}$ $L_{A90}$ $L_{A10}$ ระดับการรบกวน	Cube, France	Cube 11073	Electrical And Electronics Institute Foundation For Industrial Development	CP20230294EA	4 Aug 23	3 Aug 24	-

แผนการติดตามตรวจสอบคุณภาพสิ่งแวดล้อม  
โครงการนิคมอุตสาหกรรมอุดรธานี  
เดือนเมษายน-เดือนพฤษภาคม พ.ศ. 2567

รายการใบรับรองสอบเทียบเครื่องมือหลักประจำห้องปฏิบัติการสำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือสำหรับวิเคราะห์คุณภาพอากาศ									
1	Analytical Balance (Readability 0.1 mg)	ฝุ่นละอองรวม ( TSP )	Mettler-Toledo	AB204-S/FACT / B108115858	National Food Institute, Ministry of Industry, Thailand	2402420-001-01	19 Apr 24	18 Apr 25	-
2	Analytical Balance (Readability 0.1 mg)		Mettler-Toledo	MS204TS/00 C252436235	National Food Institute, Ministry of Industry, Thailand	2402420-003-04	19 Apr 24	18 Apr 25	-

Due Date of Calibration\* : Based on the annual calibration plan. At least 1 time per year.

## Calibration Certificate

**Certificate No.:** 2402420-003-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** MS204TS/00  
**Serial No.:** C252436235  
**ID No.:** UAE.AIR.023/2566  
**Order No.:** 2402420  
**Operation No.:** 2402420-003  
**Date of Receipt:** 19 April 2024  
**Date of Calibration:** 19 April 2024

**Calibrated by** Mr.Pheraphat Tuanjit  
Scientist

**Approved by**   
( Miss Preeyaporn Jaengkarnkit )

Vice President, Department of Laboratory Services  
Responsible for the Technical Management Team

**Date of Issue:** 23 April 2024

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its 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.:** 2402420-003-01

**Equipment:**

Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Model:** MS204TS/00

**Resolution:** 0.0001 g

**Serial No.:** C252436235

**ID No.:** UAE.AIR.023/2566

**Capacity:** 220 g

**Date of Calibration:** 19 April 2024

Page 2 of 3

**Environment Condition:** Ambient Temperature: 21.7 ± 1.5 °C Relative Humidity: 65 ± 6.7 %

**Place of Calibration:** Room 206 Balance Room 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Condition of Equipment:** Good Condition

**Condition of This Results of Calibration:**

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M2311181S	28 November 2024
Standard Weight Class E2	1-500g	15882	TCS	M2311182S	28 November 2024

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 019/23	Quality Reborn	QR24-0492	4 March 2025

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

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

**Calibration Results:**

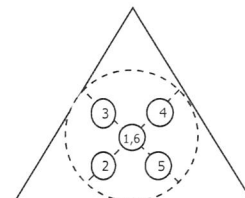
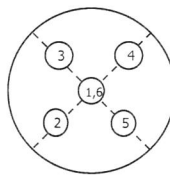
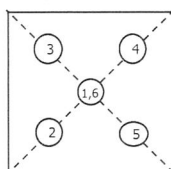
**1. Repeatability of Reading:**

Nominal Value ( g )	Standard Deviation of Reading ( g )
100	0.000074
200	0.000074

**2. Off-Center Error:**

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
( g )	( g )	( g )	( g )	( g )	( g )	( g )
100.0005	100.0006	100.0003	100.0006	100.0003	100.0005	0.0002

*P. Jaenghant*  
23 April 2024





## Calibration Report

**Certificate No.:** 2402420-003-01

**Equipment:**

Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Model:** MS204TS/00

**Resolution:** 0.0001 g

**Serial No.:** C252436235

**ID No.:** UAE.AIR.023/2566

**Capacity:** 220 g

**Date of Calibration:** 19 April 2024

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**Calibration Results:** (Continued)

**Calibration Range:** 0-200 g

**Calibration Adjustment:** Internal Calibration

### 3. Departure from Nominal Value:

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
Unload	0.00000	0.0000	0.0000	0.000094	2.00
0.1	0.10000	0.1000	0.0000	0.000094	2.00
1	0.99998	1.0000	0.0000	0.000097	2.00
5	4.99997	5.0000	0.0000	0.000096	2.00
10	10.00002	10.0000	0.0000	0.00012	2.00
20	20.00003	20.0001	-0.0001	0.00014	2.00
50	49.99998	50.0003	-0.0003	0.00012	2.00
70	70.00000	70.0005	-0.0005	0.00017	2.00
100	99.99997	100.0006	-0.0006	0.00017	2.00
150	149.99994	150.0012	-0.0013	0.00022	2.00
200	200.00001	200.0015	-0.0015	0.00028	2.00

*P. Jaenghanit*  
23 April 2024

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

----- End -----

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

Certificate No.: CP20230293EA

Operation No.: CP2023070030

## Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: 01dB (Meter), G.R.A.S. (Microphone), 01dB (Preamplifier)

Model/Type: CUBE (Meter), 40CD (Microphone), PRE22 (Preamplifier)

Serial No.: 11070 (Meter), 260897 (Microphone), 1605132 (Preamplifier)

ID No.: UAE.EFM.009/2560 (Meter), UAE.EFM.009/2560 (Extension cable)

Customer: United Analyst and Engineering Consultant Co.,Ltd.

Address: 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak  
Phrakhanong, Bangkok 10260

Received Date: 24 July 2023

Calibrated Date: 4 - 7 August 2023

Issued Date: 8 August 2023

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: \_\_\_\_\_

( Mr. Sittichai Swaksuriyawong )  
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor ( $k$ ) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

Certificate No.: CP20230293EA

### Calibration Report

Equipment: Sound Level Meter  
 Manufacturer: 01dB (Meter), G.R.A.S. (Microphone), 01dB (Preamplifier)  
 Model/Type: CUBE (Meter), 40CD (Microphone), PRE22 (Preamplifier)  
 Serial No.: 11070 (Meter), 260897 (Microphone), 1605132 (Preamplifier)  
 ID No.: UAE.EFM.009/2560 (Meter), UAE.EFM.009/2560 (Extension cable)  
 Ambient Temperature: ( 23 ± 2 ) °C  
 Relative Humidity: ( 50 ± 15 ) %  
 Pressure: (101.3 ± 1.5) kPa  
 Method of Calibration :-  
 IEC 61672-3:2013.

#### Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1024-22	6 November 2023
2) Arbitrary Function Generator	AFG2021	C010063	CK20230040EA	26 June 2024
3) Programmable Attenuator	PA5	2755	EF-0034-22	30 October 2023
4) 6.5 Digit precision multimeter	8846A	9610014	CB20220223EA	14 November 2023
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P230024 CD20230196EA	20 March 2024 23 July 2024
6) Pressure humidity and Temperature Transmitter	PTU301	F0640003	CL1-P230032 CD20230197EA	4 April 2024 23 July 2024
7) Performance Audio Analyzer	U8903B	MY56510003	CB20230038EA CK20220080EA	14 February 2024 8 September 2023

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

#### Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Correction for Microphone Model 40CD (dB)	Effective Calibration Level (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
94.1	-0.3	93.8	93.8	0.0	±0.7

Note : Absolute sensitivity was established by the use of the Sound Calibrator 01dB Type CAL31 S/N: 82795.



Certificate No.: CP20230293EA

## Calibration Report

Function : 2. Self-generated Noise

### 2.1 Microphone Installed

Measured value (dB)
16.5

### 2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	9.8
C-weighting	10.6
Z-weighting	17.4

Function : 3. Acoustical signal tests of frequency weightings (With Windscreen)

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.1	0.0	0.1	±1.0
1000	0.2	0.2	0.2	±0.7
8000	-0.3	-0.3	0.2	+1.5; -2.5

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.0	-0.2	0.1	±1.0
125	0.1	-0.1	0.1	±1.0
250	0.2	0.1	0.2	±1.0
500	0.2	0.2	0.2	±1.0
1000	0.2	0.2	0.2	±0.7
2000	0.1	0.1	0.1	±1.0
4000	0.8	0.8	0.9	±1.0
8000	-0.1	-0.1	0.5	+1.5; -2.5
16000	-9.7	-9.6	-4.3	+2.5; -16.0



# THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

## Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 1 November, 2023

Certification No. 390/23

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2205DR0113

Wind Sensor 2205DT0113

Customer : United Analyst and Engineering Consultant Co.,Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1013.5 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425

: Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

: Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer

Model DA-650-3TV

(sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

: Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER

: Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848057

: Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. K4320001

Calibrated by :

*Watchapol*

Signed :

*Pisood*

Mr. Watchapol Subwat

Mr. Pisood Promsut

Mechanical Engineer

(Authorised Signatory)

for the Chief

Sub-Standard Instrument







## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

### The Result of Calibration

Certification No. 390/23

1 November, 2023

Page : 2 of 5

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacumm inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.0
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.0
7.04	-	-	-	7.0	0.04
9.02	-	-	-	8.9	0.12
11.02	-	-	-	9.0	2.02
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.0	0.02
20.02	-	-	-	19.9	0.12

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



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JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd.  
63/14-15, 67/35-36  
Petchkasem 7,7/1, Rd. Watthapra, Bangkokyai,  
Bangkok 10600 (Thailand)  
Tel: +6608680812  
Mobile: +66863999453  
E-mail: jnac-calibration@jiranatee.com  
Web site: www.jiranatee.com

Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TISI-TIS 17025  
CALIBRATION 0367

Flow measurement laboratory  
Calibration services department.



## CERTIFICATE OF CALIBRATION

Certificate No. : COF-001-66

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Top Load Orifice  
**MANUFACTURER** : Graseby GMW  
**MODEL/TYPE** : G25A  
**SERIAL NUMBER** : 158M  
**ID NUMBER** : UAE.EMA2.033/2554  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong,  
Bangkok 10260

**RECEIVED DATE** : 07 Jul 2023  
**MEASUREMENT DATE** : 14 Jul 2023  
**ISSUE DATE** : 18 Jul 2023

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature	: 23.0 ± 3.0	°C
Relative Humidity	: 55.0 ± 15.0	%RH
Atmospheric Pressure	: 1010 ± 10	hPa

### CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.  
Measurement Condition : The average values during measurement are 23.7 °C and 52.9%RH.

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

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibration procedure:

The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/IMC/W2-dp. The WI-CL-004 was used as a calibration guideline.

### Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the VSL (National Metrology Institute of Netherlands) via Certificate number: G2211901

### Uncertainty of Measurement:

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

Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jittraporn Lertsomphol



Approved signatory: .....

Mr. Parinya Booncharoen  
Calibration Department Manager

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**MEASUREMENT RESULTS:**

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The Humid air was used as a medium in the system. The standard conditions are 25°C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

**Table 1:** The results of  $Q$  Standard calibration data

Plate	Flow rate $m^3/min$	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	$\Delta p_{meter}$ mmHg	$\Delta p_{Orifice}$ inH <sub>2</sub> O	$Y$	Standard Flow [ $Q_s$ ] $m^3/min$
1	0.700	753.503	23.71	23.16	48.213	1.565	1.248	0.653
2	1.003	753.442	23.75	23.36	52.965	3.186	1.781	0.930
3	1.115	753.274	23.95	23.57	35.125	4.160	2.034	1.059
4	1.175	753.263	23.94	23.73	26.925	4.729	2.169	1.127
5	1.412	753.351	24.03	23.75	25.751	6.920	2.623	1.358

Slope ( $m$ ): 1.95114  
 Intercept ( $b$ ): -0.02950  
 Correlation coefficient ( $r$ ): 0.99975  
 Uncertainty ( $k=2$ ): 0.015  $m^3/min$

**Table 2:** The results of  $Q$  actual calibration data

Plate	Flow rate $m^3/min$	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	$\Delta p_{meter}$ mmHg	$\Delta p_{Orifice}$ inH <sub>2</sub> O	$Y$	Standard Flow [ $Q_a$ ] $m^3/min$
1	0.700	753.503	23.71	23.16	48.213	1.565	0.785	0.656
2	1.003	753.442	23.75	23.36	52.965	3.186	1.120	0.934
3	1.115	753.274	23.95	23.57	35.125	4.160	1.281	1.064
4	1.175	753.263	23.94	23.73	26.925	4.729	1.366	1.133
5	1.412	753.351	24.03	23.75	25.751	6.920	1.652	1.365

Slope ( $m$ ): 1.22204  
 Intercept ( $b$ ): -0.01853  
 Correlation coefficient ( $r$ ): 0.99975  
 Uncertainty ( $k = 2$ ): 0.015  $m^3/min$

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



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## Certificate of Calibration

Certificate No. : 24P1251

Page : 1 of 2

Equipment : U Tube Manometer

Manufacturer: Dwyer

Model : 1221-36-W/M

Serial No.: -

ID No.: UAE.EFM.077/2566

Condition As-Received: Used Item

Received Date: 03 April 2024

Calibration Date: 11 April 2024

Reference: 2404-0118WSC

Ambient Temperature: ( 23 ± 2 ) °C

Relative Humidity: ( 50 ± 15 ) %

Atmospheric Pressure: 1012 mbar

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

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

81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260

**Procedure used:** The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to calibration procedure CP-P04, using " DKD-R 6-1 ; Calibration of Pressure Gauges " as a guidelines.

### Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Pressure Calibrator	PC106P	1189	MP-0176-23	12 Sep 2024

2.This result of calibration was made on requested at the point specified by customer.

3.Scale and conversion factor is 1 kPa = 4.0146293 inH<sub>2</sub>O

4.This instrument was used clean air as pressure media.

5.This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.

6.This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.

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

8.This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology (Thailand), NSC-ONSC Accredited No. Calibration 0144

Calibrated by : Suksan Khankaew

Issue Date : 17 April 2024

Approved Signatory :

[ ] Phalinee Prabpaipal

[ ] Sura Suwannasri

[✓] Attapol Panurach

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Cert.No.: 24P1251

Page: 2 of 2

**Result of calibration:- Without adjustment**

**Range :** 0 inH<sub>2</sub>O to 36 inH<sub>2</sub>O

**Function:- Pressure Measurement**

**Scale Interval :** 0.1 inH<sub>2</sub>O ( The Second Estimate )

**Increasing Pressure**

Applied Pressure	High-port side	UUC Indication		$\Delta P$	Error
		Low-port side			
0.00	0.00	0.00		0.00	0.00
2.00	1.00	-1.00		2.00	0.00
4.00	2.00	-2.00		4.00	0.00
6.00	3.00	-3.00		6.00	0.00
8.00	4.00	-4.00		8.00	0.00
10.00	5.00	-5.00		10.00	0.00
12.00	6.00	-6.00		12.00	0.00
14.00	7.05	-7.05		14.10	0.10
16.00	8.05	-8.05		16.10	0.10
18.00	9.05	-9.05		18.10	0.10
20.00	10.05	-10.05		20.10	0.10
22.00	11.05	-11.05		22.10	0.10
24.00	12.05	-12.05		24.10	0.10
26.00	13.05	-13.05		26.10	0.10
28.00	14.05	-14.05		28.10	0.10
30.00	15.05	-15.05		30.10	0.10
32.00	16.05	-16.10		32.15	0.15
34.00	17.05	-17.10		34.15	0.15
35.80	18.00	-18.00		36.00	0.20

The uncertainty of measurement was  $\pm 0.11$  inH<sub>2</sub>O

\*  $\Delta P$  = High-port side - Low-port side

\* UUC = Unit Under Calibration

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

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# THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

## The Result of Calibration

Certification No. 390/23

1 November, 2023

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1009.68	1009	0.68
1007.51	1007	0.51
1007.13	1007	0.13
1006.90	1007	-0.10
1006.72	1007	-0.28
1006.59	1006	0.59
1006.28	1006	0.28
1006.05	1006	0.05
1005.84	1006	-0.16
1005.48	1005	0.48
1009.61	1010	-0.39
1009.76	1010	-0.24
1009.69	1009	0.69
1009.45	1009	0.45
1009.24	1009	0.24
1008.89	1009	-0.11
1007.66	1008	-0.34
1006.99	1007	-0.01
1006.29	1006	0.29
1004.56	1005	-0.44

Average

0.12

Calibrated by :

Watchapol

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section  
Meteorological Instruments Bureau





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484



## Certificate of Calibration

Certificate No. : 23P1860

Page : 1 of 2

Equipment : Aneroid Barometer  
Manufacturer: Barigo  
Model : -  
Serial No.: -  
ID No.: UAE.ANV.153/2550

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 02 June 2023

Reference: 2305-0919WSC

Ambient Temperature: ( 23  $\pm$  2 ) °C

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

Atmospheric Pressure: 1006 mbar

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P10, using " DKD-R 6-1 ; Calibration of Pressure Gauges, Edition 03/2014 " as a guidelines.

### Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Standard Barometer	DPI142	1422505046	MP-0094-23	03 May 2024

2.This instrument was installed in vertical orientation and center of the dial was used as the reference level.

3.This result of calibration was made on requested at the point specified by customer.

4.This result of calibration instrument was in absolute pressure.

5.This instrument was used clean air as pressure media.

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

7.This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew  
Issue Date : 08 June 2023

Approved Signatory :

Attapol P.  
[ ] Phalinee Prabpaipal  
[ ] Sura Suwannasri  
[x] Attapol Panurach

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Cert.No.: 23P1860

Page: 2 of 2

Result of calibration:- Without adjustment

Range : 960 hPa to 1030 hPa

Function:- Absolute Pressure Measurement

Scale Interval : 1 hPa ( The Fifth Estimate )

Increasing Pressure

Applied Pressure (hPa)	963.65	975.02	984.39	993.78	1002.66	1011.75	1020.25	1030.28
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	-3.65	-5.02	-4.39	-3.78	-2.66	-1.75	-0.25	-0.28

Decreasing Pressure

Applied Pressure (hPa)	1030.28	1020.59	1012.07	1002.79	993.81	984.44	975.05	964.28
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-0.28	-0.59	-2.07	-2.79	-3.81	-4.44	-5.05	-4.28

The uncertainty of measurement was  $\pm 0.30$  hPa

\* UUC = Unit Under Calibration

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

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Attapol P.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484



## Certificate of Calibration

Certificate No. : 23H1201

Page : 1 of 2

Equipment : Dial Thermo-Hygrometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: UAE.EMA2.014/2555

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 30 May 2023  
to 06 June 2023

Reference: 2305-0919WSC

Ambient Temperature: ( 25 ± 3 ) °C

Relative Humidity: ( 50 ± 20 ) %

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

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

**Procedure used:** Calibration were conducted using in-house calibration procedure CP-H02 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

### Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Hygro-M2 Dew Point Monitor	5112	2360195	20703	02 Aug 2023
2) Handheld Thermometer With Sensor	1523	3240076	231305	15 Mar 2024


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

3.This Certification is traceable to the International System of Unit maintained through:-

- National Institute of Standards and Technology (NIST) , The United States of America
- Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

Calibrated by : Somchai Dumwor  
Issue Date : 07 June 2023

Approved Signatory :

  
[ ☒ ] Chakrit Waewwanjua  
[ ☐ ] Pornthippa Tameyakul  
[ ☐ ] Viporn Tantiyawutti

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Cert. No.: 23H1201

Page.: 2 of 2

**Result of Calibration:-**

Before Adjustment

Function:

Humidity Measurement

<u>Reference</u> <u>Temperature</u> (°C)	<u>Standard</u> <u>Humidity</u> (%R.H.)	<u>UUC*</u> <u>Reading</u> (%R.H.)	<u>Error</u> (%R.H.)	<u>Uncertainty</u> <u>of Measurement</u> (±%R.H.)
25.0	40.1	55	14.9	1.6
25.0	60.0	66	6.0	1.7
25.0	80.0	78	-2.0	1.9

**Result of Calibration:-**

After Adjustment

Function:

Humidity Measurement

<u>Reference</u> <u>Temperature</u> (°C)	<u>Standard</u> <u>Humidity</u> (%R.H.)	<u>UUC*</u> <u>Reading</u> (%R.H.)	<u>Error</u> (%R.H.)	<u>Uncertainty</u> <u>of Measurement</u> (±%R.H.)
25.0	40.1	46	5.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	72	-8.0	1.9

**Result of Calibration:-**

Without Adjustment

Function:

Temperature Measurement

<u>Standard</u> <u>Temperature</u> (°C)	<u>UUC*</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> <u>of Measurement</u> (±°C)
19.987	20.0	0.013	0.72
30.016	30.0	-0.016	0.72
39.944	39.0	-0.944	0.72

**UUC\*** : Unit Under Calibration

The reported uncertainty of measurement was base on standard uncertainty multiplied by coverage factor  $k = 2.00$ , providing confidence level approximately 95%.

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# THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

## The Result of Calibration

Certification No. 390/23

1 November, 2023

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
757.32	757	0.32
755.69	756	-0.31
755.41	755	0.41
755.24	755	0.24
755.10	755	0.10
755.00	755	0.00
754.77	755	-0.23
754.60	754	0.60
754.44	754	0.44
754.17	754	0.17
757.27	757	0.27
757.38	757	0.38
757.33	757	0.33
757.15	757	0.15
756.99	757	-0.01
756.73	757	-0.27
755.81	756	-0.19
755.30	755	0.30
754.78	755	-0.22
753.48	753	0.48

Average

0.15

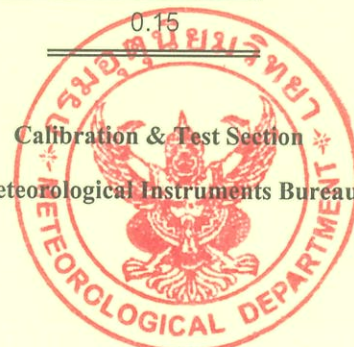
Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



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## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

### The Result of Calibration

Certification No. 390/23

1 November, 2023

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.12	45	0.12
30.21	30	0.21
15.42	15	0.42

Calibrated by :

*Watchapol*

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section  
Meteorological Instruments Bureau



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## Certificate of Calibration

### Customer

Name : UNITED ANALYST AND ENGINEERING  
CONSULTANT CO.,LTD.  
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Prakanong, Bangkok 10260

Certificate No : 23-ACT-117  
Request No : Req-2023-1546

### Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 1  
Manufacturer : SVANTEK Range : 94 , 114 dB / 1000 Hz  
Model : SV 36 Intrument Status : Used  
Serial Number : 107224  
ID : UAE.EFM.171/2564

### Calibration Environment and Details


Temperature : ( 23 ±2 °C )  
Humidity : ( 50 ± 20 %RH )  
Barometric Pressure : ( 1013 ±10.0 hPa )  
Received Date : 21 July 2023  
Calibration Date : 4 August 2023  
Location of Calibration : LAB 1 Acoustic  
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	31 May 2024
THD Multimeter	2015	1047765	NIMT	31 January 2024

**Traceability** : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

### Note

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

Calibrated By :   
Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By :   
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor

Issue Date : 4 August 2023



Certificate No : 23-ACT-117

Request No : Req-2023-1546

**Sound pressure level**

**Calibration Results : Without Adjustment**

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty ( ± dB)	Acceptance limit Class 1 ( ± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	94.03	0.03	-	-	0.13	0.25
114 dB / 1000 Hz	114.11	0.11	-	-	0.13	0.25

**Frequency of Sound pressure level**

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty ( ± %)	Acceptance limit Class 1 ( ± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70
114 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70

**Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)**

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty ( ± %)	Acceptance limit Class 1 ( ± %)
	Measured (%)	Measured (%)		
94 dB / 1000 Hz	0.26	-	0.40	2.5
114 dB / 1000 Hz	0.38	-	0.40	2.5

**Note :**

- Acceptance limit was IEC60942:2017 Class 1
- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

**End of Calibration**

Certificate No.: CP20230293EA

### Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

#### 5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

#### 5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.1

Function : 7. Level Linearity on the reference level range

#### 7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
99.0	99.0	0.0	±0.8
104.0	104.0	0.0	±0.8
109.0	108.8	-0.2	±0.8
114.0	113.8	-0.2	±0.8
119.0	118.8	-0.2	±0.8
124.0	123.8	-0.2	±0.8
129.0	128.8	-0.2	±0.8
134.0	133.8	-0.2	±0.8



Certificate No.: CP20230293EA

### Calibration Report

#### 7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	33.9	-0.1	±0.8
29.0	29.0	0.0	±0.8
24.0	24.1	0.1	±0.8

#### Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	134.0	0.0	±0.5
	2	117.0	0.0	+1.0 ; -1.5
	0.25	107.8	-0.2	+1.0 ; -3.0
Slow	200	127.6	0.0	±0.5
	2	108.0	0.0	+1.0 ; -3.0
	0.25	98.9	-0.1	+1.0 ; -3.0
LAE	200	128.0	0.0	±0.5
	2	108.0	0.0	+1.0 ; -1.5
	0.25	98.9	-0.1	+1.0 ; -3.0

#### Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	133.4	134.6	1.2	±2.0
Positive half cycle	132.4	131.6	-0.8	±1.0
Negative half cycle	132.4	131.7	-0.7	±1.0

#### Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
140.5	141.1	0.6	±1.5

Certificate No.: CP20230293EA

### Calibration Report

Function : 11. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	137.0	137.0	0.0	±0.1

#### Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.20	0.25
11) High-Level Stability	0.10	0.10

Remarks: 1. The acceptance limit is for the deviated value.  
2. Acceptance limits was IEC61672-3:2013 Class 1.  
3. The coverage factor  $k = 2.00$

-- End of Report --

Certificate No.: CP20230294EA

Operation No.: CP2023070031

## Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: 01dB (Meter), G.R.A.S. (Microphone), 01dB (Preamplifier)

Model/Type: CUBE (Meter), 40CD (Microphone), PRE22 (Preamplifier)

Serial No.: 11073 (Meter), 260921 (Microphone), 1605143 (Preamplifier)

ID No.: UAE.EFM.010/2560 (Meter), UAE.EFM.010/2560 (Extension cable)

Customer: United Analyst and Engineering Consultant Co.,Ltd.

Address: 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak  
Phrakhanong, Bangkok 10260

Received Date: 24 July 2023

Calibrated Date: 4 - 7 August 2023

Issued Date: 8 August 2023

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: \_\_\_\_\_

( Mr. Sittichai Swaksuriyawong )  
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor ( $k$ ) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.



Certificate No.: CP20230294EA

### Calibration Report

Equipment: Sound Level Meter  
 Manufacturer: 01dB (Meter), G.R.A.S. (Microphone), 01dB (Preamplifier)  
 Model/Type: CUBE (Meter), 40CD (Microphone), PRE22 (Preamplifier)  
 Serial No.: 11073 (Meter), 260921 (Microphone), 1605143 (Preamplifier)  
 ID No.: UAE.EFM.010/2560 (Meter), UAE.EFM.010/2560 (Extension cable)  
 Ambient Temperature: ( 23 ± 2 ) °C  
 Relative Humidity: ( 50 ± 15 ) %  
 Pressure: (101.3 ± 1.5) kPa  
 Method of Calibration :-  
 IEC 61672-3:2013.

#### Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1024-22	6 November 2023
2) Arbitrary Function Generator	AFG2021	C010063	CK20230040EA	26 June 2024
3) Programmable Attenuator	PA5	2755	EF-0034-22	30 October 2023
4) 6.5 Digit precision multimeter	8846A	9610014	CB20220223EA	14 November 2023
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P230024 CD20230196EA	20 March 2024 23 July 2024
6) Pressure humidity and Temperature Transmitter	PTU301	F0640003	CL1-P230032 CD20230197EA	4 April 2024 23 July 2024
7) Performance Audio Analyzer	U8903B	MY56510003	CB20230038EA CK20220080EA	14 February 2024 8 September 2023

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

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

- Reference standards instrument for Acoustic function
  - National Institute of Metrology (Thailand)
- Reference standards instrument for Electrical function
  - National Institute of Metrology (Thailand)
  - Electrical and Electronics Institute; NSC Accredited Calibration No.0119

#### Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Correction for Microphone Model 40CD (dB)	Effective Calibration Level (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
94.1	-0.3	93.8	93.8	0.0	±0.7

Note : Absolute sensitivity was established by the use of the Sound Calibrator 01dB Type CAL31 S/N: 82795.

Certificate No.: CP20230294EA

## Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
16.0

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	8.8
C-weighting	9.9
Z-weighting	15.3

Function : 3. Acoustical signal tests of frequency weightings (With Windscreen)

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.1	0.0	0.1	±1.0
1000	0.0	0.0	0.0	±0.7
8000	-1.1	-1.0	-0.6	+1.5; -2.5

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.0	-0.2	0.1	±1.0
125	0.1	-0.2	0.2	±1.0
250	0.1	0.1	0.2	±1.0
500	0.2	0.1	0.3	±1.0
1000	0.2	0.2	0.2	±0.7
2000	0.2	0.1	0.1	±1.0
4000	0.8	0.8	0.9	±1.0
8000	-0.1	-0.1	0.5	+1.5; -2.5
16000	-9.7	-9.7	-4.3	+2.5; -16.0

Certificate No.: CP20230294EA

### Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

#### 5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

#### 5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.1

Function : 7. Level Linearity on the reference level range

#### 7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
99.0	99.0	0.0	±0.8
104.0	104.0	0.0	±0.8
109.0	108.8	-0.2	±0.8
114.0	113.8	-0.2	±0.8
119.0	118.8	-0.2	±0.8
124.0	123.8	-0.2	±0.8
129.0	128.8	-0.2	±0.8



Certificate No.: CP20230294EA

### Calibration Report

#### 7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	33.9	-0.1	±0.8
29.0	28.9	-0.1	±0.8
24.0	24.0	0.0	±0.8

#### Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	134.0	0.0	±0.5
	2	117.0	0.0	+1.0 ; -1.5
	0.25	107.8	-0.2	+1.0 ; -3.0
Slow	200	127.6	0.0	±0.5
	2	108.0	0.0	+1.0 ; -3.0
	0.25	98.9	-0.1	+1.0 ; -3.0
LAE	200	128.0	0.0	±0.5
	2	108.0	0.0	+1.0 ; -1.5
	0.25	98.9	-0.1	+1.0 ; -3.0

#### Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	133.4	134.2	0.8	±2.0
Positive half cycle	132.4	131.5	-0.9	±1.0
Negative half cycle	132.4	131.6	-0.8	±1.0

#### Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
139.3	139.9	0.6	±1.5

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### Calibration Report

Function : 11. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	137.0	137.0	0.0	±0.1

### Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.20	0.25
11) High-Level Stability	0.10	0.10

Remarks: 1. The acceptance limit is for the deviated value.  
2. Acceptance limits was IEC61672-3:2013 Class 1.  
3. The coverage factor  $k = 2.00$

- - End of Report - -

## Calibration Certificate

**Certificate No.:** 2402420-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** AB204-S/FACT  
**Serial No.:** B108115858  
**ID No.:** UAE.AIR.016/2555  
**Order No.:** 2402420  
**Operation No.:** 2402420-001  
**Date of Receipt:** 19 April 2024  
**Date of Calibration:** 19 April 2024

**Calibrated by** Mr.Pheraphat Tuanjit  
Scientist

**Approved by**   
( Miss Preeyaporn Jaengkarnkit )

Vice President, Department of Laboratory Services  
Responsible for the Technical Management Team

**Date of Issue:** 23 April 2024

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its 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.:** 2402420-001-01

**Equipment:**

Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Model:** AB204-S/FACT

**Resolution:** 0.0001 g

**Serial No.:** B108115858

**ID No.:** UAE.AIR.016/2555

**Capacity:** 220 g

**Date of Calibration:** 19 April 2024

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**Environment Condition:** Ambient Temperature: 22.1 ± 0.6 °C Relative Humidity: 49 ± 1.9 %

**Place of Calibration:** Room 206 Balance Room 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Condition of Equipment:** Good Condition

### Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M2311181S	28 November 2024
Standard Weight Class E2	1-500g	15882	TCS	M2311182S	28 November 2024

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 019/23	Quality Reborn	QR24-0492	4 March 2025

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

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

### Calibration Results:

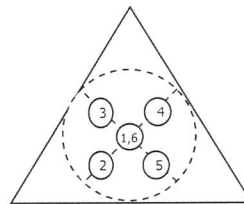
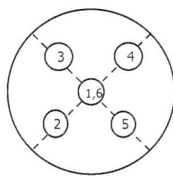
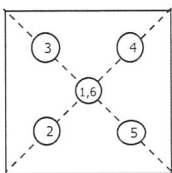
#### 1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
100	0.000057
200	0.000079

#### 2. Off-Center Error:

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1 ( g )	2 ( g )	3 ( g )	4 ( g )	5 ( g )	6 ( g )	(Maximum Difference) ( g )
99.9999	99.9997	99.9996	99.9998	100.0000	99.9998	0.0003

*P. Jaenghambit*  
23 April 2024

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



## Calibration Report

**Certificate No.:** 2402420-001-01

**Equipment:**

Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Model:** AB204-S/FACT

**Resolution:** 0.0001 g

**Serial No.:** B108115858

**ID No.:** UAE.AIR.016/2555

**Capacity:** 220 g

**Date of Calibration:** 19 April 2024

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**Calibration Results:** (Continued)

**Calibration Range:** 0-200 g

**Calibration Adjustment:** Internal Calibration

### 3. Departure from Nominal Value:

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
Unload	0.00000	0.0000	0.0000	0.000089	2.00
0.1	0.10000	0.1000	0.0000	0.000089	2.00
1	0.99998	1.0000	0.0000	0.000092	2.00
5	4.99997	5.0000	0.0000	0.000091	2.00
10	10.00002	10.0001	-0.0001	0.00012	2.00
20	20.00003	20.0001	-0.0001	0.00014	2.00
50	49.99998	50.0000	0.0000	0.00012	2.00
70	70.00000	69.9999	0.0001	0.00016	2.00
100	99.99997	100.0000	0.0000	0.00017	2.00
150	149.99994	149.9997	0.0002	0.00022	2.00
200	200.00001	199.9995	0.0005	0.00028	2.00

*P. Jongsomjit*  
23 April 2024

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

----- End -----

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

