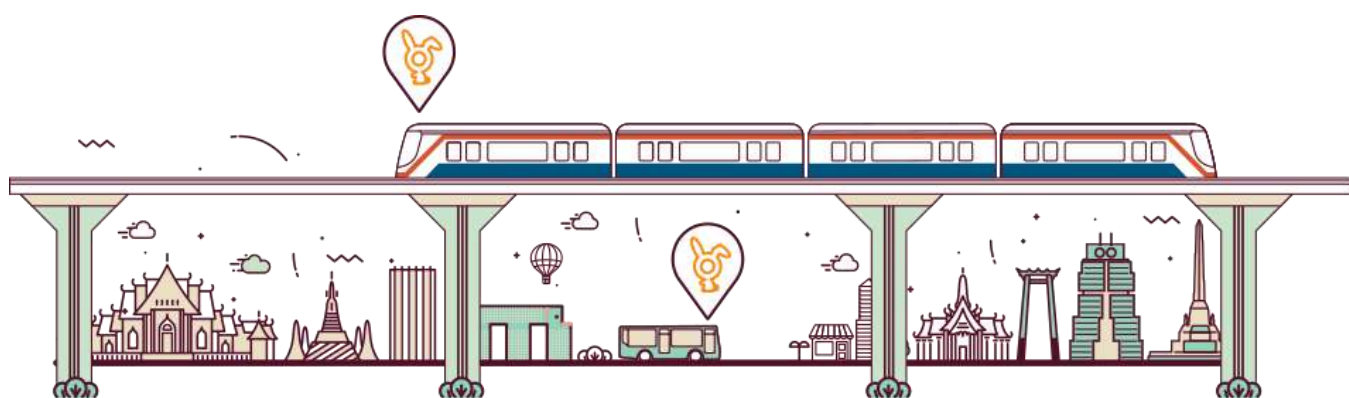


# ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือ



List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
โครงการรณไฟฟ้าสีเขียวอ่อนช่วงแบริง-สมุทรปราการ									
Water									
1	pH Meter	pH	Horiba	LAQUA-PH210 HA4G0060	Technology Promotion Association (Thailand-Japan)	24CH1284/1	15 Oct 24	14 Oct 25	-

### 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
โครงการรถไฟฟ้าสีเขียวอ่อนช่วงแบบริ้ง-สมุทรปราการ									
Ambient									
1	Orifice Transfer Standard Calibrator	Particulate Matter < 10 µm (PM <sub>10</sub> )	Tisch Environmental,Inc.	TE-5025A 3383	Jirantee Associates Co., Ltd.	COF-039-67	27 Sep 24	26 Sep 25	-
2	U-Tube Manometer	Particulate Matter < 10 µm (PM <sub>10</sub> )	Dwyer	121-36-W/M -	Technology Promotion Association (Thailand-Japan)	25P112	19 Feb 25	18 Feb 26	-
3	Aneroid Barometer	Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24P1856	4 Jun 24	3 Jun 25	-
4	Digital Thermo - Hygrometer	Particulate Matter < 10 µm (PM <sub>10</sub> )	Digicon	TH-02 435031148	Technology Promotion Association (Thailand-Japan)	24H1487	15 Jul 24	14 Jul 25	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778105	UAE Consultant Co.,Ltd.	26092024	26 Sep 24	25 Sep 25	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM22177051	UAE Consultant Co.,Ltd.	26092024	26 Sep 24	25 Sep 25	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM22387035	UAE Consultant Co.,Ltd.	17092024	17 Sep 24	16 Sep 25	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778107	UAE Consultant Co.,Ltd.	26092024	26 Sep 24	25 Sep 25	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778108	UAE Consultant Co.,Ltd.	04112024	4 Oct 24	3 Oct 25	-
10	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jun 23	6 Jun 31	-
11	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1180540074	UAE Consultant Co.,Ltd.	09092024	9 Sep 24	8 Sep 25	-
12	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201778117	UAE Consultant Co.,Ltd.	09092024	9 Sep 24	8 Sep 25	-
13	Carbon Monoxide Analyzer	Carbon Monoxide	Horiba	APMA-370 YN43AG7T	UAE Consultant Co.,Ltd.	14062024	14 Jun 24	13 Jun 25	-
14	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1200906880	UAE Consultant Co.,Ltd.	09092024	9 Sep 24	8 Sep 25	-

### 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
โครงการรถไฟฟ้าสีเขียวอ่อนช่วงบางบริง-สมุทรปราการ									
Ambient									
15	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201497730	UAE Consultant Co.,Ltd.	09092024	9 Sep 24	8 Sep 25	-
16	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jun 23	6 Jun 31	-
17	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DT0072	Thai Meteorological Department	001/25	3 Jan 25	2 Jan 26	-
18	Wind Speed/Wind Direction	WS/WD	LSI Lastem	DNA202/E-LOG BQ1705627/17037708	Jiranatee Associates Co., Ltd.	CWS-027-67	7 Aug 24	6 Aug 25	-
19	Wind Speed/Wind Direction	WS/WD	LSI Lastem	DNA202/E-LOG BQ1705626/17037713	Jiranatee Associates Co., Ltd.	CWS-028-67	7 Aug 24	6 Aug 25	-
20	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0113	Thai Meteorological Department	002/25	3 Jan 25	2 Jan 26	-
21	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0114	Thai Meteorological Department	106/25	19 Feb 25	18 Feb 26	-
22	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0116	Thai Meteorological Department	110/25	19 Feb 25	18 Feb 26	-
23	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	01dB	CAL31 84065	Innovative Instrument Co.,Ltd.	24-ACT-087	25 Jun 24	24 Jun 25	-
24	Sound Level Meter	LAeq 24 hrs, LAeq 1 hr, LAmx, LA90, LAdn	Larson Davis	LxT2 0005299	Innovative Instrument Co.,Ltd.	24-SLM-240	11 Jul 24	10 Jul 25	-
25	Sound Level Meter	LAeq 24 hrs, LAeq 1 hr, LAmx, LA90, LAdn	Larson Davis	LxT2 0005286	Innovative Instrument Co.,Ltd.	24-SLM-234	10 Jul 24	9 Jul 25	-
26	Sound Level Meter	LAeq 24 hrs, LAeq 1 hr, LAmx, LA90, LAdn	Larson Davis	LxT2 0005396	Electrical And Electronics Institute Foundation For Industrial Development	CP20240291EA	5 Aug 24	4 Aug 25	-
27	Sound Level Meter	LAeq 24 hrs, LAeq 1 hr, LAmx, LA90, LAdn	Larson Davis	LxT2 0005398	Innovative Instrument Co.,Ltd.	24-SLM-214	2 Jul 24	1 Jul 25	-
28	Sound Level Meter	LAeq 24 hrs, LAeq 1 hr, LAmx, LA90, LAdn	Larson Davis	LxT2 0005399	Electrical And Electronics Institute Foundation For Industrial Development	CP20240293EA	6 Aug 24	5 Aug 25	-
29	Sound Level Meter	LAeq 24 hrs, LAeq 1 hr, LAmx, LA90, LAdn	Larson Davis	LxT2 0005290	Innovative Instrument Co.,Ltd.	24-SLM-238	11 Jul 24	10 Jul 25	-





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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TEL.0-2717-3000-29 FAX.0-2719-9484



Cert.No.: 24CH1284/1  
Page.: 2 of 3

## Certificate of Calibration

Cert.No.: 24CH1284/1  
Page.: 1 of 3

This Certificate was issued to replace to the Certificate No. 24CH1284

**Equipment :** pH Meter  
**Manufacturer :** Horiba  
**Model :** LAQUA-PH210  
**Serial No. :** HA4G0060  
**ID No. :** UAE.EFM.202/2564(EFM.pH.10/64)  
**Condition As-Received:** Used Item  
**Received Date :** 11 October 2024  
**Calibration Date :** 15 October 2024  
**Reference :** 2410-0455WSC-1  
**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260  
**Ambient Temperature :** (25 ± 2.5) °C  
**Relative Humidity :** (50 ± 15) %  
**Calibration Procedure :** In - house method :  
- CP-CH5 by direct measurement with DC voltage  
standard and direct measurement with  
certified reference material (CRM)  
- CP-CH8 by comparison with temperature standard

**Calibrated by :** Walalak Sirithean

**Approved by :** \_\_\_\_\_  
Approved Signatory

( ) Unnopphol Harachai  
( ) Ponpan Paipim  
(✓) Saithip Meangmai

**Issue Date :** 1 November 2024

### Condition of this calibration result

#### 1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1)Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2)Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials :The measurement results are traceable to SI through Hach Lenge GmbH Ltd.,  
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00  
:The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	1034203	27 Sep 2026
pH 6.999	Hach Lenge GmbH	C03145	28 Feb 2026
pH 9.997	CPA chem	970853	25 Apr 2025

3. This certificate is valid only to the item calibrated on date and place of calibration.

### Calibration Results

#### Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement ( ±mV )	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: HA4G0060	4.00	177.48	177.1	4.01	0.058	2.00
	7.00	0.00	0.0	7.00	0.058	2.00
	7.00	0.00	0.0	7.00	0.058	2.00
	10.00	-177.48	-177.1	10.01	0.058	2.00

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

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Cert.No.: 24CH1284/1  
Page.: 3 of 3

### Calibration Results

#### Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7)(7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor $k$
pH Electrode S/N.: Q9AG0067	4.008	4.01	186.0	0.0079	2.00
	6.999	7.00	10.1	0.0084	2.00
	6.999	7.00	10.0	0.0084	2.00
	9.997	10.01	-163.2	0.0092	2.00

#### Function : Temperature Measurement

##### (\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652-10D

- Serial No. : Q9AG0067

Dimension of probe

- Length : 107 mm.

- Diameter : 15 mm.

- Immersion Depth : 85 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement ( $\pm$ °C)	Coverage factor $k$
20.0	20.002	20.0	-0.002	0.13	2.00
25.0	24.999	25.0	0.001	0.13	2.00
45.0	45.001	44.9	-0.101	0.13	2.00

**Remark** - UUC\* = Unit Under Calibration

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 %.

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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-039-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice  
MANUFACTURER : TISCH  
MODEL/TYPE : TE-5025A  
SERIAL NUMBER : 3383  
ID NUMBER : UAE.EFM.063/2560  
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 : 16 Sep 2024  
MEASUREMENT DATE : 27 Sep 2024  
ISSUE DATE : 27 Sep 2024

#### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

#### CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.  
Measurement Condition : The average values during measurement are 23.9 °C and 49.0 %RH.

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

#### TABULATION OF RESULTS:

The table on next page give the measured values.

**Calibration procedure:**  
The 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 NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0063-23.

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

Calibrated by:

☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol



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	$\gamma$	Standard Flow [ $Q_s$ ] $m^3/min$
1	0.703	758.131	23.92	22.49	56.556	1.738	1.319	0.654
2	1.000	758.205	23.70	22.81	63.034	3.473	1.865	0.922
3	1.121	758.284	23.64	22.69	42.633	4.642	2.157	1.064
4	1.167	758.274	23.64	22.65	31.359	5.197	2.282	1.125
5	1.409	758.325	24.00	23.14	30.402	7.654	2.768	1.358

Slope (m): 2.05577  
Intercept (b): -0.02807  
Correlation coefficient (r): 0.99985  
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	$\gamma$	Standard Flow [ $Q_o$ ] $m^3/min$
1	0.703	758.131	23.92	22.49	56.556	1.738	0.825	0.653
2	1.000	758.205	23.70	22.81	63.034	3.473	1.166	0.920
3	1.121	758.284	23.64	22.69	42.633	4.642	1.348	1.061
4	1.167	758.274	23.64	22.65	31.359	5.197	1.426	1.123
5	1.409	758.325	24.00	23.14	30.402	7.654	1.732	1.357

Slope (m): 1.28763  
Intercept (b): -0.01756  
Correlation coefficient (r): 0.99985  
Uncertainty ( $k=2$ ): 0.015  $m^3/min$

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



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**Certificate of Calibration**

Certificate No. : 25P112  
Page : 1 of 2

Equipment : U-Tube Manometer

Manufacturer: Dwyer

Model : 121-36-W/M

Serial No.:

ID No.: UAE.EFM.181/2561

Condition As-Received: Used Item

Received Date: 10 February 2025

Calibration Date: 19 February 2025

Reference: 2502-0083WSC

Ambient Temperature: ( 23 ± 2 ) °C

Relative Humidity: ( 60 ± 15 ) %

Atmospheric Pressure: 1012 mbar

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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: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P04, 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 :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-0113-24	10 Jul 2025

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 installed in vertical orientation and center of connector was used as the reference level.

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 at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Nopparat Phongam  
Issue Date : 21 February 2025

Approved Signatory : Attapol P.  
[ ] Phalinee Prabpalpal  
[ ] Sura Suwannasri  
[x] Attapol Panurach

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B 0250406



Cert.No.: 25P112  
Page: 2 of 2

Result of calibration:- Without adjustment

Function:- Pressure Measurement

Increasing Pressure

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

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

UUC Indication				
Applied Pressure	High-port side	Low-port side	ΔP	Error
(inH <sub>2</sub> O)	(inH <sub>2</sub> O)	(inH <sub>2</sub> O)	(inH <sub>2</sub> O)	(inH <sub>2</sub> O)
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-0.98	1.98	-0.02
4.00	2.00	-1.98	3.98	-0.02
6.00	3.00	-3.02	6.02	0.02
8.00	4.00	-4.02	8.02	0.02
10.00	5.00	-5.04	10.04	0.04
12.00	6.00	-6.04	12.04	0.04
14.00	7.00	-7.06	14.06	0.06
16.00	8.00	-8.06	16.06	0.06
18.00	9.00	-9.06	18.06	0.06
20.00	10.00	-10.06	20.06	0.06
22.00	11.00	-11.08	22.08	0.08
24.00	12.00	-12.08	24.08	0.08
26.00	13.02	-13.10	26.12	0.12
28.00	14.02	-14.10	28.12	0.12
30.00	15.02	-15.10	30.12	0.12
32.00	16.02	-16.10	32.12	0.12
34.00	17.02	-17.08	34.10	0.10
35.50	17.86	-17.92	35.78	0.28

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

\* UUC = Unit Under Calibration

\* ΔP = High-port side - Low-port side

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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a 1037943



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## Certificate of Calibration

Certificate No. : 24P1856  
Page : 1 of 2

Equipment : Aneroid Barometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: UAE.EMA2.110/2555

Condition As-Received: Used Item

Received Date: 24 May 2024

Calibration Date: 04 June 2024

Reference: 2405-0919WSC

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 :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DPI142	1422505046	MP-0094-24	03 May 2025

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 : 06 June 2024

Approved Signatory : Attapol P.

[ ] Phalinee Prabpaipal

[ ] Sura Suwannasri

✓ Attapol Panurach

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B 0316956





Cert.No.: 24P1856

Page: 2 of 2

Result of calibration:- Without adjustment

Range: 720 mmHg to 800 mmHg

Function:- Absolute Pressure Measurement

Scale Interval: 1 mmHg ( The Fifth Estimate )

Increasing Pressure

Applied Pressure (mmHg)	720.43	730.67	740.34	751.52	756.56	761.83	773.53	798.76
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	755.0	760.0	770.0	790.0
Error (mmHg)	-0.43	-0.67	-0.34	-1.52	-1.56	-1.83	-3.53	-8.76

Decreasing Pressure

Applied Pressure (mmHg)	798.76	773.60	761.89	756.65	751.59	740.72	730.68	720.59
UUC* Indication (mmHg)	790.0	770.0	760.0	755.0	750.0	740.0	730.0	720.0
Error (mmHg)	-8.76	-3.60	-1.89	-1.65	-1.59	-0.72	-0.68	-0.59

The uncertainty of measurement was  $\pm 0.24$  mmHg

\* 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.

เอกสารไม่ควบคุม  
a 1165502



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## Certificate of Calibration

Certificate No. : 24H1487

Page : 1 of 2

Equipment : Digital Thermo-Hygrometer

Manufacturer: Digicon

Model : TH-02A

Serial No.: 435031148

ID No.: UAE.EFM.006/2567

Condition As-Received: New Item

Received Date: 10 July 2024

Calibration Date: 15 July 2024  
to 17 July 2024

Reference: 2407-0393WSC

Ambient Temperature: ( 25  $\pm$  3 ) °C

Relative Humidity: ( 50  $\pm$  20 ) %

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-H03 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 :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Chilled Mirror Hygrometer Sensor	Dew Prime II	31863	21819	25 Sep 2024
2) Handheld Thermometer With Sensor	1523	5717096	2311321	08 Nov 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:-

-Thunder Scientific Corporation, NVLAB Accreditation No. Calibration 200582-0

-Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

Calibrated by : Surasit Phansudnoi  
Issue Date : 17 July 2024

Approved Signatory :

Viporn

[ ] Chakrit Waewwanjua

[✓] Viporn Tantiyawutti

[ ] Unnopphol Harachai

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United Analyst and Engineering Consultant Co., Ltd.

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

Tel. 0 2763 2828 Fax 0 2763 2800 www.uaec consultant.com E-mail: uae@uaec consultant.com

Cert. No.: 24H1487

Page.: 2 of 2

Result of Calibration:- Without Adjustment  
Function: Humidity Measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	39	-1.1	1.4
25.0	50.1	48	-2.1	1.6
25.0	60.0	58	-2.0	1.6
25.0	70.2	68	-2.2	1.6

Result of Calibration:- Without Adjustment  
Function: Temperature Measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.014	20.3	0.286	0.42
24.984	25.2	0.216	0.42
30.050	30.1	0.050	0.42
40.027	40.0	-0.027	0.42

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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## MULTI-POINT GAS TEST REPORT

Test Date : Sep 26,2024

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : 1201778105

### Standard Gas Concentration

Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM  
Nitric Oxide (NO) 46.77 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 965.9 PPM  
Cylinder No. : EB0159156  
Expiration Date : Nov 6,2026

### Dilutor Detail

Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071

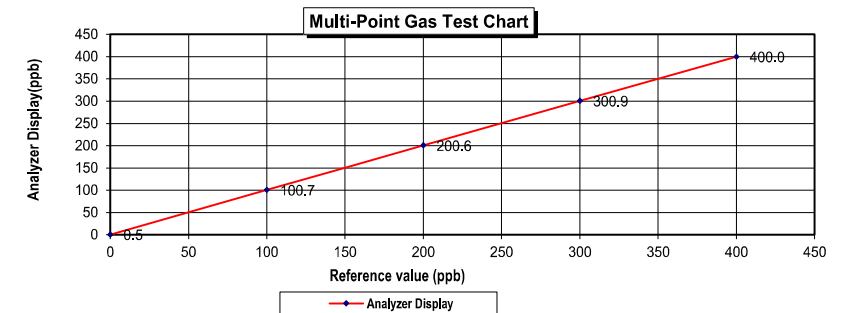
### Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.5	0.50	0.50	0.50
Level 2	20.00%	100.7	0.70	0.70	0.70
Level 3	40.00%	200.6	0.60	0.30	0.30
Level 4	60.00%	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	0.00	0.00	0.00

Remark : Measuring Range 500.0 ppb

:Acceptable Limit ± 5%

Average Difference (%) 0.36



Calculate by  
Ginchai C.  
26 / 9 / 2567

Approve by  
Pattana K.  
26 / Sep / 2024

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### MULTI-POINT GAS TEST REPORT

Test Date : Sep 26,2024

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : CM22177051

#### Standard Gas Concentration

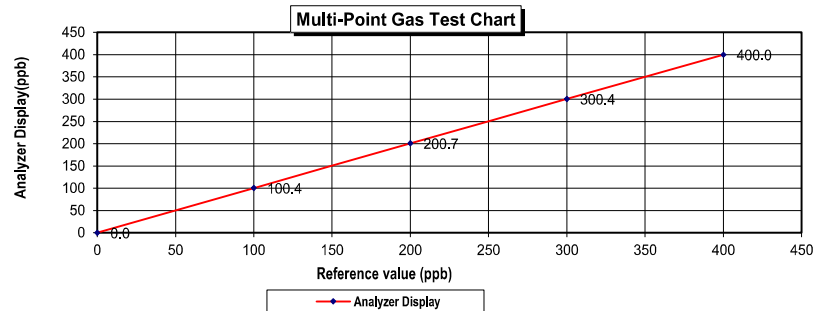
Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM  
Nitric Oxide (NO) 46.77 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 965.9  
Cylinder No. : EB0159156  
Expiration Date : Nov 6,2026

#### Dilutor Detail

Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071

#### Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.4	0.40	0.40	0.40
Level 3	40.00%	200.0	200.7	0.70	0.35	0.35
Level 4	60.00%	300.0	300.4	0.40	0.13	0.13
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.18



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### MULTI-POINT GAS TEST REPORT

Test Date : Sep 17,2024

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : CM22387035

#### Standard Gas Concentration

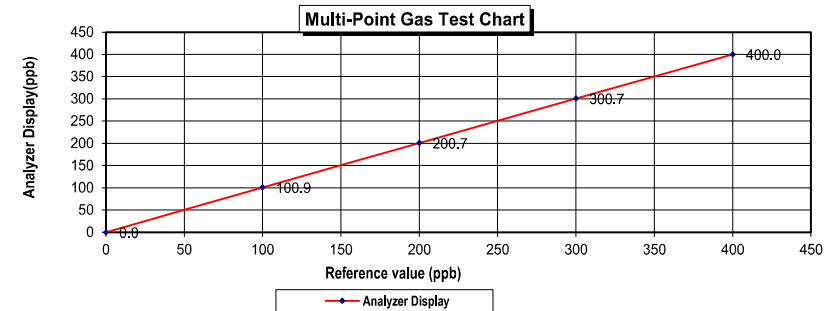
Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM  
Nitric Oxide (NO) 46.77 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 965.9  
Cylinder No. : EB0159156  
Expiration Date : Nov 06,2026

#### Dilutor Detail

Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071

#### Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.9	0.90	0.89	0.89
Level 3	40.00%	200.0	200.7	0.70	0.35	0.35
Level 4	60.00%	300.0	300.7	0.70	0.23	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%)			0.29



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### MULTI-POINT GAS TEST REPORT

Test Date : Sep 26,2024

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : 1201778107

#### Standard Gas Concentration

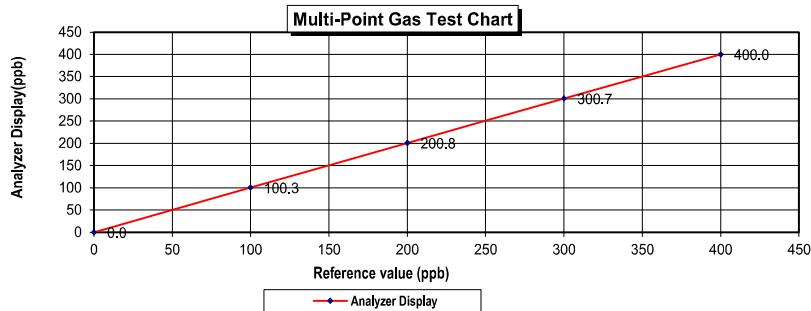
Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM  
Nitric Oxide (NO) 46.77 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 965.9 PPM  
Cylinder No. : EB0159156  
Expiration Date : Nov 6,2026

#### Dilutor Detail

Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071

#### Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[ % Error ]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.3	0.30	0.30	0.30
Level 3	40.00%	200.0	200.8	0.80	0.40	0.40
Level 4	60.00%	300.0	300.7	0.70	0.23	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.19



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### MULTI-POINT GAS TEST REPORT

Test Date : Oct 4,2024

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : 1201778108

#### Standard Gas Concentration

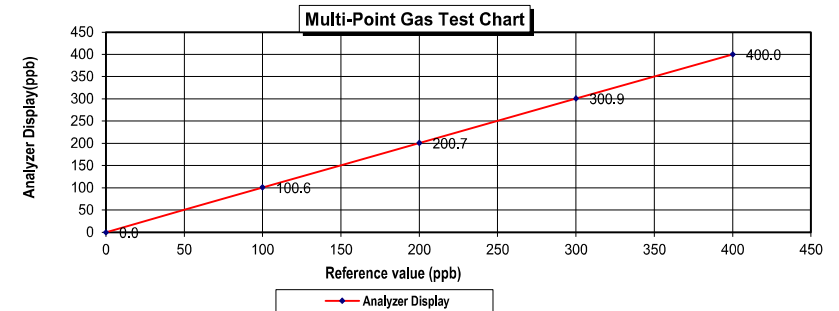
Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM  
Nitric Oxide (NO) 46.77 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 965.9 PPM  
Cylinder No. : EB0159156  
Expiration Date : Nov 6,2026

#### Dilutor Detail

Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071

#### Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[ % Error ]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.6	0.60	0.60	0.60
Level 3	40.00%	200.0	200.7	0.70	0.35	0.35
Level 4	60.00%	300.0	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)			0.25



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## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)  
LTD  
Part Number: E05NI91E15A0014  
Cylinder Number: EB0162121  
Laboratory: 124 - Plumsteadville - PA  
PGVP Number: A12023  
Gas Code: CO,CO2,NO,NOX,SO2,BALN  
Reference Number: 160-402772205-1  
Cylinder Volume: 144.0 CF  
Cylinder Pressure: 2016 PSIG  
Valve Outlet: 660  
Certification Date: Jul 06, 2023  
Expiration Date: Jul 06, 2031

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. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. 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	100.0 PPM	100.4 PPM	G1	+/- 0.9% NIST Traceable	06/27/2023, 07/06/2023
NITRIC OXIDE	100.0 PPM	100.2 PPM	G1	+/- 0.9% NIST Traceable	06/27/2023, 07/06/2023
SULFUR DIOXIDE	100.0 PPM	100.0 PPM	G1	+/- 1.4% NIST Traceable	06/27/2023, 07/06/2023
CARBON MONOXIDE	200.0 PPM	199.2 PPM	G1	+/- 0.3% NIST Traceable	06/26/2023
CARBON DIOXIDE	8.000 %	7.982 %	G1	+/- 1.2% NIST Traceable	06/27/2023
NITROGEN	Balance				

#### CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	104202308	CC754364	98.36 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Jan 04, 2031
PRM	C2219101	APE1514048	100.19 PPM NITRIC OXIDE/NITROGEN	+/- 0.3%	Feb 28, 2025
GMIS	2023042525	CC754381	98.52 PPM NITRIC OXIDE/NITROGEN	+/-0.4%	Apr 25, 2031
PRM	12409	D913660	15.01 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Feb 17, 2023
GMIS	153400202002	EB0130037	9.693 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%	Sep 29, 2025
NTRM	160102-22	KAL003820	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Nov 01, 2027
CO	230601	CC745902	249.47 PPM CARBON MONOXIDE/NITROGEN	+/- 0.3%	Dec 09, 2028
NTRM	130606-02	CC411730	13.359 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 14, 2025

The SRM, NTRM, PRM, or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

#### ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR AUP2010245 CO2	FTIR	Jun 15, 2023
SIEMENS ULTRAMAT6E N1-C8-180	NDIR	Jun 14, 2023
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Jun 29, 2023
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Jun 15, 2023
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Jun 08, 2023

  
Approved for Release

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#### MULTI-POINT GAS TEST REPORT

Test Date : Sep 9, 2024

Equipment : Gas Analyzer (CO) Model : 48i  
Manufacturer : Thermo Scientific Serial Number : 1180540074

#### Standard Gas Concentration

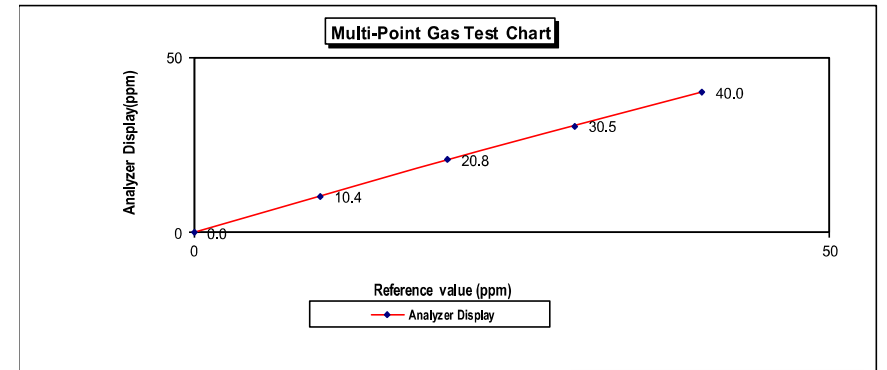
Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM  
Nitric Oxide (NO) 46.77 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 965.9 PPM  
Cylinder No. : EB01159156  
Expiration Date : Nov 06, 2026


#### Dilutor Detail


Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071

#### Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error ]
Level 1	Zero	0.0	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.4	0.4	3.8	3.8
Level 3	40.00%	20.0	20.8	0.8	3.8	3.8
Level 4	60.00%	30.0	30.5	0.5	1.6	1.6
Level 5	80.00%	40.0	40.0	0.0	0.0	0.0
Remark : Measuring Range		50.0 ppm	Average Difference (%)			1.87



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9 Sep 2024

### MULTI-POINT GAS TEST REPORT

Test Date : Sep 9, 2024

Equipment : Gas Analyzer (CO) Model : 48i  
Manufacturer : Thermo Scientific Serial Number : 1201778117

#### Standard Gas Concentration

Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM  
Nitric Oxide (NO) 46.77 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 965.9 PPM  
Cylinder No. : EB01159156  
Expiration Date : Nov 06, 2026

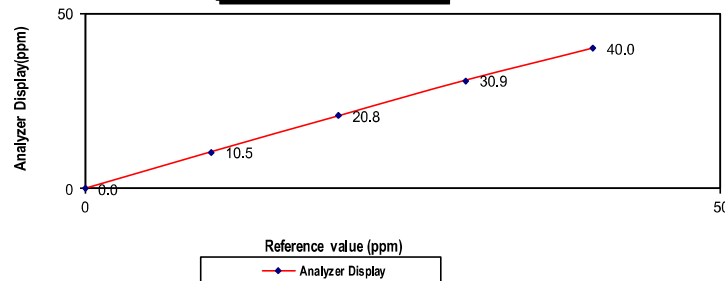
#### Dilutor Detail

Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071

#### Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error ]
Level 1	Zero	0.0	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.5	0.5	4.8	4.8
Level 3	40.00%	20.0	20.8	0.8	3.8	3.8
Level 4	60.00%	30.0	30.9	0.9	2.9	2.9
Level 5	80.00%	40.0	40.0	0.0	0.0	0.0
Remark : Measuring Range		50.0 ppm	Average Difference (%)			2.30

Multi-Point Gas Test Chart



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### MULTI-POINT GAS TEST REPORT

Test Date : June 14, 2024

Equipment : Gas Analyzer (CO) Model : APMA-370  
Manufacturer : HORIBA Serial Number : YN43AG7T

#### Standard Gas Concentration

Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM  
Nitric Oxide (NO) 46.77 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 965.9 PPM  
Cylinder No. : EB01159156  
Expiration Date : Nov 06, 2026

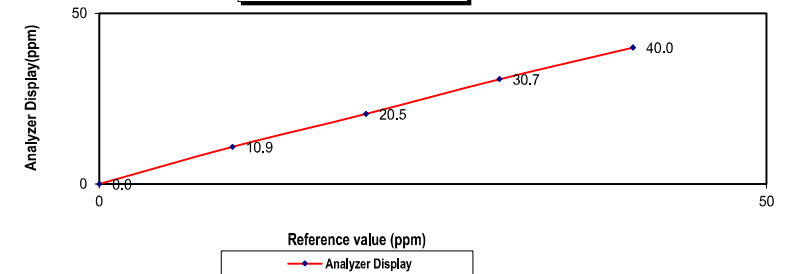
#### Dilutor Detail

Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071

#### Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[ % Error ]
Level 1	Zero	0.0	0.0		0.0	0.0
Level 2	20.00%	10.0	10.9	0.9	8.3	8.3
Level 3	40.00%	20.0	20.5	0.5	2.4	2.4
Level 4	60.00%	30.0	30.7	0.7	2.3	2.3
Level 5	80.00%	40.0	40.0	0.0	0.0	0.0
Remark : Measuring Range		50.0 ppm	Average Difference (%)			2.60

Multi-Point Gas Test Chart



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14 June / 2024

### MULTI-POINT GAS TEST REPORT

Test Date : Sep 9, 2024

Equipment : Gas Analyzer (CO) Model : 48i  
Manufacturer : Thermo Scientific Serial Number : 1200906880

#### Standard Gas Concentration

Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM  
Nitric Oxide (NO) 46.77 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 965.9 PPM  
Cylinder No. : EB01159156  
Expiration Date : Nov 06, 2026

#### Dilutor Detail

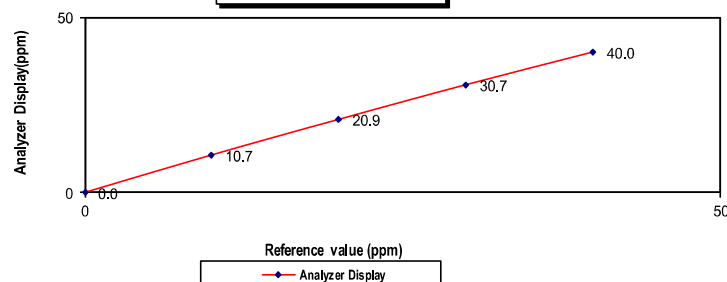
Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071

#### Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.7	6.5	6.5
Level 3	40.00%	20.0	20.9	4.3	4.3
Level 4	60.00%	30.0	30.7	2.3	2.3
Level 5	80.00%	40.0	40.0	0.0	0.0

Remark : Measuring Range 50.0 ppm  
:Acceptable Limit  $\pm 5\%$

Multi-Point Gas Test Chart



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9 Sep 2024

### MULTI-POINT GAS TEST REPORT

Test Date : Sep 9, 2024

Equipment : Gas Analyzer (CO) Model : 48i  
Manufacturer : Thermo Scientific Serial Number : 1201497730

#### Standard Gas Concentration

Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM  
Nitric Oxide (NO) 46.77 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 965.9 PPM  
Cylinder No. : EB01159156  
Expiration Date : Nov 06, 2026

#### Dilutor Detail

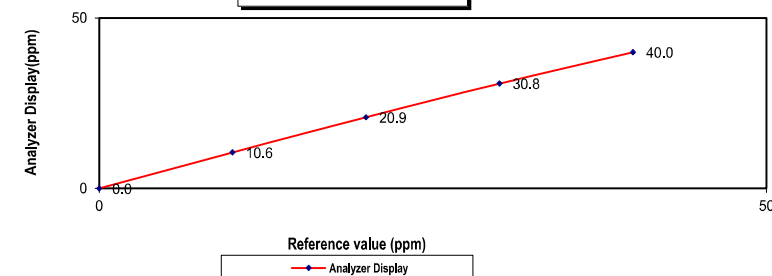
Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071

#### Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.6	5.7	5.7
Level 3	40.00%	20.0	20.9	4.3	4.3
Level 4	60.00%	30.0	30.8	2.6	2.6
Level 5	80.00%	40.0	40.0	0.0	0.0

Remark : Measuring Range 50.0 ppm  
:Acceptable Limit  $\pm 5\%$

Multi-Point Gas Test Chart



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9 Sep 2024



## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)  
LTD  
Part Number: E05NI91E15A0014  
Cylinder Number: EB0162121  
Laboratory: 124 - Plumsteadville - PA  
PGVP Number: A12023  
Gas Code: CO,CO2,NO,NOX,SO2,BALN  
Reference Number: 160-402772205-1  
Cylinder Volume: 144.0 CF  
Cylinder Pressure: 2016 PSIG  
Valve Outlet: 660  
Certification Date: Jul 06, 2023  
Expiration Date: Jul 06, 2031

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. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. 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	100.0 PPM	100.4 PPM	G1	+/- 0.9% NIST Traceable	06/27/2023, 07/06/2023
NITRIC OXIDE	100.0 PPM	100.2 PPM	G1	+/- 0.9% NIST Traceable	06/27/2023, 07/06/2023
SULFUR DIOXIDE	100.0 PPM	100.0 PPM	G1	+/- 1.4% NIST Traceable	06/27/2023, 07/06/2023
CARBON MONOXIDE	200.0 PPM	199.2 PPM	G1	+/- 0.3% NIST Traceable	06/26/2023
CARBON DIOXIDE	8.000 %	7.982 %	G1	+/- 1.2% NIST Traceable	06/27/2023
NITROGEN	Balance				

#### CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	104202308	CC754364	98.36 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Jan 04, 2031
PRM	C2219101	APE1514048	100.19 PPM NITRIC OXIDE/NITROGEN	+/- 0.3%	Feb 28, 2025
GMIS	2023042525	CC754381	98.52 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Apr 25, 2031
PRM	12409	D913680	15.01 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Feb 17, 2023
GMIS	153400202002	EB0130037	9.693 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%	Sep 29, 2025
NTRM	160102-22	KAL003820	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Nov 01, 2027
CO	230601	CC745902	249.47 PPM CARBON MONOXIDE/NITROGEN	+/- 0.3%	Dec 09, 2028
NTRM	130606-02	CC411730	13.359 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 14, 2025

The SRM, NTRM, PRM, or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

#### ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR AUP2010245 CO2	FTIR	Jun 15, 2023
SIEMENS ULTRAMAT6E N1-C8-180	NDIR	Jun 14, 2023
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Jun 29, 2023
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Jun 15, 2023
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Jun 08, 2023

Approved for Release

Page 1 of 1

เอกสารไม่ควบคุม

## 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 : 3 January, 2025

Certification No. 001/25

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2111DR0072

Wind Sensor 2111DR0072

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 1012.1 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

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 PTB380 No. K4320001

Calibrated by : Hathirapol

Signed : Mr. Pisood Promsut

Mr. Watcharapol Subwat

Mechanical Engineer

(Authorised Signatory)

for the Chief

Sub-Standard Instrument

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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. 001/25

3 January, 2025

Page : 2 of 5

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
	m/sec	inches H <sub>2</sub> O	inches H <sub>2</sub> O	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.02	-	-	-	11.0	0.02
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.1	-0.08
20.02	-	-	-	20.1	-0.08

Vane Angel Bench Stand Model 18112	
Young Meteorological Instruments	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Watharapol

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม



## THAI METEOROLOGICAL DEPARTMENT

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

### The Result of Calibration

Certification No. 001/25

3 January, 2025

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1012.05	1012	0.05
1011.25	1011	0.25
1012.92	1013	-0.08
1010.09	1010	0.09
1008.87	1009	-0.13
1010.43	1010	0.43
1011.39	1011	0.39
1011.05	1011	0.05
1010.72	1011	-0.28
1010.30	1010	0.30
1009.81	1010	-0.19
1008.93	1009	-0.07
1009.35	1009	0.35
1009.89	1010	-0.11
1010.57	1011	-0.43
1011.41	1011	0.41
1012.31	1012	0.31
1009.75	1010	-0.25
1010.67	1011	-0.33
1011.01	1011	0.01

Average

0.04

Calibrated by :

Watharapol

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม



# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 001/25

3 January, 2025

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
759.10	759	0.10
758.50	759	-0.50
759.75	760	-0.25
757.63	758	-0.37
756.71	757	-0.29
757.88	758	-0.12
758.60	759	-0.40
758.35	758	0.35
758.10	758	0.10
757.79	758	-0.21
757.42	757	0.42
756.76	757	-0.24
757.07	757	0.07
757.48	757	0.48
757.99	758	-0.01
758.62	759	-0.38
759.29	759	0.29
757.37	757	0.37
758.06	758	0.06
758.32	758	0.32

Average

-0.07

Calibrated by :

*Watchapol*

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม



# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 001/25

3 January, 2025

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.5	45	0.5
30.4	30	0.4
15.6	16	-0.4

Calibrated by :

*Watchapol*

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม



Certificate Number

CWS-027-67

Certificate Number

CWS-027-67

Page 2 of 2 Pages

## MEASUREMENT RESULTS<sup>5</sup>

The Cup anemometer, Unit Under Calibration (UUC) was exercised at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section, UUC was mounted on a round vertical tube of the lower plate at center of test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

$V_{std}$ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$V_{UUC}$ (m/s)	Error (m/s)	$U$ (k=2) (m/s)
1.093	23.98	24.05	0.9	-0.2	0.31
2.051	24.24	24.05	1.8	-0.3	0.31
3.124	24.02	24.05	2.9	-0.2	0.31
4.086	24.04	24.05	3.8	-0.3	0.31
5.09	23.68	24.05	4.9	-0.2	0.31
6.08	23.84	24.05	5.9	-0.2	0.31
6.99	23.52	24.05	6.8	-0.2	0.31
8.16	24.48	24.05	8.0	-0.2	0.31
9.12	23.50	24.05	9.1	-0.1	0.31
9.98	24.02	24.05	9.9	-0.1	0.31
11.04	23.46	24.05	11.1	0.0	0.31
12.05	23.64	24.05	12.1	0.1	0.31
13.02	23.46	24.05	13.0	-0.1	0.31
13.96	23.50	24.05	14.0	0.1	0.35
15.03	23.52	24.05	15.1	0.1	0.39
16.00	23.50	24.05	16.0	0.0	0.34

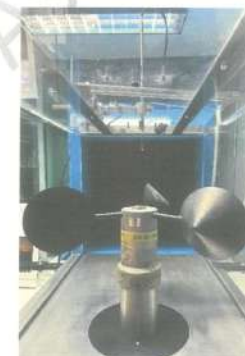
## Remark:

<sup>1</sup> Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

<sup>2</sup> Velocity of standard

<sup>3</sup> Velocity of Unit Under Calibration

## PHOTO OF CALIBRATION SET-UP



Calibration set-up of the Cup anemometer calibration in the wind tunnel of Jiranatee Associates Co., Ltd. The Cup anemometer shown may differ from the calibrated one. Remark: The proportion of the set-up is not true to scale due to imaging geometry.



## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Cup anemometer  
**MANUFACTURER** : LSI Lastem  
**MODEL/TYPE** : Sensor: DNA202  
Data logger: E-LOG  
**SERIAL NUMBER** : Sensor: BQ1705627  
Data logger: 17037708  
**ID NUMBER** : -  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phrakharong, Bangkok 10260

## Calibration procedure:

The Cup anemometer was calibrated against Standard air velocity transducer model: 8455-12 and pitot tube with precision differential pressure meter model: DPM2500 in an close test-section of Eiffel-type wind tunnel with 900 cm<sup>2</sup> cross test section area. The WI-CL-007 based on IEC 61400-12-1, Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 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 NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0007-24 and MW-0055-23

## 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'

**RECEIVED DATE** : 02 Aug 2024  
**MEASUREMENT DATE** : 07 Aug 2024  
**ISSUE DATE** : 09 Aug 2024

## 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

**PLACE OF CALIBRATION** : Eiffel-type wind tunnel of Jiranatee Associates Co., Ltd.

**CALIBRATION CONDITIONS** : Wind tunnel cross-section area<sup>1</sup> 900 cm<sup>2</sup>  
Wind direction frontal area<sup>2</sup> 195 cm<sup>2</sup>  
Diameter of mounting pipe<sup>3</sup> - mm  
Blockage ratio of test object<sup>4</sup> 0.217 [-]

**Preconditioning** : 24 hours at ambient conditions.

**Measurement Condition** : The average values during measurement are (23.8) °C, (41.5) %RH and (1009.0) hPa.

## TABULATION OF RESULTS:

The table on next page give the measured values.

## Calibrated by:

☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

## Remarks:

<sup>1</sup> Nozzle cross-section area of the wind tunnel  
<sup>2</sup> Projected cross-section area of the tested object include mounting pipe  
<sup>3</sup> Diameter of mounting pipe  
<sup>4</sup> Ratio <sup>2</sup> to <sup>1</sup>

## MEASUREMENT RESULTS <sup>5</sup>

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counterclockwise directions after offset adjustment has been made. The flow speed of wind tunnel (usually 5 m/s) is kept constant while the sensor is rotated around its vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed	D <sup>1</sup> <sub>std</sub>	D <sup>1</sup> <sub>unc</sub>	Error	U (k=2)
m/s	Degree (°)	Degree (°)	Degree (°)	Degree (°)
5.01	0.000	0	0	0.80
	45.000	46	1	0.80
	90.000	90	0	0.80
	135.000	135	0	0.80
	180.000	180	0	0.80
	225.000	225	0	0.80
	270.000	269	-1	0.80
	315.000	314	-1	0.80

### Remark:

<sup>5</sup> Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

<sup>6</sup> Direction of standard

<sup>7</sup> Direction of Unit Under Calibration

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



## CERTIFICATE OF CALIBRATION

**MEASUREMENT ITEM** : Wind Direction Sensor  
**MANUFACTURER** : LSI Lastem  
**MODEL/TYPE** : Sensor: DNA212  
Data logger: E-LOG  
**SERIAL NUMBER** : Sensor: 19020250  
Data logger: 17037708  
**ID NUMBER** : -  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260

### Calibration procedure:

The wind direction sensor was calibrated against Standard Rotary Encoder model: AX4009TS-DM04-P3-S-U0 in an close test-section of Eiffel-type wind tunnel with 900 cm<sup>2</sup> cross test-section area. The WI-CL-008 based on IEC 61400-12-1, Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 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 NIMT (National Metrology Institute of Thailand) via Certificate number: DA-0036-23.

### 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'

**RECEIVED DATE** : 02 Aug 2024  
**MEASUREMENT DATE** : 08 Aug 2024  
**ISSUE DATE** : 09 Aug 2024

### 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

**PLACE OF CALIBRATION** : Eiffel-type wind tunnel of Jiranatee Associates Co., Ltd.

**CALIBRATION CONDITION** : Wind tunnel cross-section area<sup>1</sup> 900 cm<sup>2</sup>  
Wind direction frontal area<sup>2</sup> 52 cm<sup>2</sup>  
Diameter of mounting pipe<sup>3</sup> - mm  
Blockage ratio of test object<sup>4</sup> 0.058 [-]

**Preconditioning** : 24 hours at ambient conditions.

**Measurement Condition** : The average values during measurement are (24.9)°C, (45.1) %RH and (1005.2) hPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jittraporn Lertsomphol



### Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

### Remark:

<sup>1</sup> Nozzle cross-section area of the wind tunnel

<sup>2</sup> Projected cross-section area of the tested object include mounting pipe

<sup>3</sup> Diameter of mounting pipe

<sup>4</sup> Ratio <sup>2</sup> to <sup>1</sup>

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เอกสารไม่ควบคุม



Certificate Number
CWS-028-67

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Cup anemometer  
**MANUFACTURER** : LSI Lastem  
**MODEL/TYPE** : Sensor: DNA202  
Data logger: E-LOG  
**SERIAL NUMBER** : Sensor: BQ1705626  
Data logger: 17037713  
**ID NUMBER** : -  
**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** : 02 Aug 2024  
**MEASUREMENT DATE** : 07 Aug 2024  
**ISSUE DATE** : 09 Aug 2024

### 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

**PLACE OF CALIBRATION** : Eiffel-type wind tunnel of Jiranatee Associates Co., Ltd.

**CALIBRATION CONDITIONS** : Wind tunnel cross-section area<sup>1</sup> 900 cm<sup>2</sup>  
Wind direction frontal area<sup>2</sup> 195 cm<sup>2</sup>  
Diameter of mounting pipe<sup>3</sup> - mm  
Blockage ratio of test object<sup>4</sup> 0.217 [-]

**Preconditioning** : 24-hours at ambient conditions.

**Measurement Condition** : The average values during measurement are (24.5) °C, (43.0) %RH and (1009.1) hPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Leertsomphol



Approved signatory:

*Mr. Parinya Booncharoen*  
Mr. Parinya Booncharoen  
Calibration Department Manager

### Calibration procedure:

The Cup anemometer was calibrated against Standard air velocity transducer model: B455-12 and pitot tube with precision differential pressure meter model: DPM2500 in an close test-section of Eiffel-type wind tunnel with 900 cm<sup>2</sup> cross test section area. The WI-CL-007 based on IEC 61400-12-1, Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 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 NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0007-24 and MW-0055-23

### 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"

Page 2 of 2 Pages

### MEASUREMENT RESULTS<sup>5</sup>

The Cup anemometer, Unit Under Calibration (UUC) was exercise at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section, UUC was mounted on a round vertical tube of the lower plate at center of test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

$V_{std}$ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$V_{UUC}$ (m/s)	Error (m/s)	$U (k=2)$ (m/s)
1.101	24.08	24.75	0.91	-0.19	0.31
2.056	25.40	24.75	1.84	-0.22	0.31
3.148	24.10	24.75	2.91	-0.23	0.31
4.060	24.10	24.75	3.76	-0.30	0.31
5.10	23.80	24.75	4.91	-0.19	0.31
6.05	25.50	24.75	5.91	-0.13	0.31
6.99	23.90	24.75	6.83	-0.16	0.31
8.11	25.08	24.75	7.99	-0.12	0.31
9.12	24.10	24.75	9.06	-0.06	0.31
9.96	24.70	24.75	9.90	-0.06	0.31
11.05	24.20	24.75	11.05	0.00	0.31
12.01	24.52	24.75	11.97	-0.04	0.35
13.03	24.30	24.75	12.96	-0.07	0.31
13.99	24.44	24.75	13.96	-0.03	0.38
15.00	24.30	24.75	14.96	-0.04	0.37
16.01	24.30	24.75	16.02	0.01	0.34

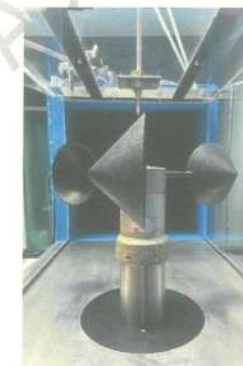
### Remark:

<sup>1</sup> Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

<sup>2</sup> Velocity of standard

<sup>3</sup> Velocity of Unit Under Calibration

### PHOTO OF CALIBRATION SET-UP



Calibration set-up of the Cup anemometer calibration in the wind tunnel of Jiranatee Associates Co., Ltd. The Cup anemometer shown may differ from the calibrated one. Remark: The proportion of the set- up is not true to scale due to imaging geometry.

### Remark:

<sup>1</sup> Nozzle cross-section area of the wind tunnel  
<sup>2</sup> Projected cross-section area of the tested object include mounting pipe  
<sup>3</sup> Diameter of mounting pipe  
<sup>4</sup> Ratio <sup>2</sup> to <sup>1</sup>

## MEASUREMENT RESULTS <sup>5</sup>

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counterclockwise directions after offset adjustment has been made. The flow speed of wind tunnel (usually 5 m/s) is kept constant while the sensor is rotated around its vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed	$D'_{std}$	$D'_{unc}$	Error	$U (k=2)$
m/s	Degree (°)	Degree (°)	Degree (°)	Degree (°)
5.04	0.000	0	0	0.80
	45.000	46	1	0.80
	90.000	91	1	0.80
	135.000	136	1	0.80
	180.000	181	1	0.80
	225.000	226	1	0.80
	270.000	270	0	0.80
	315.000	315	0	0.80

## Remark:

<sup>5</sup> Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

<sup>6</sup> Direction of standard

<sup>7</sup> Direction of Unit Under Calibration

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



## CERTIFICATE OF CALIBRATION

**MEASUREMENT ITEM** : Wind Direction Sensor  
**MANUFACTURER** : LSI Lastem  
**MODEL/TYPE** : Sensor: DNA212  
Data logger: E-LOG  
**SERIAL NUMBER** : Sensor: 19050292  
Data logger: 17037713  
**ID NUMBER** : -  
**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** : 02 Aug 2024  
**MEASUREMENT DATE** : 08 Aug 2024  
**ISSUE DATE** : 09 Aug 2024

## 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

**PLACE OF CALIBRATION** : Eiffel-type wind tunnel of Jiranatee Associates Co., Ltd.

**CALIBRATION CONDITION** : Wind tunnel cross-section area<sup>1</sup> 900 cm<sup>2</sup>  
Wind direction frontal area<sup>2</sup> 52 cm<sup>2</sup>  
Diameter of mounting pipe<sup>3</sup> - mm  
Blockage ratio of test object<sup>4</sup> 0.058 [-]

**Preconditioning** : 24 hours at ambient conditions.

**Measurement Condition** : The average values during measurement are (24.3)°C, (45.1) %RH and (1005.1) hPa.

## TABULATION OF RESULTS:

The table on next page give the measured values.

## Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol



## Approved signatory:

*Mr. Parinya Booncharoen*  
Mr. Parinya Booncharoen  
Calibration Department Manager

## Remark:

<sup>1</sup> Nozzle cross-section area of the wind tunnel

<sup>2</sup> Projected cross-section area of the tested object include mounting pipe

<sup>3</sup> Diameter of mounting pipe

<sup>4</sup> Ratio <sup>2</sup> to <sup>1</sup>

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เอกสารไม่ควบคุม

# 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 : 3 January, 2025

Certification No. 002/25

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 1012.8 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO. 1425

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 :

Mr. Watcharapol Subwat

Signed :

Mr. Pisood Promsut

Mechanical Engineer

(Authorised Signatory)

for the Chief

Sub-Standard Instrument

เอกสารไม่ควบคุม



# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 002/25

3 January, 2025

Page : 2 of 5

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
Ultrasonic Anemometer	Pressure	Vacumm	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.02	-	-	-	11.0	0.02
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Vane Angel Bench Stand Model 18112

Young Meteorological Instruments

WIND DIRECTION	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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## The Result of Calibration

Certification No. 002/25

3 January, 2025

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1012.05	1012	0.05
1011.25	1011	0.25
1012.92	1013	-0.08
1010.09	1010	0.09
1008.87	1009	-0.13
1010.43	1010	0.43
1011.39	1011	0.39
1011.05	1011	0.05
1010.72	1011	-0.28
1010.30	1010	0.30
1009.81	1010	-0.19
1008.93	1009	-0.07
1009.35	1009	0.35
1009.89	1010	-0.11
1010.57	1011	-0.43
1011.41	1012	-0.59
1012.31	1012	0.31
1009.75	1010	-0.25
1010.67	1011	-0.33
1011.01	1011	0.01

Average

-0.01

Calibrated by :

*Watchapol*

Mr. Watchapol Subwat

Mechanical Engineer



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## The Result of Calibration

Certification No. 002/25

3 January, 2025

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
759.10	759	0.10
758.50	759	-0.50
759.75	760	-0.25
757.63	757	0.63
756.71	757	-0.29
757.88	758	-0.12
758.60	758	0.60
758.35	758	0.35
758.10	758	0.10
757.79	758	-0.21
757.42	757	0.42
756.76	757	-0.24
757.07	757	0.07
757.48	758	-0.52
757.99	758	-0.01
758.62	759	-0.38
759.29	759	0.29
757.37	757	0.37
758.06	758	0.06
758.32	758	0.32

Average

0.04

Calibrated by :

*Watchapol*

Mr. Watchapol Subwat

Mechanical Engineer



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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. 002/25

3 January, 2025

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.5	45	0.5
30.4	30	0.4
15.6	15	0.6

Calibrated by :

*Watchapol*

Mr. Watchapol Subwat  
Mechanical Engineer



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## 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 : 19 February, 2025

Certification No. 106/25

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver : 2205DR0114

Wind Sensor : 2205DT0114

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 : 1011.3 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer : Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

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 :

Mr. Watchapol Subwat

Mechanical Engineer

Mr. Pisood Promsut

(Authorised Signatory)

for the Chief

Sub-Standard Instrument

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## The Result of Calibration

Certification No. 106/25

19 February, 2025

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1012.05	1012	0.05
1011.25	1011	0.25
1012.92	1013	-0.08
1010.09	1010	0.09
1008.87	1009	-0.13
1010.43	1010	0.43
1011.39	1011	0.39
1011.05	1011	0.05
1010.72	1011	-0.28
1010.30	1010	0.30
1009.81	1010	-0.19
1008.93	1009	-0.07
1009.35	1009	0.35
1009.89	1010	-0.11
1010.57	1011	-0.43
1011.41	1011	0.41
1012.31	1012	0.31
1009.75	1010	-0.25
1010.67	1011	-0.33
1011.01	1011	0.01

Average

0.04

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



## The Result of Calibration

Certification No. 106/25

19 February, 2025

Page : 2 of 5

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	Velocity	Velocity	Correction
	m/sec	inches H2O	inches H2O	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.02	-	-	-	11.0	0.02
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Vane Angel Bench Stand Model 18112

Young Meteorological Instruments

WIND DIRECTION	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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## THAI METEOROLOGICAL DEPARTMENT

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

### The Result of Calibration

Certification No. 106/25

19 February, 2025

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
759.10	759	0.10
758.50	759	-0.50
759.75	760	-0.25
757.63	758	-0.37
756.71	757	-0.29
757.88	758	-0.12
758.60	758	0.60
758.35	758	0.35
758.10	758	0.10
757.79	758	-0.21
757.42	757	0.42
756.76	757	-0.24
757.07	757	0.07
757.48	757	0.48
757.99	758	-0.01
758.62	759	-0.38
759.29	759	0.29
757.37	757	0.37
758.06	758	0.06
758.32	758	0.32

Average

0.04

Calibrated by:

*Watcharapol Subwat*

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. 106/25

19 February, 2025

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.5	45	0.5
30.4	30	0.4
15.6	16	-0.4

Calibrated by:

*Watcharapol Subwat*

Mr. Watcharapol Subwat

Mechanical Engineer



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# 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 19 February, 2025

Certification No. 110/25

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2205DR0116

Wind Sensor 2205DT0116

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 1011.4 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

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. K4920001

Calibrated by : Watcharapol

Signed :

Mr. Watcharapol Subwat

Mr. Pisood Promsut

Mechanical Engineer

(Authorised Signatory)

for the Chief

Sub-Standard Instrument

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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. 110/25

19 February, 2025

Page : 2 of 5

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure m/sec	Vacumm inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.02	-	-	-	11.0	0.02
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Vane Angel Bench Stand Model 18112

Young Meteorological Instruments

WIND DIRECTION	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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## The Result of Calibration

Certification No. 110/25

19 February, 2025

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1012.05	1012	0.05
1011.25	1011	0.25
1012.92	1013	-0.08
1010.09	1010	0.09
1008.87	1009	-0.13
1010.43	1010	0.43
1011.39	1011	0.39
1011.05	1011	0.05
1010.72	1011	-0.28
1010.30	1010	0.30
1009.81	1010	-0.19
1008.93	1009	-0.07
1009.35	1009	0.35
1009.89	1010	-0.11
1010.57	1011	-0.43
1011.41	1011	0.41
1012.31	1012	0.31
1009.75	1010	-0.25
1010.67	1010	0.67
1011.01	1011	0.01

Average

0.39

Calibrated by :

Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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## The Result of Calibration

Certification No. 110/25

19 February, 2025

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
759.10	759	0.10
758.50	758	0.50
759.75	760	-0.25
757.63	758	-0.37
756.71	757	-0.29
757.88	758	-0.12
758.60	759	-0.40
758.35	758	0.35
758.10	758	0.10
757.79	758	-0.21
757.42	757	0.42
756.76	757	-0.24
757.07	757	0.07
757.48	757	0.48
757.99	758	-0.01
758.62	759	-0.38
759.29	759	0.29
757.37	757	0.37
758.06	758	0.06
758.32	758	0.32

Average

0.94

Calibrated by :

Watcharapol

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. 110/25

19 February, 2025

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.5	45	0.5
30.4	30	0.4
15.6	15	0.6

q

Calibrated by :

Watcharapol

Mr. Watcharapol Subwat  
Mechanical Engineer

Calibration & Test Section  
Meteorological Instruments Bureau



เอกสารไม่ควบคุม

INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE  
7/139 MOO 13, SOI SUNTINAKORN 11 TAMBON BANG KAO,  
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND  
TEL : (66)0-2116-5860-1 FAX: (66)0-2116-7140



Page 1 of 3

### 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 : 24-ACT-087

Request No : Req-2024-1365

#### Unit Under Calibration Details

Measurement item : Acoustic Calibrator  
Manufacturer : 01dB  
Model : CAL31  
Serial Number : 84065  
ID : UAE.EFM.167/2561  
Class : 1  
Range : 94 dB / 1000 Hz  
Instrument Status : Used

#### Calibration Environment and Details

Temperature : ( 23 ±2 °C )  
Humidity : (50 ± 20 %RH )  
Barometric Pressure : (1013 ±10.0 hPa )  
Received Date : 20 June 2024  
Calibration Date : 25 June 2024  
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	12 June 2025
THD Multimeter	2015	1047765	NIMT	16 January 2025

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 : me  
Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By : พช  
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor

Issue Date : 25 June 2024

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

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FM-708-ACT-02 Rev.03 Issue date 5/6/24

Certificate No : 24-ACT-087

Request No : Req-2024-1365

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty ( $\pm$ dB)	Acceptance limit Class 1 ( $\pm$ dB)	Result
	Measured	Deviated value	Measured	Deviated value			
94 dB / 1000 Hz	93.78	-0.22	-	-	0.13	0.25	Pass

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty ( $\pm$ %)	Acceptance limit Class 1 ( $\pm$ %)	Result
	Measured (Hz)	Deviated	Measured (Hz)	Deviated			
94 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70	Pass

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

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty ( $\pm$ %)	Acceptance limit Class 1 ( $\pm$ %)	Result
	Measured (%)	Measured (%)			
94 dB / 1000 Hz	0.14	-	0.40	2.5	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
Sound pressure level	0.15 dB
Frequency	0.20%
Total distortion+noise	0.50%

- Acceptance limit was IEC60942:2017 Class 1

- The calibration results exclude the calibrator pressure correction

- The calibration results exclude the microphone volume correction

Certificate No : 24-ACT-087

Request No : Req-2024-1365

Decision Rule for Statements of Conformity

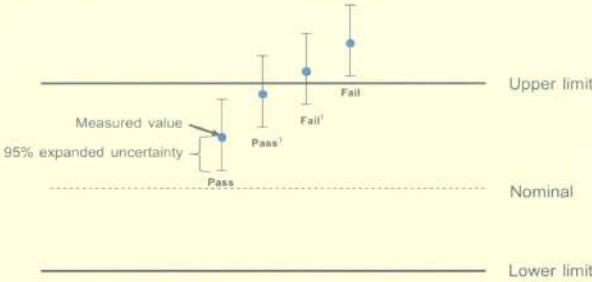
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09:2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass<sup>1</sup> = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>1</sup> = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Calibration





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 : 24-SLM-240

Request No : Req-2024-1459

Unit Under Calibration Details

Measurement item : Sound Level Meter  
Manufacturer : Larson Davis  
Model : LxT2  
Serial Number : 0005299  
ID : UAE.EFM.114/2562  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : 375A04  
Microphone S/N : 323471  
Preamplifier Model : PRMLxT2C  
Preamplifier S/N : 071493  
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 2 July 2024  
Calibrated Date : 11 July 2024  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	Svantek	Svan401	131	8 October 2024	WK Electric

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 : me  
Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By : นพิต  
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor

Issue Date : 11 July 2024



Certificate No : 24-SLM-240

Request No : Req-2024-1459

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR			
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)			
1000 Hz 114 dB	113.76	115.3	1.54	113.8	+0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	( ± dB)
A	27.1	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	( ± dB)
A	26.6	0.10
C	26.2	0.10
Z	30.6	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Responce curve			UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
	A	C	Z			
FAST / 37-139						
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.0	0.2	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	0.2	0.3	0.4	0.60	3.0	Pass
8000 Hz	-0.5	-0.4	-0.2	0.70	5.0	Pass

Certificate No : 24-SLM-240  
Request No : Req-2024-1459

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency			UNCERTAINTY	Acceptance	Result
FAST / 37-139	Weighting Response curve				Limit	
STD Setting	A (dB)	C (dB)	Z (dB)	( ± dB)	( ± dB)	
63 Hz	-0.2	0.0	0.0	0.20	2.0	Pass
125 Hz	-0.1	0.0	0.0		1.5	Pass
250 Hz	-0.1	0.0	0.0		1.5	Pass
500 Hz	-0.1	0.0	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.0	0.0	0.0		2.0	Pass
4000 Hz	0.0	0.0	0.0		3.0	Pass
8000 Hz	0.0	0.0	0.0		5.0	Pass
16000 Hz	-0.1	-0.1	-0.1		+5, -INF.	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
		UUC	ERR		Limit	
FAST / 37-139	REF			( ± dB)	( ± dB)	
UUC Weighting	(dB)	(dB)	(dB)		( ± dB)	
A	114.00	114.0	0.0		0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
		UUC	ERR		Limit	
37-139 / A	REF			( ± dB)	( ± dB)	
UUC Time Response	(dB)	(dB)	(dB)		( ± dB)	
Fast	114.00	114.0	0.0		0.10	Pass
Slow	114.00	114.0	0.0		0.10	Pass
Leq	114.00	114.0	0.0		0.10	Pass

Certificate No : 24-SLM-240  
Request No : Req-2024-1459

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC			
STD Setting	(dB)	( ± dB)	( ± dB)	
Initial	114.0			
Final	114.0			
Deviated	0.0	0.10	0.30	Pass

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance	Result
		UUC	ERR		Limit	
FAST / A / 37-139	REF			( ± dB)	( ± dB)	
STD dB	(dB)	(dB)	(dB)		( ± dB)	
139.00	139	139.0	0.0		1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
129.00	129	129.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	94.0	0.0		1.1	Pass
89.00	89	89.0	0.0		1.1	Pass
84.00	84	84.0	0.0		1.1	Pass
79.00	79	79.0	0.0		1.1	Pass
74.00	74	74.0	0.0		1.1	Pass
69.00	69	69.0	0.0		1.1	Pass
64.00	64	64.0	0.0		1.1	Pass
59.00	59	59.0	0.0		1.1	Pass
54.00	54	54.0	0.0		1.1	Pass
49.00	49	49.0	0.0		1.1	Pass
44.00	44	44.0	0.0		1.1	Pass
39.00	39	39.2	0.2		1.1	Pass
38.00	38	38.3	0.3		1.1	Pass
37.00	37	37.4	0.4		1.1	Pass
36.00	36	36.5	0.5		1.1	Pass

Certificate No : 24-SLM-240  
Request No : Req-2024-1459

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
FAST / A	REF	UUC	ERR		Limit	
UUC Range	(dB)	(dB)	(dB)	( ± dB)	( ± dB)	
37-139	41.90	42.1	0.2	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
A / 37-139	Toneburst	Ref	UUC	ERR		Limit	
UUC Time Response	(ms)	(dB)	(dB)	(dB)	( ± dB)	( ± dB)	
Fast	200	135.0	134.9	-0.1	0.20	1.0	Pass
	2	118.0	117.9	-0.1		+1.0, -2.5	Pass
	0.25	109.0	108.8	-0.2		+1.5, -5.0	Pass
Slow	200	128.6	128.5	-0.1		1.0	Pass
	2	109.0	108.9	-0.1		+1.0, -5.0	Pass
SEL	200	129.0	129.0	0.0		1.0	Pass
	2	109.0	109.1	+0.1		+1.0, -2.5	Pass
	0.25	100.0	100.0	0.0		+1.5, -5.0	Pass

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
FAST / C / 95-142	REF	UUC	ERR		Limit	
STD Setting	(dB)	(dB)	(dB)	( ± dB)	( ± dB)	
Complete cycle	137.4	136.6	-0.80	0.20	3.0	Pass
Positive half cycle	136.4	136.2	-0.20		2.0	Pass
Negative half cycle	136.4	136.2	-0.20		2.0	Pass

Certificate No : 24-SLM-240  
Request No : Req-2024-1459

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)	( ± dB)	( ± dB)	
Positive one-half cycle	140.6			
Negative one-half cycle	140.7			
Deviated	-0.1	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)	( ± dB)	( ± dB)	
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.30	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

- Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-1:2013



Certificate No : 24-SLM-240  
Request No : Req-2024-1459

Decision Rule for Statements of Conformity

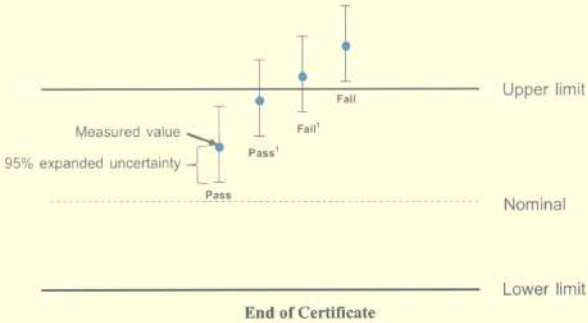
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass<sup>1</sup> = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>1</sup> = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 24-SLM-234  
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok Request No : Req-2024-1453  
10260

Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2  
Manufacturer : Larson Davis Microphone Model : 375B02  
Model : LX12 Microphone S/N : 011740  
Serial Number : 0005286 Preamplifier Model : PRMLxT2B  
ID : UAE.EFM.102/2562 Preamplifier S/N : 056087  
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 1 July 2024  
Calibrated Date : 10 July 2024  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	Svantek	Svan401	131	8 October 2024	WK Electric

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 : 10 July 2024



Certificate No : 24-SLM-234  
Request No : Req-2024-1453

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR			
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)			
1000 Hz 114 dB	113.76	114.4	0.64	113.8	+0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	( ± dB)
A	31.3	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	( ± dB)
A	31.1	0.10
C	30.6	0.10
Z	34.9	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
	A	C	Z			
FAST / 37-139	(dB)	(dB)	(dB)	0.60	1.5	Pass
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.0	0.1	0.1			
1000 Hz	0.0	0.0	0.0			
4000 Hz	1.2	1.2	1.2			
8000 Hz	2.7	2.8	2.9	0.70	5.0	Pass1



Certificate No : 24-SLM-234  
Request No : Req-2024-1453

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
FAST / 37-139	A (dB)	C (dB)	Z (dB)			
STD Setting	(dB)	(dB)	(dB)	0.20	2.0	Pass
63 Hz	-0.1	0.0	0.0			
125 Hz	-0.1	0.0	0.0			
250 Hz	-0.1	0.0	0.0			
500 Hz	0.0	0.1	0.0			
1000 Hz	0.0	0.0	0.0			
2000 Hz	0.0	0.1	0.0			
4000 Hz	0.0	0.0	0.0			
8000 Hz	0.0	0.0	0.0			
16000 Hz	0.0	-0.1	-0.1		+5, -INF.	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD REF	Measured		UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
FAST / 37-139		UUC	ERR			
UUC Weighting	(dB)	(dB)	(dB)	0.20	0.20	Pass
A	114.00	114.0	0.0			
C	114.00	114.0	0.0			
Z	114.00	114.0	0.0			

UUC Setting	STD REF	Measured		UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
37-139 / A		UUC	ERR			
UUC Time Response	(dB)	(dB)	(dB)	0.20	0.10	Pass1
Fast	114.00	114.0	0.0			
Slow	114.00	114.0	0.0			
Leq	114.00	114.0	0.0			



Certificate No : 24-SLM-234  
Request No : Req-2024-1453

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY  ( ± dB)	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)		( ± dB)	
Initial	114.0			
Final	114.0			
Deviated	0.0	0.10	0.30	Pass

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance	
FAST / A / 37-139	REF	UUC	ERR		Limit	Result
STD dB	(dB)	(dB)	(dB)	( ± dB)	( ± dB)	
139.00	139	139.0	0.0	0.30	1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
129.00	129	129.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	94.0	0.0		1.1	Pass
89.00	89	89.0	0.0		1.1	Pass
84.00	84	84.0	0.0		1.1	Pass
79.00	79	79.0	0.0		1.1	Pass
74.00	74	74.0	0.0		1.1	Pass
69.00	69	69.0	0.0		1.1	Pass
64.00	64	64.0	0.0		1.1	Pass
59.00	59	59.0	0.0		1.1	Pass
54.00	54	54.0	0.0		1.1	Pass
49.00	49	49.1	0.1		1.1	Pass
44.00	44	44.2	0.2		1.1	Pass
43.00	43	43.3	0.3		1.1	Pass
42.00	42	42.3	0.3		1.1	Pass
41.00	41	41.4	0.4		1.1	Pass

Certificate No : 24-SLM-234  
Request No : Req-2024-1453

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
FAST / A	REF	UUC	ERR		Limit	
UUC Range	(dB)	(dB)	(dB)	( ± dB)	( ± dB)	
37-139	46.30	46.4	0.1	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
A / 37-139	Toneburst	Ref	UUC	ERR		Limit	
UUC Time Response	(ms)	(dB)	(dB)	(dB)	( ± dB)	( ± dB)	
Fast	200	135.0	134.9	-0.1	0.20	1.0	Pass
	2	118.0	117.6	-0.4		+1.0, -2.5	Pass
	0.25	109.0	108.6	-0.4		+1.5, -5.0	Pass
Slow	200	128.6	128.5	-0.1		1.0	Pass
	2	109.0	108.9	-0.1		+1.0, -5.0	Pass
SEL	200	129.0	129.0	0.0		1.0	Pass
	2	109.0	109.0	0.0		+1.0, -2.5	Pass
	0.25	100.0	99.8	-0.2	+1.5, -5.0	Pass	

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
FAST / C / 95-142		REF	UUC		ERR	
STD Setting	(dB)	(dB)	(dB)	( ± dB)	( ± dB)	
Complete cycle	137.4	136.8	-0.60	0.20	3.0	Pass
Positive half cycle	136.4	136.2	-0.20		2.0	Pass
Negative half cycle	136.4	136.2	-0.20		2.0	Pass

Certificate No : 24-SLM-234  
Request No : Req-2024-1453

12. Overload indication

UUC Setting	Measured	UNCERTAINTY  ( ± dB)	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)		( ± dB)	
Positive one-half cycle	145.5			
Negative one-half cycle	145.4			
Deviated	0.1	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY  ( ± dB)	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)		( ± dB)	
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.30	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

- Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-1:2013

Certificate No : 24-SLM-234  
Request No : Req-2024-1453

Decision Rule for Statements of Conformity

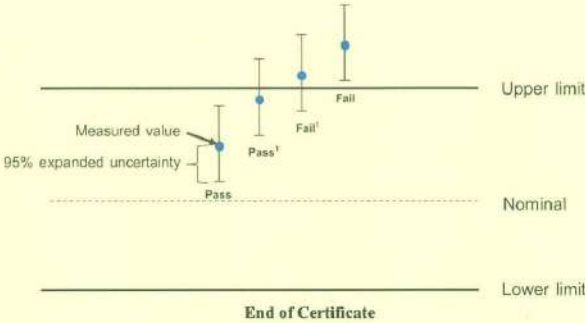
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass<sup>1</sup> = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>1</sup> = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.





ELECTRICAL AND ELECTRONICS INSTITUTE  
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Tel: +66 2709 4860 Fax: +66 2324 0917



Certificate No.: CP20240291EA

Operation No.: CP2024070254

## Certificate of Calibration

**Equipment:** Sound Level Meter

**Manufacturer:** Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)

**Model/Type:** LxT2 (Meter), 375A04B02 (Microphone), PRMLxT2C (Preamplifier)

**Serial No.:** 0005396 (Meter), 329350 (Microphone), 073805 (Preamplifier)

**ID No.:** UAE.EFM.033/2564

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

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

**Received Date:** 25 July 2024

**Calibrated Date:** 5 - 6 August 2024

**Issued Date:** 7 August 2024

**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.



ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240291EA

## Calibration Report

**Equipment:** Sound Level Meter

**Manufacturer:** Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)

**Model/Type:** LxT2 (Meter), 375A04B02 (Microphone), PRMLxT2C (Preamplifier)

**Serial No.:** 0005396 (Meter), 329350 (Microphone), 073805 (Preamplifier)

**ID No.:** UAE.EFM.033/2564

**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-1012-23	12 November 2024
2)	Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3)	Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4)	6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5)	Pressure humidity and Temperature Transmitter	PTU301	L3950483	CL1-P240023 CD20240142EA	24 March 2025 12 June 2025
6)	Pressure humidity and Temperature Transmitter	PTU301	L3950484	CL1-P240030 CD20240143EA	11 April 2025 12 June 2025
7)	Performance Audio Analyzer	U8903B	MY56510003	CB20240035EB CK20230072EA	13 February 2025 13 September 2024

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)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-

Certificate No.: CP20240291EA

### Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
29.3

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	29.1
C-weighting	28.8
Z-weighting	34.1

Function : 3. Acoustical signal tests of frequency weightings (Without 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	0.3	0.1	0.3	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	0.2	0.2	0.2	±5.0

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	0.0	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	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	-0.1	0.0	±5.0

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

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Certificate No.: CP20240291EA

### Calibration Report

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	±0.3

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	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
134.0	134.1	0.1	±1.1
139.0	139.1	0.1	±1.1
140.0	140.1	0.1	±1.1
141.0	141.1	0.1	±1.1

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### 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	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.1	0.1	±1.1
43.0	43.1	0.1	±1.1
42.0	42.2	0.2	±1.1
41.0	41.2	0.2	±1.1
40.0	40.3	0.3	±1.1

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	135.9	-0.1	±1.0
	2	118.8	-0.2	+1.0 ; -2.5
	0.25	109.8	-0.2	+1.5 ; -5.0
Slow	200	129.5	-0.1	±1.0
	2	109.9	-0.1	+1.0 ; -5.0
	200	130.0	0.0	±1.0
LAE	2	110.0	0.0	+1.0 ; -2.5
	0.25	101.0	0.0	+1.5 ; -5.0

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	135.4	134.8	-0.6	±3.0
Positive half cycle	134.4	134.0	-0.4	±2.0
Negative half cycle	134.4	134.0	-0.4	±2.0

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
143.4	143.4	0.0	±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	139.0	139.0	0.0	±0.3

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. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
2. The acceptance limit is for the deviated value.
3. Acceptance limits was IEC61672-3:2013 Class 2.
4. The coverage factor  $k = 2.00$

-- End of Report --

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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 : 24-SLM-214  
Request No : Req-2024-1379

Unit Under Calibration Details

Measurement item : Sound Level Meter  
Manufacturer : Larson Davis  
Model : LxT2  
Serial Number : 0005398  
ID : UAE.EFM.035/2564  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : 375A04  
Microphone S/N : 328675  
Preamplifier Model : PRMLxT2C  
Preamplifier S/N : 073793  
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 24 June 2024  
Calibrated Date : 2 July 2024  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	Svantek	Svan401	131	8 October 2024	WK Electric

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 : 2 July 2024

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Certificate No : 24-SLM-214  
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1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR			
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)			
1000 Hz 114 dB	113.76	114.0	0.24	113.8	+0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY ( ± dB)
FAST / 37-139		
UUC Weighting	(dB)	( ± dB)
A	28.8	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY ( ± dB)
FAST / 37-139		
UUC Weighting	(dB)	( ± dB)
A	28.1	0.10
C	27.9	0.10
Z	32.1	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
	A	C	Z			
STD Setting	(dB)	(dB)	(dB)			
125 Hz	-0.1	0.1	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	0.6	0.6	0.6	0.60	3.0	Pass
8000 Hz	0.5	0.4	0.4	0.70	5.0	Pass

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Certificate No : 24-SLM-214  
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5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency			UNCERTAINTY	Acceptance	Result
FAST / 37-139	Weighting Response curve				Limit	
STD Setting	A (dB)	C (dB)	Z (dB)	( ± dB)	( ± dB)	
63 Hz	-0.1	0.0	0.0	0.20	2.0	Pass
125 Hz	-0.1	0.0	0.0		1.5	Pass
250 Hz	-0.1	0.0	0.0		1.5	Pass
500 Hz	0.0	0.0	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.1	0.1	0.0		2.0	Pass
4000 Hz	0.0	0.0	0.1		3.0	Pass
8000 Hz	0.0	0.0	0.1		5.0	Pass
16000 Hz	0.0	0.0	-0.1		+5,-INF.	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
FAST / 37-139	REF	UUC	ERR			
UUC Weighting	(dB)	(dB)	(dB)	( ± dB)	Limit ( ± dB)	
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
37-139 / A	REF	UUC	ERR			
UUC Time Response	(dB)	(dB)	(dB)	( ± dB)	Limit ( ± dB)	
Fast	114.00	114.0	0.0	0.20	0.10	Pass1
Slow	114.00	114.0	0.0		0.10	Pass1
Leq	114.00	114.0	0.0		0.10	Pass1



Certificate No : 24-SLM-214  
Request No : Req-2024-1379

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC			
STD Setting	(dB)	( ± dB)	Limit ( ± dB)	
Initial	114.0			
Final	114.0			
Deviated	0.0	0.10	0.30	Pass

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	REF	UUC	ERR			
STD dB	(dB)	(dB)	(dB)	( ± dB)	Limit ( ± dB)	
139.00	139	139.0	0.0	0.30	1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
129.00	129	129.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	93.9	-0.1		1.1	Pass
89.00	89	88.9	-0.1		1.1	Pass
84.00	84	83.9	-0.1		1.1	Pass
79.00	79	78.9	-0.1		1.1	Pass
74.00	74	73.9	-0.1		1.1	Pass
69.00	69	68.9	-0.1		1.1	Pass
64.00	64	63.9	-0.1		1.1	Pass
59.00	59	58.9	-0.1		1.1	Pass
54.00	54	53.9	-0.1		1.1	Pass
49.00	49	49.0	0.0		1.1	Pass
44.00	44	44.0	0.0		1.1	Pass
39.00	39	39.3	0.3		1.1	Pass
38.00	38	38.4	0.4		1.1	Pass



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Request No : Req-2024-1379

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY  ( ± dB)	Acceptance	Result
FAST / A	REF	UUC	ERR		Limit	
UUC Range	(dB)	(dB)	(dB)		( ± dB)	
37-139	43.60	43.7	0.1	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
A / 37-139	Toneburst	Ref	UUC	ERR		Limit	
UUC Time Response	(ms)	(dB)	(dB)	(dB)	( ± dB)	( ± dB)	
Fast	200	135.0	135.0	0.0	0.20	1.0	Pass
	2	118.0	117.8	-0.2		+1.0, -2.5	Pass
	0.25	109.0	108.6	-0.4		+1.5, -5.0	Pass
Slow	200	128.6	128.5	-0.1		1.0	Pass
	2	109.0	108.9	-0.1		+1.0, -5.0	Pass
SEL	200	129.0	129.0	0.0		1.0	Pass
	2	109.0	109.0	0.0		+1.0, -2.5	Pass
	0.25	100.0	99.8	-0.2		+1.5, -5.0	Pass

11. Peak C Sound level

UUC Setting	Anticipated  REF  (dB)	Measured		UNCERTAINTY  ( ± dB)	Acceptance	Result
FAST / C / 95-142		UUC	ERR		Limit	
STD Setting		(dB)	(dB)		(dB)	
Complete cycle	137.4	136.7	-0.70	0.20	3.0	Pass
Positive half cycle	136.4	136.2	-0.20		2.0	Pass
Negative half cycle	136.4	136.2	-0.20		2.0	Pass

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Certificate No : 24-SLM-214

Request No : Req-2024-1379

12. Overload indication

UUC Setting	Measured	UNCERTAINTY  ( ± dB)	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)		( ± dB)	
Positive one-half cycle	142.0			
Negative one-half cycle	142.1			
Deviated	-0.1	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY  ( ± dB)	Acceptance Limit	Result
FAST / A / 37-139	UUC		( ± dB)	
STD Setting	(dB)			
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.30	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

- Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-1:2013

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Certificate No : 24-SLM-214

Request No : Req-2024-1379

#### Decision Rule for Statements of Conformity

The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019: Guidelines on the

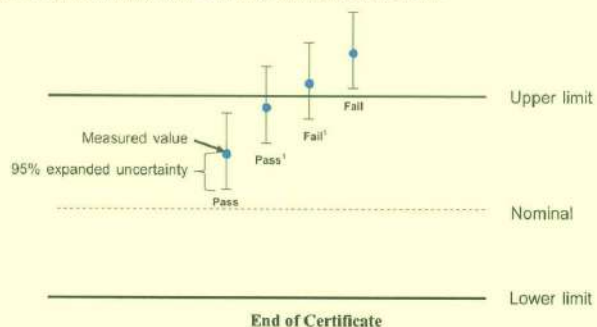
Reporting of Compliance with Specification as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass<sup>1</sup> = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>1</sup> = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



## ELECTRICAL AND ELECTRONICS INSTITUTE FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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Certificate No.: CP20240293EA

Operation No.: CP2024070256

## Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)

Model/Type: LxT2 (Meter), 375B02 (Microphone), PRMLxT2B (Preamplifier)

Serial No.: 0005399 (Meter), 11789 (Microphone), 056125 (Preamplifier)

ID No.: UAE.EFM.036/2564

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

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

Received Date: 25 July 2024

Calibrated Date: 6 - 7 August 2024

Issued Date: 7 August 2024

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.: CP20240293EA

### Calibration Report

Equipment: Sound Level Meter  
Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)  
Model/Type: LxT2 (Meter), 375B02 (Microphone), PRMLxT2B (Preamplifier)  
Serial No.: 0005399 (Meter), 11789 (Microphone), 056125 (Preamplifier)  
ID No.: UAE.EFM.036/2564  
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-1012-23	12 November 2024
2)	Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3)	Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4)	6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5)	Pressure humidity and Temperature Transmitter	PTU301	L3950483	CL1-P240023 CD20240142EA	24 March 2025 12 June 2025
6)	Pressure humidity and Temperature Transmitter	PTU301	L3950484	CL1-P240030 CD20240143EA	11 April 2025 12 June 2025
7)	Performance Audio Analyzer	U8903B	MY56510003	CB20240035EB CK20230072EA	13 February 2025 13 September 2024

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)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-

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Certificate No.: CP20240293EA

### Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
30.6

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	29.5
C-weighting	28.9
Z-weighting	34.4

Function : 3. Acoustical signal tests of frequency weightings (Without 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	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	1.9	1.9	1.9	±5.0

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	-0.1	0.0	0.0	±2.0
125	0.0	0.0	0.1	±1.5
250	-0.1	0.0	0.0	±1.5
500	0.0	-0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	-0.1	0.0	0.0	±5.0

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

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Certificate No.: CP20240293EA

### Calibration Report

#### 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	±0.3

#### 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	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
134.0	134.1	0.1	±1.1
139.0	139.1	0.1	±1.1
140.0	140.1	0.1	±1.1
141.0	141.1	0.1	±1.1

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Certificate No.: CP20240293EA

### 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	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.1	0.1	±1.1
43.0	43.2	0.2	±1.1
42.0	42.2	0.2	±1.1
41.0	41.3	0.3	±1.1
40.0	40.4	0.4	±1.1

#### Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	135.9	-0.1	±1.0
	2	118.8	-0.2	+1.0 ; -2.5
	0.25	109.6	-0.4	+1.5 ; -5.0
Slow	200	129.5	-0.1	±1.0
	2	109.9	-0.1	+1.0 ; -5.0
	200	130.0	0.0	±1.0
LAE	2	110.0	0.0	+1.0 ; -2.5
	0.25	100.8	-0.2	+1.5 ; -5.0

#### 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	135.4	134.7	-0.7	±3.0
Positive half cycle	134.4	134.1	-0.3	±2.0
Negative half cycle	134.4	134.1	-0.3	±2.0

#### Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
143.6	143.5	-0.1	±1.5

เอกสารไม่ควบคุม

Certificate No.: CP20240293EA

### 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	139.0	139.0	0.0	±0.3

### 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. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
2. The acceptance limit is for the deviated value.
3. Acceptance limits was IEC61672-3:2013 Class 2.
4. The coverage factor  $k = 2.00$

-- End of Report --

เอกสารไม่ควบคุม



### 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 : 24-SLM-238

Request No : Req-2024-1457

#### Unit Under Calibration Details

Measurement item : Sound Level Meter  
Microphone Class : 2  
Manufacturer : Larson Davis  
Microphone Model : 375A04  
Model : LxT2  
Microphone S/N : 351857  
Serial Number : 0005290  
Preamplifier Model : PRMLxT2B  
ID : UAE.EFM.106/2562  
Preamplifier S/N : 056077  
Resolution : 0.1 dB  
Instrument Status : Used

#### Calibration Environment and Details


Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 2 July 2024  
Calibrated Date : 11 July 2024  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic


#### Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	SvanteK	Svan401	131	8 October 2024	WK Electric

#### 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 : 11 July 2024





Certificate No : 24-SLM-238

Request No : Req-2024-1457

## 1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR		Limit	
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)		( ± dB)	
1000 Hz 114 dB	113.76	114.1	0.34	113.8	+0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

## 2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY ( $\pm$ dB)
FAST / 37-139		
UUC Weighting	(dB)	( $\pm$ dB)
A	25.4	0.10

## 3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY ( $\pm$ dB)
FAST / 37-139		
UUC Weighting	(dB)	( $\pm$ dB)
A	24.8	0.10
C	24.3	0.10
Z	28.6	0.10

## 4. Acoustic signal test of frequency weightings (Without Windscreen)

1.7. Results of the test of the accuracy of the weighting						
UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance Limit	Result
FAST / 37-139	A	C	Z	(± dB)	(± dB)	
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.1	0.2	0.2	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	0.6	0.6	0.6	0.60	3.0	Pass
8000 Hz	0.8	0.8	0.9	0.70	5.0	Pass1



Certificate No : 24-SLM-238

Request No : Req-2024-1457

## 5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency			UNCERTAINTY	Acceptance Limit	Result
FAST / 37-139	Weighting Response curve					
STD Setting	A (dB)	C (dB)	Z (dB)	( ± dB)	( ± dB)	
63 Hz	-0.2	-0.1	-0.1	0.20	2.0	Pass
125 Hz	-0.1	0.0	-0.1		1.5	Pass
250 Hz	-0.1	0.0	-0.1		1.5	Pass
500 Hz	-0.1	0.0	-0.1		1.5	Pass
1000 Hz	0.0	0.0	-0.1		1.0	Pass
2000 Hz	0.0	0.0	0.0		2.0	Pass
4000 Hz	0.0	0.0	0.0		3.0	Pass
8000 Hz	-0.1	-0.1	0.0		5.0	Pass
16000 Hz	-0.1	-0.1	-0.1		+5, -INF.	Pass

## 6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
FAST / 37-139	REF	UUC	ERR		Limit	
UUC Weighting	(dB)	(dB)	(dB)	( ± dB)	( ± dB)	
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
37-139 / A	REF	UUC	ERR		Limit	
UUC Time Response	(dB)	(dB)	(dB)	( ± dB)	( ± dB)	
Fast	114.00	114.0	0.0	0.20	0.10	Pass1
Slow	114.00	114.0	0.0		0.10	Pass1
Leq	114.00	114.0	0.0		0.10	Pass1



Certificate No : 24-SLM-238  
Request No : Req-2024-1457

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
FAST / A / 37-139	UUC			
STD Setting	(dB)			
Initial	114.0			
Final	114.0			
Deviated	0.0	0.10	0.30	Pass

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
FAST / A / 37-139	REF	UUC	ERR			
STD dB	(dB)	(dB)	(dB)			
137.00	137	137.0	0.0	0.30	1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
129.00	129	129.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	93.9	-0.1		1.1	Pass
89.00	89	88.9	-0.1		1.1	Pass
84.00	84	83.9	-0.1		1.1	Pass
79.00	79	78.9	-0.1		1.1	Pass
74.00	74	73.9	-0.1		1.1	Pass
69.00	69	68.9	-0.1		1.1	Pass
64.00	64	63.9	-0.1		1.1	Pass
59.00	59	58.9	-0.1		1.1	Pass
54.00	54	53.9	-0.1		1.1	Pass
49.00	49	48.9	-0.1		1.1	Pass
44.00	44	44.0	0.0		1.1	Pass
39.00	39	39.1	0.1		1.1	Pass
38.00	38	38.2	0.2		1.1	Pass
37.00	37	37.2	0.2		1.1	Pass
36.00	36	36.3	0.3		1.1	Pass
35.00	35	35.4	0.4		1.1	Pass



Certificate No : 24-SLM-238  
Request No : Req-2024-1457

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
FAST / A	REF	UUC	ERR			
UUC Range	(dB)	(dB)	(dB)			
37-139	40.10	40.2	0.1	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
A / 37-139	Toneburst	Ref	UUC	ERR			
UUC Time Response	(ms)	(dB)	(dB)	(dB)			
Fast	200	135.0	135.0	0.0	0.20	1.0	Pass
	2	118.0	117.9	-0.1		+1.0, -2.5	Pass
	0.25	109.0	108.6	-0.4		+1.5, -5.0	Pass
Slow	200	128.6	128.5	-0.1		1.0	Pass
	2	109.0	108.9	-0.1		+1.0, -5.0	Pass
SEL	200	129.0	129.0	0.0		1.0	Pass
	2	109.0	109.0	0.0		+1.0, -2.5	Pass
	0.25	100.0	99.8	-0.2		+1.5, -5.0	Pass

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
FAST / C / 95-142	REF	UUC	ERR			
STD Setting	(dB)	(dB)	(dB)			
Complete cycle	137.4	136.6	-0.80	0.20	3.0	Pass
Positive half cycle	136.4	136.2	-0.20		2.0	Pass
Negative half cycle	136.4	136.2	-0.20		2.0	Pass



Certificate No : 24-SLM-238

Request No : Req-2024-1457

## 12. Overload indication

UUC Setting	Measured	UNCERTAINTY  ( ± dB)	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)		( ± dB)	
Positive one-half cycle	138.8			
Negative one-half cycle	138.7			
Deviated	0.1	0.20	1.5	Pass

## 13. High Level Stability

UUC Setting	Measured	UNCERTAINTY  ( ± dB)	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)		( ± dB)	
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.30	Pass

## Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

- Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-1:2013

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

เอกสารไม่ควบคุม

FM-708-SLM-01 Rev.04 Issue date 5/6/24



Certificate No : 24-SLM-238

Request No : Req-2024-1457

## Decision Rule for Statements of Conformity

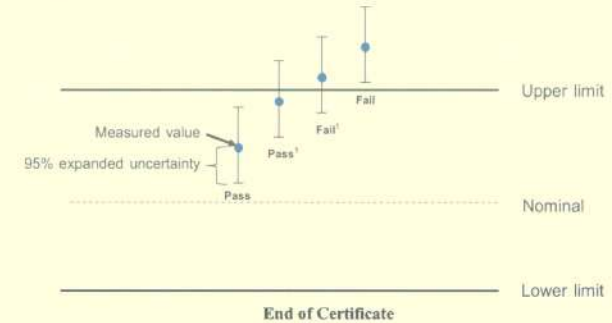
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019: Guidelines on the

Reporting of Compliance with Specification as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass<sup>1</sup> = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.Fail<sup>1</sup> = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



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

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FM-708-SLM-01 Rev.04 Issue date 5/6/24

แผนการติดตามตรวจสอบคุณภาพสิ่งแวดล้อม

โครงการรถไฟฟ้าสายสีเขียว ช่วงแบริ่ง-สมุทรปราการ

เดือนมกราคม-มิถุนายน 2568

### List Certificate of Instrument for Environmental Quality Analysis.

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
<b>Equipment for Air Quality Analysis</b>									
1	Analytical Balance (Readability 0.1 mg)	ฝุ่นละอองขนาดเล็กไม่เกิน 10 ไมครอน (PM10)	Mettler-Toledo	MS204TS/00 C252436235	National Food Institute, Ministry of Industry, Thailand	2502228-003-01	19 Mar 25	18 Mar 26	-
<b>Equipment for Water Quality Analysis</b>									
2	pH Meter	pH	Mettler-Toledo	SevenCompact S220/ C113432421	National Food Institute, Ministry of Industry, Thailand	2403175-001-01	25 Jun 24	24 Jun 25	-
3	Analytical Balance (Readability 0.01 mg)	SS TDS	Mettler-Toledo	XSR205DU / C210685394	National Food Institute, Ministry of Industry, Thailand	2502226-002-01	20 Mar 25	19 Mar 26	-
4	Hot Air Oven		Memmert	UF55 / B216.1666	National Food Institute, Ministry of Industry, Thailand	2500116-001-01	8 Oct 24	7 Oct 25	-
5	Analytical Balance (Readability 0.1 mg)	Oil&Grease	Mettler-Toledo	AB-204S/FACT / 1129361010	United Analyst and Engineering Consultant. Co.,Ltd (UAE)	250422-1-BL002-25	23 Apr 25	22 Apr 26	-
6	BOD Incubator	BOD	Arco	UC4-1320 / (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	25TM205	8 Feb 25	8 Feb 26	-
7	DO Meter		YSI	5100 / 11B101863	Technology Promotion Association (Thailand-Japan)	25TW29	17 Feb 25	16 Feb 26	-
8	Digestor Unit	TKN	FOSS TECATOR	DT2520 / 91794469	National Food Institute, Ministry of Industry, Thailand	2402957-001-01	23 May 24	22 May 25	-
9	Distillation Unit (Kjeldahl Method)		FOSS TECATOR	KT8100/ 91889052	FOSS South East Asia	13854	24 Feb 25	23 Feb 26	-



แผนการติดตามตรวจสอบคุณภาพสิ่งแวดล้อม

โครงการรถไฟฟ้าสายสีเขียว ช่วงแบริ่ง-สมุทรปราการ

เดือนมกราคม-มิถุนายน 2568

### List Certificate of Instrument for Environmental Quality Analysis.

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Equipment for Water Quality Analysis									
10	Incubator	TDS	Memmert	IPP 260 / V618.0033	National Food Institute, Ministry of Industry, Thailand	2502229 003 01	19 Mar 25	18 Mar 26	-
11	Water Bath		Memmert	WNE 14 / L416.0606	National Food Institute, Ministry of Industry, Thailand	25051624-001-01	10 Feb 25	9 Feb 26	-
12	Auto Clave		ALP	CL-40L / 808763	National Food Institute, Ministry of Industry, Thailand	2502229 007 01	19 Mar 25	18 Mar 26	-
13	Analytical Balance		OHAUS	PX623 / C236754745	National Food Institute, Ministry of Industry, Thailand	2502227-001-01	19 Mar 25	18 Mar 26	-

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

## Calibration Certificate

**Certificate No.:** 2502228-003-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
 Bangchack, Prakhnong, 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.:** 2502228  
**Operation No.:** 2502228-003  
**Date of Receipt:** 19 March 2025  
**Date of Calibration:** 19 March 2025

**Calibrated by** Mr.Yothin Charoensuk  
 Scientist

**Approved by** *for N. myudat*  
 ( Mr.Pheraphat Tuanjit )  
 Manager, Division of Calibration Laboratory  
 Responsible for the Technical Management Team

**Date of Issue:** 25 March 2025

### 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.:** 2502228-003-01  
**Equipment:** Electronic Balance  
**Model:** MS204TS/00  
**Serial No.:** C252436235  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.023/2566

**Date of Calibration:** 19 March 2025

Page 2 of 3

**Environment Condition:** Ambient Temperature: 21.1 ± 0.6 °C Relative Humidity: 55 ± 0.75 %

**Place of Calibration:** 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	1mg to 200g	B505567572	TCS	M2404100S	19 April 2025
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 017/23	Quality Reborn	QR25-0542	10 February 2026

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:

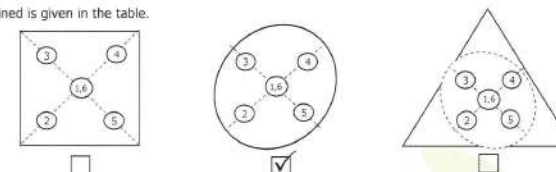
#### 1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
100	0.000052
200	0.000079

#### 2. Off-Center Error:

A mass of 200 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 )
99.9997	99.9995	99.9995	99.9997	99.9999	99.9998	0.0003

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

## Calibration Report

**Certificate No.:** 2502228-003-01  
**Equipment:** Electronic Balance  
**Model:** MS204TS/00  
**Serial No.:** C252436235  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.023/2566

**Date of Calibration:** 19 March 2025

Page 3 of 3

**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 <i>k</i>
Unload	0.00000	0.0000	0.0000	0.000089	2.00
0.1	0.10001	0.1001	-0.0001	0.000089	2.00
1	1.00000	1.0000	0.0000	0.000089	2.00
3	3.00003	3.0000	0.0000	0.000091	2.00
5	5.00002	5.0000	0.0000	0.000090	2.00
10	10.00001	9.9999	0.0001	0.000092	2.00
20	20.00003	20.0000	0.0000	0.000096	2.00
50	50.00003	49.9998	0.0002	0.00012	2.00
70	70.00006	69.9998	0.0003	0.00013	2.00
100	100.00006	99.9998	0.0003	0.00016	2.00
150	150.00009	150.0000	0.0001	0.00021	2.00
200	200.00013	200.0000	0.0001	0.00029	2.00

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

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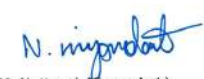
## Calibration Certificate

**Certificate No.:** 2403175-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
 Bangchack, Prakanong, Bangkok 10260

Page 1 of 5

**Equipment:** pH Meter  
**Manufacturer:** METTLER ROLEDO  
**Model:** SevenCompact S220  
**Serial No.:** C113432421  
**ID No.:** UAE.WAT.009/2564  
**Order No.:** 2403175  
**Operation No.:** 2403175-001  
**Date of Receipt:** 13 June 2024  
**Date of Calibration:** 25 June 2024

**Calibrated by** Mr.Pheraphat Tuanjit  
 Scientist

**Approved by**   
 ( Mr.Nittapong Niyomchat )  
 Specialist, Division of Calibration Laboratory  
 Responsible for the Technical Management Team

**Date of Issue:** 28 June 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

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## Calibration Report

**Certificate No.:** 2403175-001-01  
**Equipment:** pH Meter  
**Resolution:** 0.01 pH ; 1 mV  
**Manufacturer:** METTLER ROLEDO  
**Model:** SevenCompact S220  
**Serial No.:** C113432421  
**Type:** Bench top  
**ID No.:** UAE.WAT.009/2564

**Date of Calibration:** 25 June 2024 Page 2 of 5

**Location:** Chemical Calibration Laboratory, National Food Institute  
**Environment Condition:** **Ambient Temperature:** ( 22.5 ± 1.5 ) °C **Relative Humidity:** ( 50 ± 3 ) %  
**Condition of Equipment:** Good Condition

### Condition of this Results of Calibration

1. Calibration Method: W-CC-002 : In house method based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

### 2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	24E1752	30 May 2025
2.2 Digital Thermometer	2709007	Fluke	CC 660570-01	30 October 2024
2.3 Thermo-Hygro Meter	NFI.BTH 019/23	testo	QR24-0492	4 March 2025
Certified Reference Material	Lot. No.	Manufacturer	Ref N	Expire Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	873608	CPAchem	PH216.L5	16 February 2025
2.5 pH buffer 6.865 (Primary pH buffer Solution)	873609	CPAchem	PH217.L5	16 February 2025
2.6 pH buffer 10.01 (Primary pH buffer Solution)	949189	CPAchem	PH220.L5	30 November 2024
2.7 pH buffer 7.00 (Standard pH buffer Solution)	C03109	HACH LANGE GmbH	S11M004	16 October 2025

### 3. This certification is traceable to The International System of Unit (SI Unit)

3.1 Instruments No.2.1	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0008
3.2 Instruments No.2.2	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061
3.3 Instruments No.2.3	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0292
3.4 Certified Reference Material No.2.4 to 2.6	traceable to	Primary measurement method- Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
3.5 Certified Reference Material No.2.7	traceable to	PTB Certificate Nr. PTB-PHOA-563/30504/23 and Certificate Nr. PTB-PHOB-555/30620/22 (PTB: Physikalisch-Technische Bundesanstalt, Braunschweig, Germany)

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.

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



## Calibration Report

**Certificate No.:** 2403175-001-01  
**Equipment:** pH Meter  
**Resolution:** 0.01 pH ; 1 mV  
**Manufacturer:** METTLER ROLEDO  
**Model:** SevenCompact S220  
**Serial No.:** C113432421  
**Type:** Bench top  
**ID No.:** UAE.WAT.009/2564

**Date of Calibration:** 25 June 2024 Page 3 of 5

### Calibration Results:

1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0	414.122	414	0.00	0.58	2.00
2	295.815	296	2.00	0.58	2.00
4	177.463	177	4.00	0.58	2.00
6	59.160	59	6.00	0.58	2.00
7	0.001	0	7.00	0.58	2.00
8	-59.159	-59	8.00	0.58	2.00
10	-177.462	-177	10.00	0.58	2.00
12	-295.813	-296	12.00	0.58	2.00
14	-414.121	-414	14.00	0.58	2.00

### 2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

**Equipment:** pH Electrode **Type:** Combined Electrode  
**Manufacturer:** METTLER ROLEDO **Model:** InLab Expert Pro-ISM  
**Serial No.:** 4114099 **ID No.:** N/A

**Performance of Electrode system** (Three-Point Calibration at pH 4, 7 and 10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.00	176	-	0.0071	2.00
7.001	7.00	1	98.60	0.0086	2.00
9.997	10.00	-174	98.60	0.0092	2.00
6.865	6.86	9	-	0.0075	2.00

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





## Calibration Report

**Certificate No.:** 2403175-001-01  
**Equipment:** Digital Thermometer with RTD (pH Meter)  
**Resolution:** 0.1 °C **Model:** SevenCompact S220  
**Serial No.:** C113432421 **ID No.:** UAE.WAT.009/2564  
**Manufacturer:** METTLER TOLEDO  
**Date of Calibration:** 25 June 2024

Page 4 of 5

**Location:** Chemical Calibration Laboratory, National Food Institute  
**Environment Condition:**  
**Ambient Temperature:** 23 °C ± 1 °C  
**Relative Humidity:** 50 % ± 5 %

### Condition of this results of Calibration:

- Calibration Method :
  - In house method: W-TE-025 by comparison with standard thermometer.
  - 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
HANDHELD THERMOMETER	1521	A85997	TE 670101-01	16-Dec-2024	NATIONAL FOOD INSTITUTE
Platinum Resistance Thermometer (PRT)	385	509201			

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 341592/2

- 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.

6. Condition of Calibrated item : ☒ Good  
 7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

*N. Nigubant*

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## Calibration Report

**Certificate No.:** 2403175-001-01  
**Equipment:** Digital Thermometer with RTD (pH Meter)  
**Resolution:** 0.1 °C **Model:** SevenCompact S220  
**Serial No.:** C113432421 **ID No.:** UAE.WAT.009/2564  
**Manufacturer:** METTLER TOLEDO  
**Date of Calibration:** 25 June 2024

Page 5 of 5

**Calibration point:** 15.0, 25.0 and 35.0 °C  
**Calibration result:**

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.
- Description of probe, model : InLab Expert Pro-ISM S/N : 4114099
- Dimension of probe : Diameter : 12 mm., Length : 120 mm.,
- Sheath material : Teflon

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
14.9	14.998	0.1	0.099
25.2	24.998	-0.2	0.099
35.3	34.997	-0.3	0.099

### Note

- UUC\* : Unit Under Calibration

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

----- End -----

*N. Nigubant*

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## Calibration Certificate

**Certificate No.:** 2502226-002-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
 Bangchack, Prakhnong, Bangkok 10260

Page 1 of 4

**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** XSR205DU  
**Serial No.:** C210685394  
**ID No.:** UAE.WAO.010/2565  
**Order No.:** 2502226  
**Operation No.:** 2502226-002  
**Date of Receipt:** 19 March 2025  
**Date of Calibration:** 20 March 2025

**Calibrated by** Mr.Yothin Charoensuk  
 Scientist

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

**Date of Issue:** 25 March 2025

### 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

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## Calibration Report

**Certificate No.:** 2502226-002-01  
**Equipment:** Electronic Balance  
**Model:** XSR205DU  
**Serial No.:** C210685394  
**Capacity:** 82 g / 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.00001 g / 0.0001 g  
**ID No.:** UAE.WAO.010/2565

**Date of Calibration:** 20 March 2025

Page 2 of 4

**Environment Condition:** Ambient Temperature: 21.2 ± 0.6 °C Relative Humidity: 48 ± 3.5 %

**Place of Calibration:** 208 Balance Room, 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	1mg to 200g	B505567572	TCS	M24041005	19 April 2025
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 017/23	Quality Reborn	QR25-0542	10 February 2026

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:

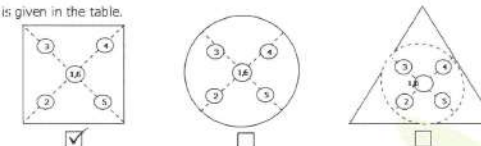
#### 1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
40	0.000042
80	0.000042
100	0.000000
200	0.000000

#### 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 )
100.0001	100.0001	100.0001	100.0001	100.0001	100.0001	0.0000

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

for N. nigredat

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## Calibration Report

**Certificate No.:** 2502226-002-01  
**Equipment:** Electronic Balance  
**Model:** XSR205DU  
**Serial No.:** C210685394  
**Capacity:** 82 g / 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.00001 g / 0.0001 g  
**ID No.:** UAE.WAO.010/2565

**Date of Calibration:** 20 March 2025

Page 3 of 4

**Calibration Results:** (Continued)

**Calibration Range:** 0-80 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:** (Range: 0 - 82 g ; Resolution: 0.00001 g)

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
Unload	0.000000	0.00000	0.00000	0.0000087	2.00
0.001	0.001003	0.00100	0.00000	0.0000090	2.00
0.005	0.005002	0.00501	-0.00001	0.0000092	2.00
0.01	0.010003	0.01002	-0.00002	0.0000089	2.00
0.05	0.049996	0.05001	-0.00001	0.0000096	2.00
0.1	0.100011	0.10002	-0.00001	0.000011	2.00
0.5	0.500016	0.50004	-0.00002	0.000014	2.00
1	1.000003	1.00005	-0.00005	0.000016	2.00
2	2.000023	2.00006	-0.00004	0.000017	2.00
5	5.000015	5.00006	-0.00005	0.000020	2.00
10	10.000009	10.00005	-0.00004	0.000026	2.00
20	20.000030	20.00007	-0.00004	0.000037	2.00
30	30.000039	30.00009	-0.00005	0.000050	2.00
50	50.000028	50.00008	-0.00005	0.000068	2.00
80	80.000067	80.00013	-0.00006	0.00011	2.00

## Calibration Report

**Certificate No.:** 2502226-002-01  
**Equipment:** Electronic Balance  
**Model:** XSR205DU  
**Serial No.:** C210685394  
**Capacity:** 82 g / 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.00001 g / 0.0001 g  
**ID No.:** UAE.WAO.010/2565

**Date of Calibration:** 20 March 2025

Page 4 of 4

**Calibration Results:** (Continued)

**Calibration Range:** >80-200 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:** (Range: >80 - 200 g ; Resolution: 0.0001 g)

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
90	90.00010	90.0002	-0.0001	0.00015	2.00
100	100.00006	100.0001	0.0000	0.00016	2.00
110	110.00007	110.0002	-0.0001	0.00017	2.00
120	120.00009	120.0002	-0.0001	0.00018	2.00
130	130.00010	130.0002	-0.0001	0.00019	2.00
140	140.00013	140.0002	-0.0001	0.00019	2.00
150	150.00009	150.0002	-0.0001	0.00021	2.00
160	160.00010	160.0002	-0.0001	0.00022	2.00
170	170.00012	170.0002	-0.0001	0.00023	2.00
200	200.00013	200.0002	-0.0001	0.00028	2.00

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

2008 ต.บางนา-สวนสุนันทา 36 หมู่ 5 ต.บางนา-สวนสุนันทา แขวงบางนา-สวนสุนันทา กรุงเทพมหานคร  
 2008 Soi 36, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand  
 Tel: +66(0) 2422 8588 Fax: +66(0) 2422 8545

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 2008 Soi 36, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand  
 Tel: +66(0) 2422 8588 Fax: +66(0) 2422 8545

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## Calibration Certificate

**Certificate No.:** 2500116-001-01  
**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:** CHAMBER (Hot Air Oven)

**Manufacturer:** MEMMERT

**Model:** UF55

**Serial No.:** B216.1666

**ID No.:** UAE.WAO.027/2559


**Order No.:** 2500116

**Operation No.:** 2500116-001

**Date of Receipt:** 8 October 2024

**Date of Calibration:** 8 October 2024

**Calibrated by** Mr.Yothin Charoensuk  
Scientist

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

**Date of Issue:** 15 October 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.:** 2500116-001-01  
**Equipment:** CHAMBER (Hot Air Oven)  
Model: UF55 Serial No.: B216.1666  
Resolution: 0.1 °C ID No.: UAE.WAO.027/2559  
Manufacturer: MEMMERT  
**Date of Calibration:** 8 October 2024

Page 2 of 3

**Location:** Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Environment Condition:** Ambient Temperature ( 30.3 ± 1 ) °C  
Relative Humidity ( 55 ± 1 ) %  
Line Voltage ( 230 ± 3 ) Volt

### Condition of this results of Calibration:

- This instrument was calibrated by insert 9 standard thermometer into its chamber and calibration according to W-TE-014 Based on TLAS G-20-1/02-08 (E): Guidelines for Calibration and Checks of Temperature Controlled Enclosures.  
- The temperature scale used was based on ITS - 90.  
- All data show below were final values and the initial data may be obtained upon request.

### 2. Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY57003188	TE 670486-01	8 June 2025	NATIONAL FOOD INSTITUTE
	RTD	CH#201-209/ RTD#201-209			

- 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

### UUC Description :

Time of Record 1 Hour 9 Minute At 104.0,140.0 and 180.0 °C  
Fresh air Damper 

-	Open	Position	-
X	Close	Fan	40%
-	Not Available		

7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

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





Certificate No.: 250422-1-BL002-25

Code No.: BL002-25

Page: 2 of 3

Certificate No.: 250422-1-BL002-25

Code No.: BL002-25

Page: 3 of 3

**Equipment:** Electronic Balance  
**Model:** AB204-S/FACT  
**Serial No.:** 1129361010  
**Max. Capacity:** 220 g  
**Calibration Date:** April 23, 2025  
**Condition As-Received:** In Condition

**Manufacturer:** Mettler Toledo  
**Readability:** 0.0001 g  
**ID No.:** UAE.WAS.002/2552

Condition of Equipment:

Condition of This Result of Calibration:

1. Calibration Method: This instrument was calibrated by method UAE.CP.CAL.006 In-House Method based on UKAS Lab 14 : 2022

2. Reference Standards:

Reference Standard:	Model	Serial No.	Calibrated By	Certificate No.	Traceability	Due Date
Standard Weight Class E2 (OIML)	1 mg to 1 kg	8749109122	AMARC	25-009359	Mettler-Toledo	21-Jan-27
Standard Weight Class F1 (OIML)	1 mg to 200 g	11119512	AMARC	24-013840	Mettler-Toledo	04-Feb-26
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Traceability	Due Date
Thermo-Hygro-Baro Meter	MHB-382SD	AK.46457	SUCCESS	SG-H-00997/67	Success Gateway	21-Nov-25
Thermo-Hygro-Baro Meter	MHB-382SD	AK.46457	TPA	25P795	TPA	25-Feb-26

3. This certification is traceable to SI Unit

4. This certification 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.

6. Through the reference standard laboratory of AMARC 25-009359 Calibration 0152

Calibration Result:

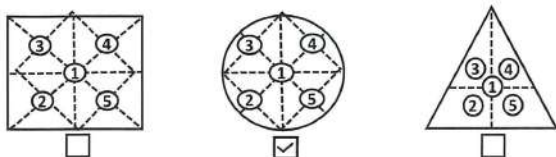
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
200*	0.000045

2. Eccentric or off-center loading

A mass of 100 g was placed and moved to various positions on the pan

The Balance reading obtained is given in the table.



1 (g)	2 (g)	3 (g)	4 (g)	5 (g)	Maximum Difference (g)
100.0000	99.9996	99.9997	100.0003	100.0005	0.0005

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**Equipment:** Electronic Balance  
**Model:** AB204-S/FACT  
**Serial No.:** 1129361010  
**Max. Capacity:** 220 g  
**Calibration Date:** April 23, 2025

**Manufacturer:** Mettler Toledo  
**Readability:** 0.0001 g  
**ID No.:** UAE.WAS.002/2552

**Calibration Result:** (Continued)

**Calibration Range:** 0 - 200 g

**Calibration Adjustment:** Internal Calibration

3. Error of indication from nominal or conventional mass value:

Nominal Value (g)	Reference Value (g)	Indication (g)	Correction (g)	Uncertainty ( $\pm$ mg)	Coverage Factor k
Unload	0.0000000	0.0000	0.0000	0.10	2.05
0.01	0.0100025	0.0099	0.0001	0.10	2.05
0.05	0.0500056	0.0500	0.0000	0.10	2.05
0.1	0.1000012	0.0999	0.0001	0.10	2.05
0.5	0.5000133	0.5000	0.0000	0.10	2.05
1	1.0000105	1.0000	0.0000	0.10	2.05
10	10.000010	10.0000	0.0000	0.11	2.04
40	40.000076	40.0000	0.0000	0.14	2.00
50	50.000056	50.0000	0.0001	0.13	2.00
80	80.000107	80.0000	0.0001	0.18	2.00
100	100.000109	99.9999	0.0002	0.17	2.00
120	120.00015	119.9999	0.0003	0.21	2.00
150	150.000165	149.9998	0.0003	0.24	2.00
160	160.000175	159.9997	0.0005	0.26	2.00
200	200.000129	199.9998	0.0004	0.30	2.00

4. Effect of Tare test:

Tare Load (g)	Test Load (g)	Indication (g)	Correction (g)
100	20.000041	19.9999	0.0001
	40.000076	39.9998	0.0002
	60.000066	59.9997	0.0003
	80.000107	79.9999	0.0002
	100.000168	100.0004	-0.0003

Remark:

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

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## Certificate of Calibration

Cert. No.: 25TM205  
Page : 1 of 3

Equipment : BOD Incubator  
Manufacturer : Arco  
Model : UC4-1320  
Serial No. : 13URC4S013201  
ID No. : UAE.WAO.015/2561  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road  
Bangchak, Phrakhanong  
Bangkok 10260  
Location : Lab. Floor 2  
Received Order : 08 February 2025  
Calibration Date : 08 February 2025  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$   
AC Line Voltage :  $(220 \pm 22) \text{ V}$

Calibrated by : Krisda Malee

Kunchit

Approved by :

Approved Signatory

( ) Chakrit Waewwanjua  
( ) Suwit Imjai  
(✓) Kunchit Promprat

Issue Date : 21 February 2025

The Uncertainties are for a confidence probability of approximately 95%

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.

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Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2502-0166OC-1

Cert. No.: 25TM205  
Page : 2 of 3

### Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ).  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY57013823	24LM71	TPA	12 May 2025

2. This 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.

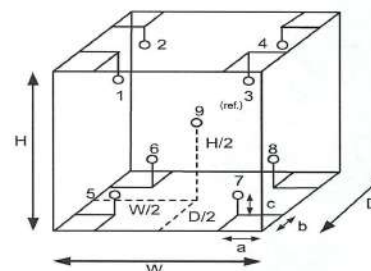
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	26	25
REL.Humid. ( % )	49	52
AC Supply ( Volt )	221	220



### Probe Installation Details :

a = 10 cm  
b = 10 cm  
c = 10 cm

### Dimension of Chamber :

D = 0.62 m  
W = 1.2 m  
H = 1.2 m  
Capacity = 0.89 m<sup>3</sup>

Position :	Ref. Std. ID No.:
1	21-17RTD-01
2	21-17RTD-02
3	17RTD-03
4	24-17RTD-04
5	17RTD-05
6	17RTD-06
7	17RTD-07
8	23-17RTD-08
9 (ref.)	23-17RTD-09

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Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2502-0166OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 25TM205  
Page : 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor <i>k</i>
20.0	20.0	19.9	0.36	0.56	0.99	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty  ( ± °C )
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.841	19.714	20.110	19.862	19.747	19.710	19.676	19.789	19.695	0.54

Average\* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC\* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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 %.

-o0o-

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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 FAX. 0-2719-9484

## Certificate of Testing

Cert.No.: 25TW29  
Page.: 1 of 2

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5100  
Serial No. : 11B 101863  
ID No. : UAE.WAO.004/2554  
Received Date : 14 February 2025  
Test Date : 17 February 2025  
Reference : 2502-0473DSC-1  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260  
Laboratory Condition : Temperature ( 25 ± 5 ) °C  
Humidity ( 50 ± 20 ) %  
Test Procedure : In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method  
Tested by : Walalak Sirithean  
Approved by :   
Approved Signatory  
( ) Chakrit Waewwanjua  
( ) Ponpan Paipim  
(✓) Saithip Meangmai  
Issue Date : 18 February 2025

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## Verification Certificate

**Substitute for Certificate No.:** 2402957-001-01  
**Certificate No.:** 2402957-001-02  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
 Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

**Equipment:** HEATING BLOCK DIGESTION  
**Manufacturer:** FOSS  
**Model:** 2520  
**Serial No.:** 91794469  
**ID No.:** UAE.WAS.011/2560  
**Order No.:** 2402957  
**Operation No.:** 2402957-001  
**Date of Receipt:** 23 May 2024  
**Date of Calibration:** 23-24 May 2024

**Calibrated by** Mr.Jerawut Prapawuttipong  
 Scientist

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

**Date of Issue:** 18 June 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-011 Revision: 01 Date: 20-04-65

2008 ซอยอุดมสุข 41 ถนนสุขุมวิท เขตบางนา กรุงเทพมหานคร 10700

2008 Soi 41, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand

Tel: +66(0) 2422 8588 Fax: +66(0) 2422 8545

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## Verification Report

**Certificate No.:** 2402957-001-02  
**Equipment:** HEATING BLOCK DIGESTION  
 Model: 2520 Serial No.: 91794469  
 Resolution: 1 °C ID No.: UAE.WAS.011/2560  
 Manufacturer: FOSS  
**Date of Calibration:** 23-24 May 2024

Page 2 of 4

**Location:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Environment Condition:** Ambient Temperature ( 25 ± 3 ) °C  
 Relative Humidity ( 55 ± 15 ) %  
 Line Voltage ( 220 ± 10 ) Volt

### Condition of this results of Calibration:

- This instrument was calibrated by insert standard thermocouples type R into its heating block digestion and compared to temperature obtained from reference standards thermometer at calibrated point.  
 - The temperature scale used was based on ITS - 90 .  
 - All data show below were final values and the initial data may be obtained upon request.

### 2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with Thermocouple	34970A	MY44045576/MY41194453	TC23/0048	2-Jun-2024	N.M. Technical Center Laboratory
	Type R	TC#101-103 / CH#101-103			

- 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

UUC\* Description

Time of Record - Hour 30 Minute At 380 °C

7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

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

2008 ซอยอุดมสุข 41 ถนนสุขุมวิท เขตบางนา กรุงเทพมหานคร 10700

2008 Soi 41, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand

Tel: +66(0) 2422 8588 Fax: +66(0) 2422 8545

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## Verification Report

**Certificate No.:** 2402957-001-02  
**Equipment:** HEATING BLOCK DIGESTION  
 Model: 2520 Serial No.: 91794469  
 Resolution: 1 °C ID No.: UAE.WAS.011/2560  
 Manufacturer: FOSS

**Date of Calibration:** 23-24 May 2024 Page 3 of 4

**Calibration point:** 380 °C

**Calibration result:**

### Reporting of Temperature

Block No.	UUC* Setting (°C)	UUC* Reading (°C)	Stability (±°C)	Standard Thermometer (°C)	Uncertainty (±°C)
1	380	380	0.96	378.86	2.1
2	380	380	0.40	378.41	2.1
3	380	380	1.18	378.94	2.1
4	380	380	0.44	377.64	1.6
5	380	380	0.11	377.75	1.6
6	380	380	0.14	378.35	1.6
7	380	380	1.17	377.09	2.1
8	380	380	0.33	377.08	2.1
9	380	380	0.14	376.61	2.1
10	380	380	0.96	377.74	2.1
11	380	380	0.40	377.17	2.1
12	380	380	1.18	377.71	2.1
13	380	380	0.44	379.07	1.6
14	380	380	0.11	379.19	1.6
15	380	380	0.14	379.78	1.6
16	380	380	1.17	378.74	2.1
17	380	380	0.33	378.74	2.1
18	380	380	0.14	378.27	2.1
19	380	380	0.96	379.53	2.1
20	380	380	0.40	378.96	2.1

### Note:

- UUC\* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.



## Verification Report

**Certificate No.:** 2402957-001-02  
**Equipment:** HEATING BLOCK DIGESTION  
 Model: 2520 Serial No.: 91794469  
 Resolution: 1 °C ID No.: UAE.WAS.011/2560  
 Manufacturer: FOSS

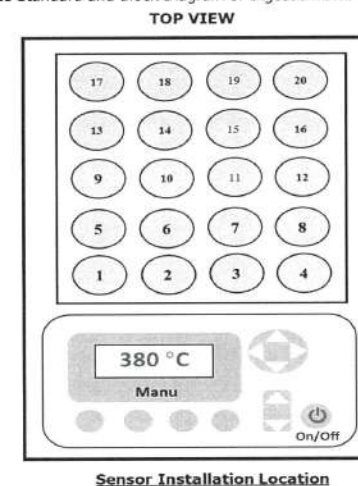
**Date of Calibration:** 23-24 May 2024 Page 4 of 4

**Calibration point:** 380 °C

**Calibration result:**

Continued

Figure 1. Location of Reference Standard and Block Diagram of Digestion Unit



Remark: Edited Date of Calibration from 23-24 May 204 to 23-24 May 2024.

### Note:

- UUC\* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

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 -----





# FOSS

## Customer Service Report

Date: 9 Feb 2024

Customer: UAE

Instrument: KT200

Hours Start Finish

Travel To Customer

08:30 1hr

09:30

Labour

09:30 2hrs

12:00

Travel From Customer

14:30 2hrs

16:30

Job Type							
Application	Special	Standard					
Normal	Courtesy Visit	Installation	Training				
Distributor	PMA Onboarding	Quote	In House				
Internal	Warranty	Repair	PM				
Digital Service	Sales Support	Remote	Other				

PO/Quote Number: If applicable

PMA Type: Fosscore If applicable Contract No. If applicable

Details of Work / Test	Condition / Status
# PM KT200	
- ตรวจสอบเครื่องวัดค่า PM	
- ตรวจสอบค่า 3 min 100 ml	
- Alkaline 30 ml - 30 ml	
- ตรวจสอบค่า PM kit	
- ตรวจสอบค่า PM kit	
# ตรวจสอบ SOPH Mod ตรวจสอบค่า PM kit	
10000725 SOPH new complete 1 PC	
Instrument Ready for Use	OK Not OK If not OK - Comment

Part No:	Batch	Description	Qty
10009965	14.12.2020	Foss PM kit kt200 kjetit Analysis 2100	1

I confirm this report is accurate and complete

Signed FOSS: [Signature] Signed Customer: [Signature]

Name: Name

Would you be willing to participate in a brief survey in order to tell us how we performed? Email

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# FOSS

## Customer Service Report

Date: 24 February 2025

Job No.: 11735

Instrument: KT8100

Travel To Customer (Hrs)

07:00 2hrs

09:00

Labour (Hrs)

09:00-12:00 0hrs

13:00-14:00

Travel From Customer (Hrs)

15:00 0hrs

17:00

Job Type							
Application	Special	Standard					
Distributor	Courtesy Visit	Installation	Training				
Digital Service	PMA Onboarding	Quote	In House				
Internal	Warranty	Repair	PM				
Investigate	Sales Support	Remote	Health Check Visit				

PMA Type	Smartcare	Smartcare Pro	Fosscore
	Smartcare Advance	Fosscore Pro	N/A

Details of Work / Test
# PM KT8100 12 Mo
- test before PM
- Cleaning KT8100, 36 Mo replace
- flushing Alkali pump
- test operation
- Distillation 80 - 80 ml
- Distillation 5 min 150 - 170 ml
- Alkali 50 - 50 ml
- All pass
Instrument Ready for Use

Part No:	Batch	Description	Qty
60031210	08.01.2024	Foss PM kit kt200 kjetit Analysis 2100 36 Mo	1

I confirm this report is accurate and complete

Signed FOSS: [Signature] Signed Customer: [Signature]

Name: Name

Email: Customer Contact:

\*Remark:

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Please scan QR code






## Calibration Certificate

**Certificate No.:** 2502229-003-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
 Bangchack, Prakhnong, Bangkok 10260

Page 1 of 3

**Equipment:** CHAMBER (Incubator)  
**Manufacturer:** MEMMERT  
**Model:** IPP260  
**Serial No.:** V618.0033  
**ID No.:** UAE.MIC.021/2561  
**Order No.:** 2502229  
**Operation No.:** 2502229-003  
**Date of Receipt:** 19 March 2025  
**Date of Calibration:** 19 March 2025

**Calibrated by** Mr.Yothin Charoensuk  
 Scientist

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

**Date of Issue:** 25 March 2025

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

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## Calibration Report

**Certificate No.:** 2502229-003-01  
**Equipment:** CHAMBER (Incubator)  
 Model: IPP260 Serial No.: V618.0033  
 Resolution: 0.1 °C ID No.: UAE.MIC.021/2561  
 Manufacturer: MEMMERT  
**Date of Calibration:** 19 March 2025

Page 2 of 3

**Location:** 302, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Environment Condition:** Ambient Temperature ( 23.0 ± 1 ) °C  
 Relative Humidity ( 59 ± 1 ) %  
 Line Voltage ( 223 ± 3 ) Volt

### Condition of this results of Calibration:

- This instrument was calibrated by insert 9 standard thermometer into its chamber and calibration according to W-TE-014 Based on TLAS G-20-1/02-08 (E): Guidelines for Calibration and Checks of Temperature Controlled Enclosures.
  - The temperature scale used was based on ITS - 90.
  - All data show below were final values and the initial data may be obtained upon request.
- Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY57003188	TE 670486-01	8 June 2025	NATIONAL FOOD INSTITUTE
	RTD	CH#301-309/ RTD#301-309			

- 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

UUC Description :

Time of Record 1 Hour 9 Minute At 22.0 and 25.0 °C  
 Fresh air Damper ☐ Open Position ☐  
☒ Close Fan ☐  
☐ Not Available

- Result of Calibration : ☒ Without adjustment ☐ After adjustment

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

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## Calibration Report

**Certificate No.:** 2502229-003-01  
**Equipment:** CHAMBER (Incubator)  
**Model:** IPP260 **Serial No.:** V618.0033  
**Resolution:** 0.1 °C **ID No.:** UAE.MIC.021/2561  
**Manufacturer:** MEMMERT

**Date of Calibration:** 19 March 2025

Page 3 of 3

**Calibration point:** 22.0 and 25.0 °C

**Calibration result:**

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	22.7	58	220.0
MAX	23.3	60	225.0

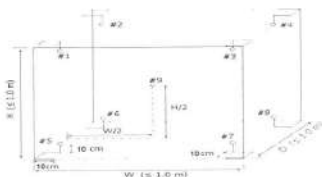


Table 1 : Reporting of Temperature

Calibration point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
22.0	22.18	22.18	22.16	22.19	21.94	21.95	21.96	21.98	22.08	0.27
25.0	25.51	25.32	25.29	25.34	25.05	25.02	25.04	25.09	25.15	0.27

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
22.0	22.0	22.0	22.0	0.026	0.14	0.29
25.0	25.0	25.0	25.0	0.035	0.36	0.55

**Note** The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity) "

UUC\* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

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.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.

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 -----

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

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## Calibration Certificate

**Certificate No.:** 2501624-001-01  
**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:** Water Bath

**Manufacturer:** MEMMERT

**Model:** WNE14

**Serial No.:** L416.0606

**ID No.:** UAE.MIC.002/2560

**Order No.:** 2501624

**Operation No.:** 2501624-001

**Date of Receipt:** 10 February 2025

**Date of Calibration:** 10 February 2025

**Calibrated by** Mr.Worapob Sooktong  
Scientist

WB

**Date of Issue:** 19 February 2025

**Approved by** *P. Jengbharit*  
( Mr.Pheraphat Tuanjit ) (for)

Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team

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

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

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

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## Calibration Report

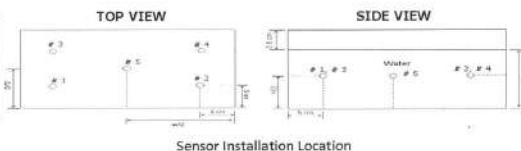
**Certificate No.:** 2501624-001-01  
**Equipment:** Water Bath  
 Model: WNE14 Serial No.: L416.0606  
 Resolution: 0.1 °C ID No.: UAE.MIC.002/2560  
 Manufacturer: MEMMERT  
**Date of Calibration:** 10 February 2025

Page 3 of 3

**Calibration point:** 44.5 °C

**Calibration result:**

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	25.7	52	223.0
Max	26.3	65	225.0



**Table 1 : Reporting of Temperature**

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.5 is REF)					Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	
44.5	44.55	44.46	44.48	44.47	44.48	0.18

**Table 2 : Reporting of Characterization Result**

UUC* Setting (°C)	UUC* Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
44.5	44.5	44.5	44.5	0.082	0.070	0.29

**Note** The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity)"

UUC\* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

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.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.

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 -----

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

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## Calibration Report

**Certificate No.:** 2501624-001-01  
**Equipment:** Water Bath  
 Model: WNE14 Serial No.: L416.0606  
 Resolution: 0.1 °C ID No.: UAE.MIC.002/2560  
 Manufacturer: MEMMERT  
**Date of Calibration:** 10 February 2025

Page 2 of 3

**Location:** 302 Microbiology Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

**Environment Condition:**

Ambient Temperature ( 26 ± 1 ) °C  
 Relative Humidity ( 59 ± 7 ) %  
 Line Voltage ( 224 ± 1 ) Volt

**Condition of this results of Calibration:**

- This instrument was calibrated by insert 5 standard thermometer into its liquid bath and calibration according to W-TE-011 based on ASTM E715-80 (2022): Standard Specification for Gravity-Convection and Forced-Circulation Water Baths.  
 - The temperature scale used is ITS - 90.  
 - All data show below were final values and the initial data may be obtained upon request.
- Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY59002902	TE 670478-01	4-May-25	NATIONAL FOOD INSTITUTE
	RTD	RTD#301-305 / CH#301-305			

- 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

UUC Description:

Time of Record 1 Hour 9 Minute At 44.5 °C

7. Result of Calibration :
- |                                     |                    |
|-------------------------------------|--------------------|
| <input checked="" type="checkbox"/> | Without adjustment |
| <input type="checkbox"/>            | After adjustment   |

  
 19 Feb. 2025

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

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## Calibration Certificate

**Certificate No.:** 2501624-001-01  
**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:** Water Bath

**Manufacturer:** MEMMERT

**Model:** WNE14

**Serial No.:** L416.0606

**ID No.:** UAE.MIC.002/2560

**Order No.:** 2501624


**Operation No.:** 2501624-001

**Date of Receipt:** 10 February 2025

**Date of Calibration:** 10 February 2025

**Calibrated by** Mr.Worapob Sooktong  
 Scientist

**Date of Issue:** 19 February 2025

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

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

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

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

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## Calibration Report

**Certificate No.:** 2501624-001-01  
**Equipment:** Water Bath  
 Model: WNE14 Serial No.: L416.0606  
 Resolution: 0.1 °C ID No.: UAE.MIC.002/2560  
 Manufacturer: MEMMERT

**Date of Calibration:** 10 February 2025

Page 3 of 3

**Calibration point:** 44.5 °C

**Calibration result:**

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	25.7	52	223.0
Max	26.3	65	225.0

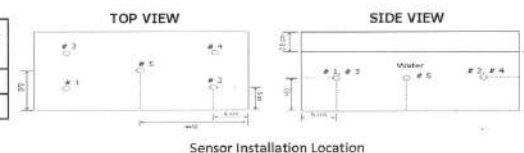


Table1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.5 is REF)					Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	
44.5	44.55	44.46	44.48	44.47	44.48	0.18

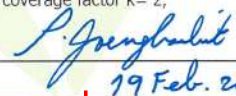
Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
44.5	44.5	44.5	44.5	0.082	0.070	0.29

**Note** The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity)"  
 UUC\* = Unit Under Calibration  
 Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.  
 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.  
 Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.  
 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 -----

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

  
 19 Feb. 2025



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## Calibration Report

**Certificate No.:** 2501624-001-01  
**Equipment:** Water Bath  
Model: WNE14 Serial No.: L416.0606  
Resolution: 0.1 °C ID No.: UAE.MIC.002/2560  
Manufacturer: MEMMERT  
**Date of Calibration:** 10 February 2025

Page 2 of 3

**Location:** 302 Microbiology Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Environment Condition:** Ambient Temperature ( 26 ± 1 ) °C  
Relative Humidity ( 59 ± 7 ) %  
Line Voltage ( 224 ± 1 ) Volt

### Condition of this results of Calibration:

- This instrument was calibrated by insert 5 standard thermometer into its liquid bath and calibration according to W-TE-011 based on ASTM E715-80 (2022): Standard Specification for Gravity-Convection and Forced-Circulation Water Baths.  
- The temperature scale used is ITS - 90.  
- All data show below were final values and the initial data may be obtained upon request.

### 2. Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY59002902	TE 670478-01	4-May-25	NATIONAL FOOD INSTITUTE
	RTD	RTD#301-305 / CH#301-305			

- 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  
UUC Description:

Time of Record 1 Hour 9 Minute At 44.5 °C

7. Result of Calibration : ☒ Without adjustment  
☐ After adjustment

*P. Pongphatit*  
19 Feb. 2025

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



## Calibration Certificate

**Certificate No.:** 2502227-001-01  
**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:** OHAUS  
**Model:** PX623  
**Serial No.:** C236754745  
**ID No.:** UAE.MIC.055/2565  
**Order No.:** 2502227  
**Operation No.:** 2502227-001  
**Date of Receipt:** 19 March 2025  
**Date of Calibration:** 19 March 2025

**Calibrated by** Mr.Yothin Charoensuk  
Scientist

**Approved by** *for N. Pongphatit*  
( Mr.Pheraphat Tuanjit )

**Date of Issue:** 25 March 2025

**Manager, Division of Calibration Laboratory**  
**Responsible for the Technical Management Team**

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

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

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





## Calibration Report

**Certificate No.:** 2502227-001-01  
**Equipment:** Electronic Balance  
**Model:** PX623  
**Serial No.:** C236754745  
**Capacity:** 620  
**Manufacturer:** OHAUS  
**Resolution:** 0.001  
**ID No.:** UAE.MIC.055/2565

**Date of Calibration:** 19 March 2025

Page 3 of 3

**Calibration Results:** (Continued)

**Calibration Range:** 0-600 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	0.0000	0.000	0.000	0.00086	2.00
1	1.0000	1.000	0.000	0.00086	2.00
5	5.0000	4.999	0.001	0.00086	2.00
10	10.0000	10.000	0.000	0.00086	2.00
20	20.0000	20.000	0.000	0.00086	2.00
50	50.0000	50.000	0.000	0.00087	2.00
100	100.0001	100.000	0.000	0.00087	2.00
200	200.0001	200.001	-0.001	0.00090	2.00
300	300.0002	300.001	-0.001	0.00094	2.00
400	400.0003	399.999	0.001	0.0011	2.00
500	500.0003	499.999	0.001	0.0011	2.00
600	600.0004	600.000	0.000	0.0012	2.00

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

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## Calibration Report

**Certificate No.:** 2502227-001-01  
**Equipment:** Electronic Balance  
**Model:** PX623  
**Serial No.:** C236754745  
**Capacity:** 620  
**Manufacturer:** OHAUS  
**Resolution:** 0.001  
**ID No.:** UAE.MIC.055/2565

**Date of Calibration:** 19 March 2025

Page 2 of 3

**Environment Condition:** Ambient Temperature: 22.8 ± 0.3 °C Relative Humidity: 51 ± 0.95 %

**Place of Calibration:** 301, 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	1mg to 200g	B505567572	TCS	M24041005	19 April 2025
Standard Weight Class E2	500g	B505567696	TCS	M24041015	19 April 2025
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 017/23	Quality Reborn	QR25-0542	10 February 2026

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:

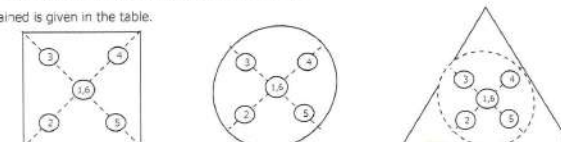
#### 1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
300	0.00042
600	0.00048

#### 2. Off-Center Error:

A mass of 200 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 )
200.002	200.003	200.001	200.001	200.002	200.002	0.001

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

2008 ซอย 36, ถนนสุขุมวิท แขวงบางซื่อ เขตบางซื่อ กรุงเทพมหานคร 10700

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