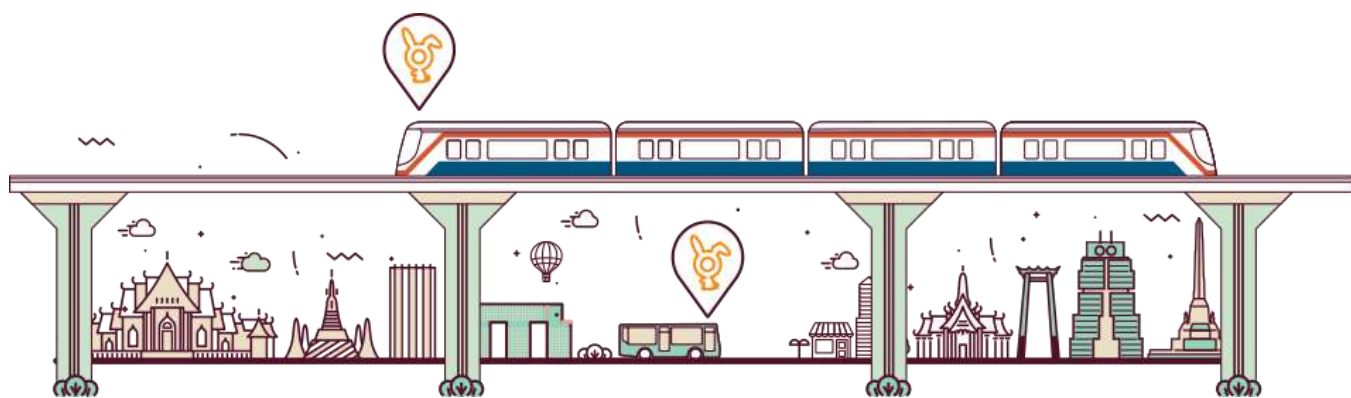


ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือ



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
โครงการรถไฟฟ้าสายสีเขียว เฉพาะช่วงหมอชิต-สะพานใหม่									
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Tisch Environmental, Inc.	TE-5025A 3540	Jiranatee Associates Co., Ltd.	COF-045-67	4 Nov 24	3 Nov 25	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	121-36-W/M -	Technology Promotion Association (Thailand-Japan)	25P114	19 Feb 25	18 Feb 26	-
3	Air Flow Meter	Particular Matter (PM _{2.5})	Mesa Labs	DeltaCal DC1 158850	Innovative Instrument Co., Ltd.	24-AFM-173	28 Aug 24	27 Aug 25	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24P1858	4 Jun 24	3 Jun 25	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	25H812	10 Apr 25	9 Apr 26	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Electron	42C 42C-0508011076	UAE Consultant Co., Ltd.	04102024	4 Oct 24	3 Oct 25	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Fisher Scientific	42C 0517512000	UAE Consultant Co., Ltd.	04102024	4 Oct 24	3 Oct 25	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Electron	42C 0517512001	UAE Consultant Co., Ltd.	11102024	11 Oct 24	10 Oct 25	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM08130002	UAE Consultant Co., Ltd.	17092024	17 Sep 24	16 Sep 25	-
10	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050148	UAE Consultant Co., Ltd.	20092024	20 Sep 24	19 Sep 25	-
11	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050149	UAE Consultant Co., Ltd.	17092024	17 Sep 24	16 Sep 25	-
12	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050150	UAE Consultant Co., Ltd.	17092024	17 Sep 24	16 Sep 25	-
13	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jun 23	6 Jun 31	-

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
โครงการรถไฟฟ้าสายสีเขียว เฉพาะช่วงหมอชิต-สะพานใหม่									
Ambient									
14	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i CM08140003	UAE Consultant Co.,Ltd.	03092024	3 Sep 24	2 Sep 25	-
15	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1180540069	UAE Consultant Co.,Ltd.	14062024	14 Jun 24	13 Jun 25	-
16	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1180540074	UAE Consultant Co.,Ltd.	09092024	9 Sep 24	8 Sep 25	-
17	Carbon Monoxide Analyzer	Carbon Monoxide	Horiba	APMA-370 YN43AG7T	UAE Consultant Co.,Ltd.	14062024	14 Jun 24	13 Jun 25	-
18	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48C 48C-65506-348	UAE Consultant Co.,Ltd.	06122024	6 Dec 24	5 Dec 25	-
19	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i CM08140004	UAE Consultant Co.,Ltd.	03092024	3 Sep 24	2 Sep 25	-
20	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1182920018	UAE Consultant Co.,Ltd.	06122024	6 Dec 24	5 Dec 25	-
21	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jun 23	6 Jun 31	-
22	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 VUPVTC21	UAE Consultant Co.,Ltd.	02092024	2 Sep 24	1 Sep 25	-
23	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 PDXEGXF7	UAE Consultant Co.,Ltd.	19092024	19 Sep 24	18 Sep 25	-
24	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 SSGEJYBJ	UAE Consultant Co.,Ltd.	19092024	19 Sep 24	18 Sep 25	-
25	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 VW2FY3R3	UAE Consultant Co.,Ltd.	02092024	2 Sep 24	1 Sep 25	-
26	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 T4FG19AN	UAE Consultant Co.,Ltd.	01102024	1 Oct 24	30 Sep 25	-
27	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 HAMEHU5M	UAE Consultant Co.,Ltd.	19092024	19 Sep 24	18 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
โครงการรถไฟฟ้าสายสีเขียว เฉพาะช่วงหมอชิต-สะพานใหม่									
Ambient									
28	Standard Gas	Total Hydrocarbons	Linde	D824432	Linde	09042013	4 Aug 20	4 Aug 28	-
29	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0105	Thai Meteorological Department	146/25	10 Mar 25	9 Mar 26	-
30	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0113	Thai Meteorological Department	002/25	3 Jan 25	2 Jan 26	-
31	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0114	Thai Meteorological Department	106/25	19 Feb 25	18 Feb 26	-
32	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0116	Thai Meteorological Department	110/25	19 Feb 25	18 Feb 26	-
33	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	-
34	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	-
35	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM13539	Calibration Laboratory Co.Ltd	Q24135552A1	20 Dec 24	19 Dec 25	-
36	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	-
37	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, $L_{Aeq\ 1\ hr}$, L_{Amax} , L_{A90} , L_{Adn}	Larson Davis	LxT2 0005286	Innovative Instrument Co.,Ltd.	24-SLM-234	10 Jul 24	9 Jul 25	-
38	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, $L_{Aeq\ 1\ hr}$, L_{Amax} , L_{A90} , L_{Adn}	Larson Davis	LxT2 0005290	Innovative Instrument Co.,Ltd.	24-SLM-238	11 Jul 24	10 Jul 25	-
39	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, $L_{Aeq\ 1\ hr}$, L_{Amax} , L_{A90} , L_{Adn}	Larson Davis	LxT2 0005293	Innovative Instrument Co.,Ltd.	24-SLM-231	10 Jul 24	9 Jul 25	-
40	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, $L_{Aeq\ 1\ hr}$, L_{Amax} , L_{A90} , L_{Adn}	Larson Davis	LxT2 0005299	Innovative Instrument Co.,Ltd.	24-SLM-240	11 Jul 24	10 Jul 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
โครงการรถไฟฟ้าสายสีเขียว เฉพาะช่วงหมอชิต-สะพานใหม่									
Ambient									
41	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, $L_{Aeq\ 1\ hr}$, L_{Amax} , L_{A90} , L_{Adn}	Larson Davis	LxT2 0005372	Innovative Instrument Co.,Ltd.	24-SLM-229	9 Jul 24	8 Jul 25	-
42	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, $L_{Aeq\ 1\ hr}$, L_{Amax} , L_{A90} , L_{Adn}	Larson Davis	LxT2 0005341	Innovative Instrument Co.,Ltd.	24-SLM-232	10 Jul 24	9 Jul 25	-
43	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, $L_{Aeq\ 1\ hr}$, L_{Amax} , L_{A90} , L_{Adn}	Larson Davis	LxT2 0005346	Innovative Instrument Co.,Ltd.	24-SLM-235	10 Jul 24	9 Jul 25	-
44	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, $L_{Aeq\ 1\ hr}$, L_{Amax} , L_{A90} , L_{Adn}	Larson Davis	LxT2 0005348	Electrical And Electronics Institute Foundation For Industrial Development	CP20240292EA	6 Aug 24	5 Aug 25	-

CERTIFICATE OF CALIBRATION

Certificate No. : COF-045-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : TISCH
MODEL/TYPE : TE-5025A
SERIAL NUMBER : 3540
ID NUMBER : UAE.EFM.176/2561
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 : 24 Oct 2024
MEASUREMENT DATE : 04 Nov 2024
ISSUE DATE : 05 Nov 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

CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are 23.7 °C and 49.7 %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/W3-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'

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	Δp_{meter} mmHg	$\Delta p_{Orifice}$ inH ₂ O	γ	Standard Flow [Q_s] m^3/min
1	0.702	755.241	23.67	22.27	57.134	1.612	1.268	0.651
2	1.000	755.312	23.55	22.71	61.321	3.248	1.801	0.920
3	1.117	755.324	23.36	22.72	41.180	4.309	2.075	1.057
4	1.163	755.361	23.37	22.77	30.028	4.806	2.392	1.119
5	1.417	755.397	23.65	23.10	29.199	7.191	2.680	1.363

Slope (m): 1.98270
Intercept (b): -0.02316
Correlation coefficient (r): 0.99988
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	Δp_{meter} mmHg	$\Delta p_{Orifice}$ inH ₂ O	γ	Standard Flow [Q_s] m^3/min
1	0.702	755.241	23.67	22.27	57.134	1.612	0.796	0.652
2	1.000	755.312	23.55	22.71	61.321	3.248	1.129	0.921
3	1.117	755.324	23.36	22.72	41.180	4.309	1.301	1.058
4	1.163	755.361	23.37	22.77	30.028	4.806	1.374	1.119
5	1.417	755.397	23.65	23.10	29.199	7.191	1.681	1.365

Slope (m): 1.24186
Intercept (b): -0.01454
Correlation coefficient (r): 0.99988
Uncertainty ($k=2$): 0.015 m^3/min

End of Certificate of Calibration

Calibrated by:

- ☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol



Approved signatory: _____
Mr. Parinya Booncharoen
Calibration Department Manager





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

Certificate of Calibration

Certificate No. : 25P114
Page : 1 of 2

Equipment : U Tube Manometer

Manufacturer: Dwyer

Model : 1221-36-W/M

Serial No.: -

ID No.: UAE.EFM.178/2561

Condition As-Received: Used Item

Received Date: 10 February 2025

Calibration Date: 19 February 2025

Reference: 2502-0083WSC Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1012 mbar

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

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

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments
Standard according to 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 inH₂O

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 Prabpaipal
[] Sura Suwannasri
[x] Attapol Panurach

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Cert.No.: 25P114
Page: 2 of 2

Result of calibration:- Without adjustment

Function:- Pressure Measurement
Increasing Pressure

Range : 0 inH₂O to 36 inH₂O
Scale Interval : 0.1 inH₂O (The Fifth Estimate)

Applied Pressure (inH ₂ O)	UUC Indication		ΔP (inH ₂ O)	Error (inH ₂ O)
	High-port side (inH ₂ O)	Low-port side (inH ₂ O)		
0.00	0.00	0.00	0.00	0.00
2.00	0.98	-0.94	1.92	-0.08
4.00	2.02	-1.96	3.98	-0.02
6.00	3.02	-2.96	5.98	-0.02
8.00	4.02	-3.96	7.98	-0.02
10.00	5.02	-4.96	9.98	-0.02
12.00	6.02	-5.96	11.98	-0.02
14.00	7.06	-7.00	14.06	0.06
16.00	8.06	-7.98	16.04	0.04
18.00	9.06	-8.98	18.04	0.04
20.00	10.06	-9.98	20.04	0.04
22.00	11.06	-10.98	22.04	0.04
24.00	12.06	-11.98	24.04	0.04
26.00	13.08	-13.02	26.10	0.10
28.00	14.08	-14.02	28.10	0.10
30.00	15.08	-15.02	30.10	0.10
32.00	16.08	-16.04	32.12	0.12
34.00	17.10	-17.04	34.14	0.14
35.80	17.90	-17.84	35.74	-0.06

The uncertainty of measurement was ± 0.11 inH₂O

* 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 %.

-oOo-

Attapol P.
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a 1037941

Certificate of Calibration

Customer

Certificate No : 24-AFM-173

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Request No : Req-2024-1833

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

Unit Under Calibration Details

Measurement Item : Air Flow Meter

Manufacturer : BGI

Accuracy : 0.75% of Reading

Model : Delta Cal DC1

Sensor Model : -

Serial Number : 158850

Sensor Serial Number : -

ID : UAE.EFM.038/2561

Instrument Status : Used

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 15 August 2024

Calibration Date : 28 August 2024

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator


Reference Standard	Model	Serial Number	Traceble	Due Calibration
Air Flow Meter	Gilibrator 3 High flow	18501012012	Sensidyne	1 August 2025
Temperature meter	GT 11	08000057	Qreborn	1 March 2025
Pressure meter	CPG2400	41000KDU/651882	TPA	9 November 2024


Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

Note :

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

Calibration By : 

Approved By : 

Mr. Noppadon Luangart

Mr. Pacit Mathavorn

Service Calibration Engineer

Calibration Engineer Supervisor

Issue Date : 28 August 2024

Certificate No : 24-AFM-173

Request No : Req-2024-1833

Result of Calibration : Without Adjustment

Temperature	Pressure	STD	UUC	Error	Uncertainty	MPE	Result
(°C)	(kPa)	(l/min)	(l/min)	(l/min)	(l/min)	(l/min)	
25.60	99.80	14.50	14.46	-0.04	0.20	0.109	N/A
25.60	99.80	15.00	14.95	-0.05	0.21	0.113	N/A
25.50	99.70	15.80	15.73	-0.07	0.22	0.119	N/A
25.40	99.60	16.67	16.59	-0.08	0.23	0.125	N/A
25.50	99.50	18.30	18.20	-0.10	0.26	0.137	N/A

Note

STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : 25 °C, 101.3 kPa, Air

- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P_{meas}} \times \frac{T_{meas}}{T_{ref}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature

Meas = Measurement Condition ref = Standard Condition

* Indicates non accredited

MPE = Maximum Permissible Error (Specified in Manufacturer's Specifications)

N/A = Not Aavailable, Customer does not require a statement of conformity.

Certificate No : 24-AFM-173

Request No : Req-2024-1833

Decision Rule for Statements of Conformity

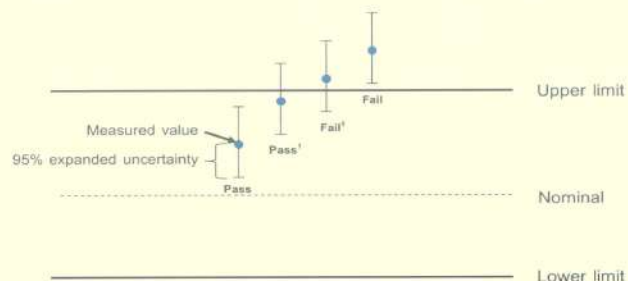
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-GS:09:2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ = 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 Certificate

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-TPM-390

Request No : Req-2024-1833

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Air Flow meter
Manufacturer : BGI
Model : Delta Cal DC1
Serial Number : 158850
Resolution : 0.1 °C
ID Number : UAE.EFM.038/2561
Range Calibration : 20 °C to 50 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 3
Calibration Position (mm) : 45
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 15 August 2024
Calibrated Date : 29 August 2024
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/ RTD100, SN: 08000057, ID: 02-TPM Which was calibrated on 1 March 2024, Calibration Certificate No. : QR24-0478
Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0292

Note

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

Approved By :

Mr. Noppadon Luangart

Technical Manager

Issue Date : 29 August 2024

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Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 24-TPM-391

Request No : Req-2024-1832

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
Ta	20.031	20.0	0.0	0.13
	25.034	25.1	- 0.1	0.13
	30.035	30.1	- 0.1	0.13
	35.029	35.1	- 0.1	0.13
	40.011	39.9	+ 0.1	0.13
	45.008	44.8	+ 0.2	0.13
	50.007	49.8	+ 0.2	0.13
Tf	20.031	19.9	+ 0.1	0.13
	25.034	24.9	+ 0.1	0.13
	30.035	30.0	0.0	0.13
	35.029	35.1	- 0.1	0.13
	40.011	40.1	- 0.1	0.13
	45.008	45.2	- 0.2	0.13
	50.007	50.2	- 0.2	0.13

End of Certificate

Calibrated By :

Mr. Sittichok Jirapukdeesakul

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



Certificate of Calibration

Certificate No. : 24P1858

Page : 1 of 2

Equipment : Aneroid Barometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: UAE.ANV.124/2550

Condition As-Received: Used Item

Received Date: 24 May 2024

Calibration Date: 04 June 2024

Reference: 2405-0919WSC

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1007 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 :

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

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B 0316958



Cert.No.: 24P1858

Page: 2 of 2

Result of calibration:- Without adjustment

Range: 960 hPa to 1030 hPa

Function:- Absolute Pressure Measurement

Scale Interval: 1 hPa (The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	959.93	970.47	981.93	991.32	1002.29	1011.64	1021.14	1032.30
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	0.07	-0.47	-1.93	-1.32	-2.29	-1.64	-1.14	-2.30

Decreasing Pressure

Applied Pressure (hPa)	1032.30	1021.44	1011.67	1002.36	992.35	981.94	970.49	959.94
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-2.30	-1.44	-1.67	-2.36	-2.35	-1.94	-0.49	0.06

The uncertainty of measurement was ± 0.30 hPa

* UUC = Unit Under Calibration

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

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Attapol P.
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a 1165506



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



Certificate of Calibration

Certificate No.: 25H812

Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.132/2550

Condition As-Received: Used Item

Received Date: 04 April 2025

Calibration Date: 10 April 2025

Reference: 2504-0193WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

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

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

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

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Dew Point Hygrometer	Optidew 401	164756	TH-0005-25	05 Feb 2026
2) Handheld Thermometer With Sensor	1523	5717096	241241	18 Nov 2025

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

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

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

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

Calibrated by: Somchai Dumwor
Issue Date: 18 April 2025

Approved Signatory:

Viporn
[] Chakrit Waewwanjua
[] Pornthippa Tameyakul
[✓] Viporn Tantiyawutti

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Cert. No.: 25H812

Page: 2 of 2

Result of Calibration:-

Without Adjustment

Function: Humidity Measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Correction (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	42	-1.9	1.7
25.0	60.0	60	0.0	1.8
25.0	80.0	76	4.0	1.9

Result of Calibration:-

Without Adjustment

Function: Temperature Measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Correction (°C)	Uncertainty of Measurement (±°C)
20.001	21.0	-0.999	0.72
24.987	25.0	-0.013	0.72
30.021	30.0	0.021	0.72
34.964	34.0	0.964	0.72
40.032	39.0	1.032	0.72

UUC* : Unit Under Calibration

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

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MULTI-POINT GAS TEST REPORT

Test Date : Oct 4,2024

Equipment : Gas Analyzer (NO₂) Model : 42C
Manufacturer : Thermo Electron Corporation Serial Number : 42C-0508011076

Standard Gas Concentration

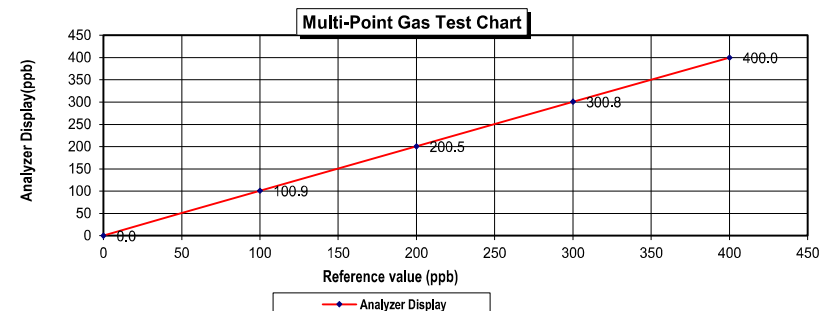
Sulphur Dioxide (SO₂) 42.89 PPM
Nitric Oxide (NO) 46.77 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 965.9
Cylinder No. : EB0159156
Expiration Date : Nov 6,2026

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	100.9	0.90	0.89	0.89
Level 3	40.00%	200.0	200.5	0.50	0.25	0.25
Level 4	60.00%	300.0	300.8	0.80	0.27	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%)			0.28



Calculate by

Grichai G.
4 / 10 / 2567

Approve by

4 Oct 2024

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MULTI-POINT GAS TEST REPORT

Test Date : Oct 4, 2024

Equipment : Gas Analyzer (NO₂) Model : 42C
Manufacturer : Thermo Electron Corporation Serial Number : 0517512000

Standard Gas Concentration

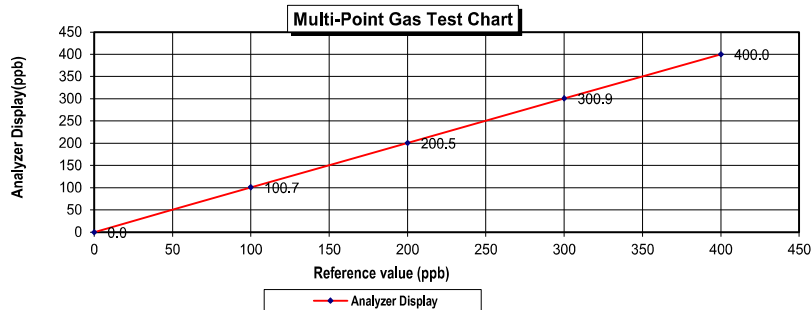
Sulphur Dioxide (SO₂) 42.89 PPM
Nitric Oxide (NO) 46.77 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 965.9 PPM
Cylinder No. : EB0159156
Expiration Date : Nov 6, 2026

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	100.7	0.70	0.70	0.70
Level 3	40.00%	200.0	200.5	0.50	0.25	0.25
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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4 / Oct / 2024

MULTI-POINT GAS TEST REPORT

Test Date : Oct 11, 2024

Equipment : Gas Analyzer (NO₂) Model : 42C
Manufacturer : Thermo Electron Corporation Serial Number : 0517512001

Standard Gas Concentration

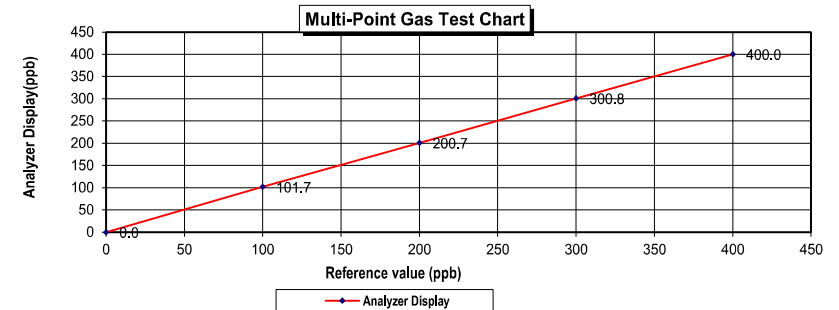
Sulphur Dioxide (SO₂) 42.89 PPM
Nitric Oxide (NO) 46.77 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 965.9 PPM
Cylinder No. : EB0159156
Expiration Date : Nov 6, 2026

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	101.7	1.70	1.67	1.67
Level 3	40.00%	200.0	200.7	0.70	0.35	0.35
Level 4	60.00%	300.0	300.8	0.80	0.27	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%)			0.46



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11 / Oct / 2024

MULTI-POINT GAS TEST REPORT

Test Date : Sep 17, 2024

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM08130002

Standard Gas Concentration

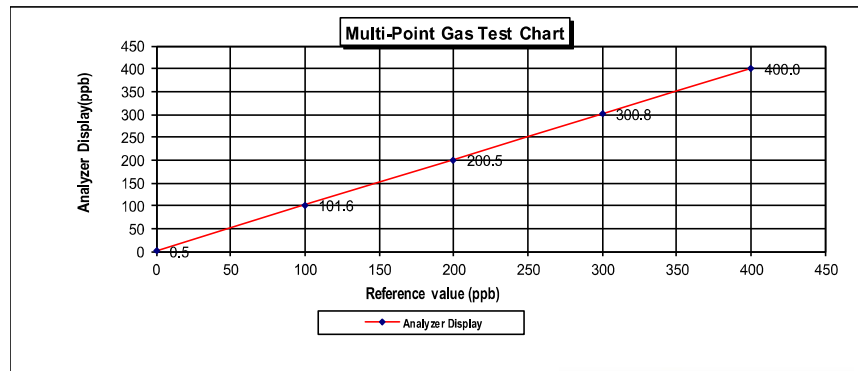
Sulphur Dioxide (SO₂) 42.89 PPM
Nitric Oxide (NO) 46.77 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 965.9 PPM
Cylinder No. : EB0159156
Expiration Date : Nov 6, 2026

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	0.5	0.50	0.50	0.50
Level 2	20.00%	100.0	101.6	1.60	1.57	1.57
Level 3	40.00%	200.0	200.5	0.50	0.25	0.25
Level 4	60.00%	300.0	300.8	0.80	0.27	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)			0.52



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17 Sep / 2024

MULTI-POINT GAS TEST REPORT

Test Date : Sep 20, 2024

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM19050148

Standard Gas Concentration

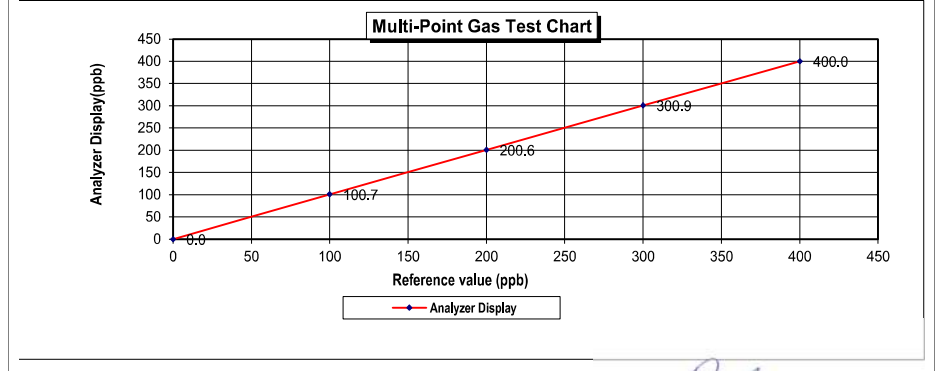
Sulphur Dioxide (SO₂) 42.89 PPM
Nitric Oxide (NO) 46.77 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 965.9 PPM
Cylinder No. : EB0159156
Expiration Date : Nov 6, 2026

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	100.7	0.70	0.70	0.70
Level 3	40.00%	200.0	200.6	0.60	0.30	0.30
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 (%)			0.26



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20 Sep / 2024

MULTI-POINT GAS TEST REPORT

Test Date : Sep 17, 2024

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM19050149

Standard Gas Concentration

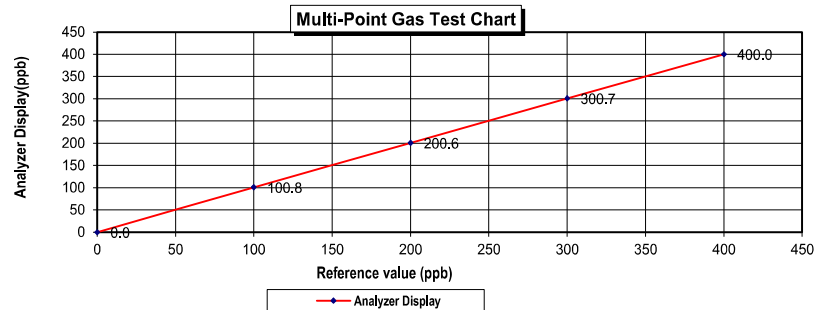
Sulphur Dioxide (SO₂) 42.89 PPM
Nitric Oxide (NO) 46.77 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 965.9
Cylinder No. : EB0159156
Expiration Date : Nov 06, 2026

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	100.8	0.80	0.79	0.79
Level 3	40.00%	200.0	200.6	0.60	0.30	0.30
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 (%)			0.27



Calculate by
Girchan. G
17 / 9 / 2567

Approve by
P. Kham
17 / Sep / 2024

MULTI-POINT GAS TEST REPORT

Test Date : Sep 17, 2024

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM19050150

Standard Gas Concentration

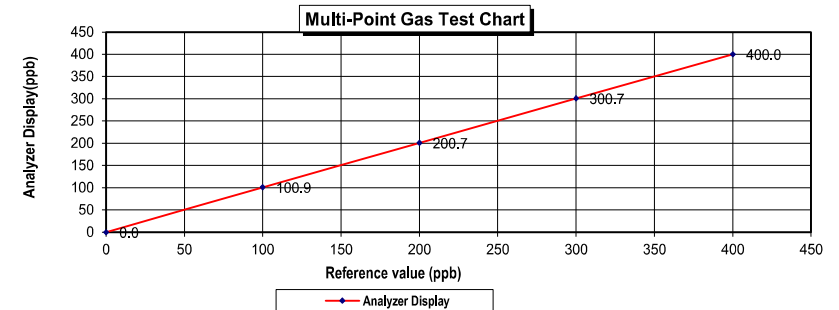
Sulphur Dioxide (SO₂) 42.89 PPM
Nitric Oxide (NO) 46.77 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 965.9
Cylinder No. : EB0159156
Expiration Date : Nov 06, 2026

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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P. Kham
17 / 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, NO_x, 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 CO ₂	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 NO ₂	FTIR	Jun 15, 2023
Nicolet iS50 FTIR AUP2010245 SO ₂	FTIR	Jun 08, 2023


Approved for Release

Page 1 of 1

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MULTI-POINT GAS TEST REPORT

Test Date : Sep 3, 2024

Equipment :	Gas Analyzer (CO)	Model :	48i
Manufacturer :	Thermo Scientific	Serial Number :	CM08140003

Standard Gas Concentration

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

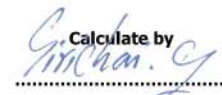
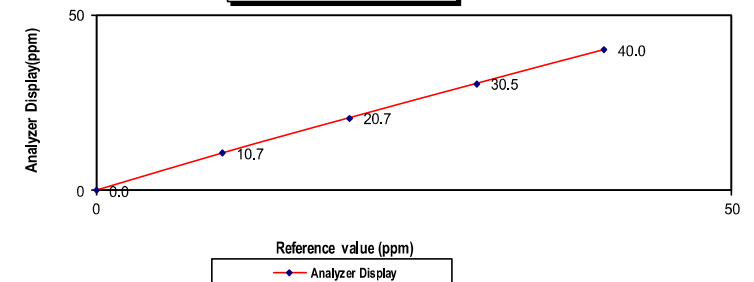

Dilutor Detail

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	10.7	0.7	6.5	6.5
Level 3	40.00%	20.0	20.7	0.7	3.4	3.4
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 (%)			2.31

Multi-Point Gas Test Chart


Calculate by
3 / 9 / 2567
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3 / Sep / 2024

MULTI-POINT GAS TEST REPORT

Test Date : June 14, 2024

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo Scientific Serial Number : 1180540069

Standard Gas Concentration

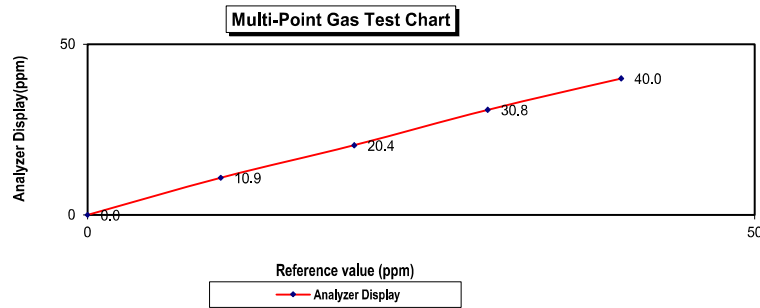
Sulphur Dioxide (SO₂) 42.89 PPM
Nitric Oxide (NO) 46.77 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 965.9 PPM
Cylinder No. : EB0159156
Expiration Date : Nov 06, 2026

Dilutor Detail

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

Multi-point gas test data

Reference Value (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	10.9	0.9	8.3	8.3
Level 3	40.00%	20.0	20.4	0.4	2.0	2.0
Level 4	60.00%	30.0	30.8	0.8	2.6	2.6
Level 5	80.00%	40.0	40.0	0.0	0.0	0.0
Remark : Measuring Range		50.0 ppm	Average Difference (%)			2.56



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Approve by

14 / June / 2024

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

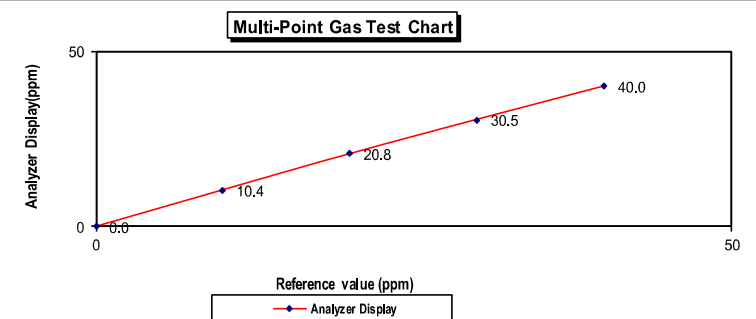
Sulphur Dioxide (SO₂) 42.89 PPM
Nitric Oxide (NO) 46.77 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 965.9 PPM
Cylinder No. : EB01159156
Expiration Date : Nov 06, 2026

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



Calculate by

9 / 9 / 2567

Approve by

9 / Sep / 2024

MULTI-POINT GAS TEST REPORT

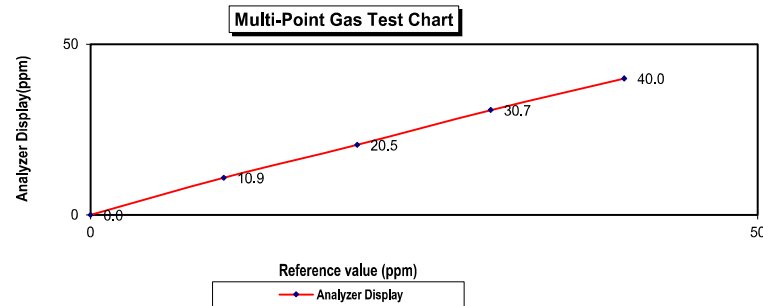
Test Date : June 14, 2024

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

Standard Gas Concentration			Dilutor Detail	
Sulphur Dioxide (SO ₂)	42.89	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	46.77	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9	PPM		
Cylinder No. :	EB0159156			
Expiration Date :	Nov 06, 2026			

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	10.9	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



Calculate by
Girichai G.
14/06/2567

Approve by
Pattana K.
14 June 2024

MULTI-POINT GAS TEST REPORT

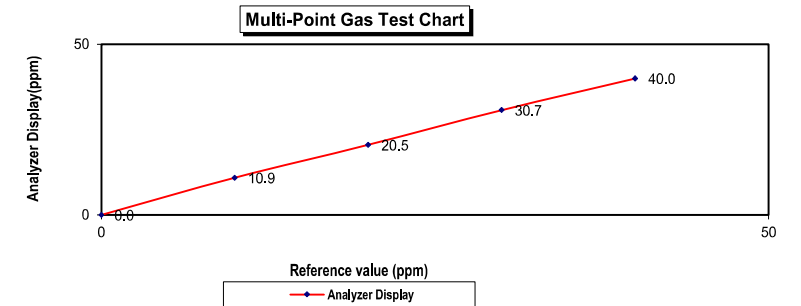
Test Date : Dec 6, 2024

Equipment : Gas Analyzer (CO) Model : 48C
Manufacturer : Thermo Environmental Instruments Serial Number : 48C-65506-348

Standard Gas Concentration			Dilutor Detail	
Sulphur Dioxide (SO ₂)	42.89	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	46.77	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9	PPM		
Cylinder No. :	EB01159156			
Expiration Date :	Nov 06, 2026			

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	10.9	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



Calculate by
Girichai G.
6/12/2567

Approve by
Pattana K.
6 Dec 2024

MULTI-POINT GAS TEST REPORT

Test Date : Sep 3, 2024

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo Scientific Serial Number : CM08140004

Standard Gas Concentration

Sulphur Dioxide (SO₂) 42.89 PPM
Nitric Oxide (NO) 46.77 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 965.9 PPM
Cylinder No. : EB01159156
Expiration Date : Nov 06, 2026

Dilutor Detail

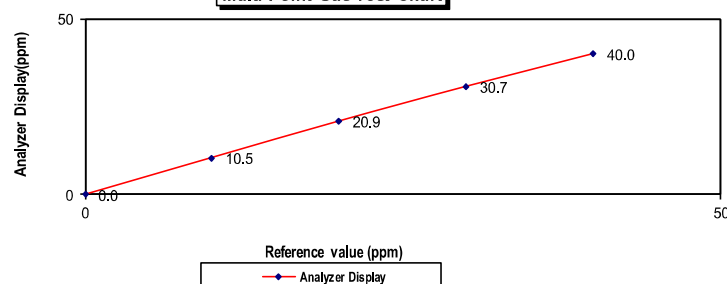
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

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	10.5	4.8	4.8
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		Average Difference (%)		2.27	

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

3 / 9 / 2567

Approve by

3 / Sep / 2024

MULTI-POINT GAS TEST REPORT

Test Date : Dec 6, 2024

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920018

Standard Gas Concentration

Sulphur Dioxide (SO₂) 42.89 PPM
Nitric Oxide (NO) 46.77 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 965.9 PPM
Cylinder No. : EB01159156
Expiration Date : Nov 06, 2026

Dilutor Detail

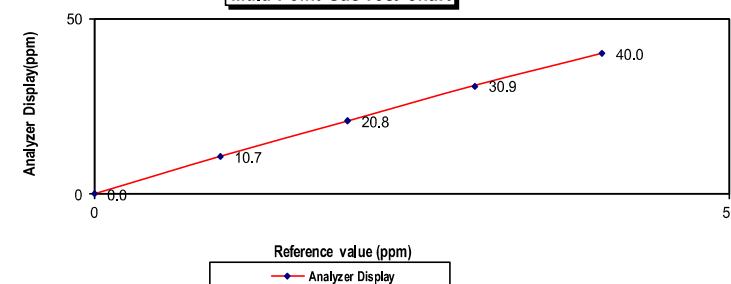
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

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	20.8	3.8	3.8
Level 4	60.00%	30.0	30.9	2.9	2.9
Level 5	80.00%	40.0	40.0	0.0	0.0
Remark : Measuring Range 50.0 ppm		Average Difference (%)		2.66	

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

6 / 12 / 2567

Approve by

6 / Dec / 2024

MULTI-POINT GAS TEST REPORT

Test Date : Sep 2, 2024

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : VUPVTC21

Standard Gas Concentration

Sulphur Dioxide (SO₂) - PPM
Nitric Oxide (NO) - PPM
Methane (CH₄) 39.8 PPM
Carbon Monoxide (CO) - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

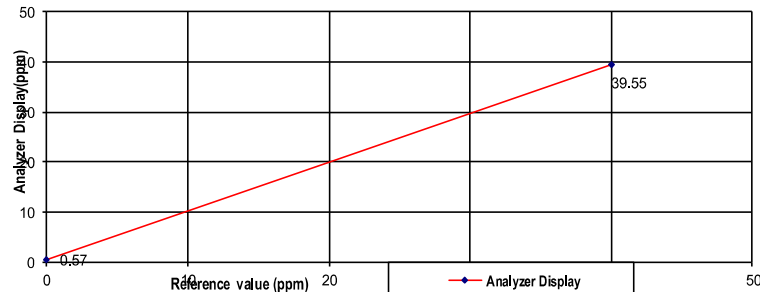
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

	Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	0.57	0.57	0.57	0.57
Level 2	80.00%	40.00	39.55	-0.45	-1.14	1.14
Remark : Measuring Range 50.00 ppm			Average Difference (%)		0.85	

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

Ginchai G.
2024/9/2 2567

Approve by

Pattana K.
2024/9/2

MULTI-POINT GAS TEST REPORT

Test Date : Sep 19, 2024

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : PDXEGXF7

Standard Gas Concentration

Sulphur Dioxide (SO₂) - PPM
Nitric Oxide (NO) - PPM
Methane (CH₄) 39.8 PPM
Carbon Monoxide (CO) - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

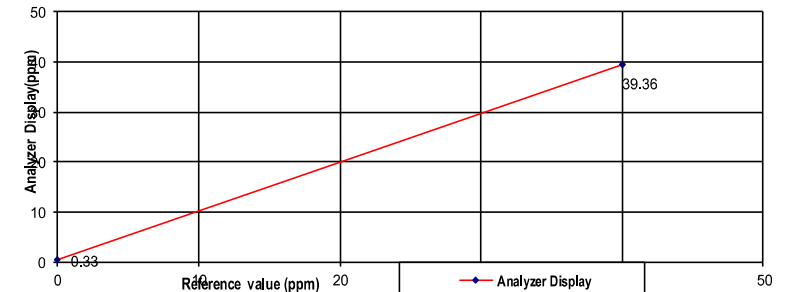
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

	Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	0.33	0.33	0.33	0.33
Level 2	80.00%	40.00	39.36	-0.64	-1.63	1.63
Remark : Measuring Range 50.00 ppm			Average Difference (%)		0.98	

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

Ginchai G.
2024/9/19 2567

Approve by

Pattana K.
2024/9/19

MULTI-POINT GAS TEST REPORT

Test Date : Sep 19, 2024

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : SSGEYBJ

Standard Gas Concentration

Sulphur Dioxide (SO₂) : - PPM
Nitric Oxide (NO) : - PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

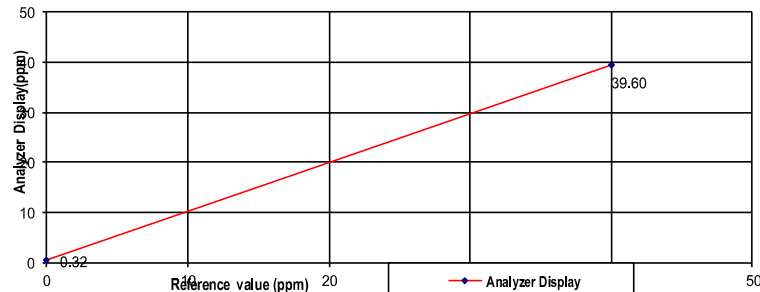
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

	Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	0.32	0.32	0.32	0.32
Level 2	80.00%	40.00	39.60	-0.40	-1.01	1.01
Remark : Measuring Range 50.00 ppm			Average Difference (%)		0.67	

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

Girichai C.
19/9/2567

Approve by

Pattana K.
19/Sep/2024

MULTI-POINT GAS TEST REPORT

Test Date : Sep 2, 2024

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : VV2FY3R3

Standard Gas Concentration

Sulphur Dioxide (SO₂) : - PPM
Nitric Oxide (NO) : - PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

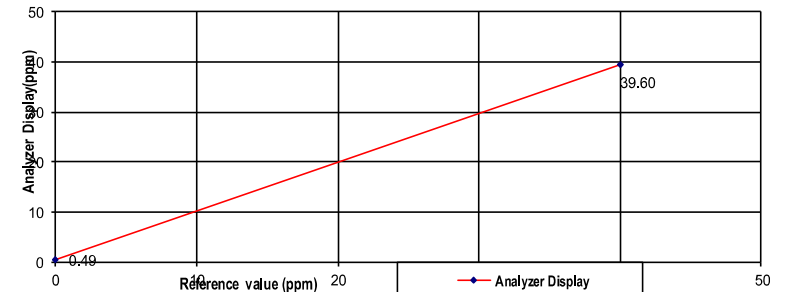
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

	Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	0.49	0.49	0.49	0.49
Level 2	80.00%	40.00	39.60	-0.40	-1.01	1.01
Remark : Measuring Range 50.00 ppm			Average Difference (%)		0.75	

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

Girichai C.
2/9/2567

Approve by

Pattana K.
2/Sep/2024

MULTI-POINT GAS TEST REPORT

Test Date : Oct 1, 2024

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : T4FG19AN

Standard Gas Concentration

Sulphur Dioxide (SO₂) - PPM
Nitric Oxide (NO) - PPM
Methane (CH₄) 39.8 PPM
Carbon Monoxide (CO) - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

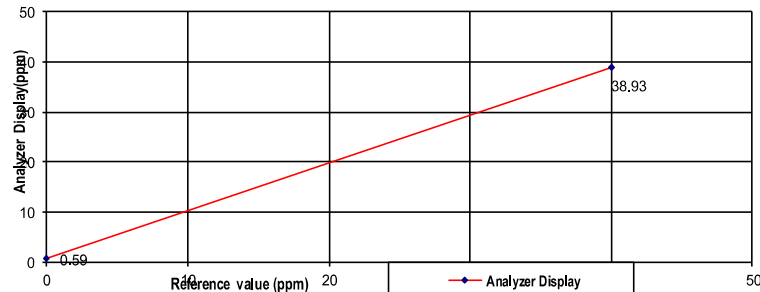
Dilutor Detail

Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	0.59	0.59	0.59	0.59
Level 2	80.00%	40.00	38.93	-1.07	-2.75	2.75
Remark : Measuring Range 50.00 ppm				Average Difference (%)		1.67

Multi-Point Gas Test Chart



Calculate by

10/1/2567

Approve by

10/1/2567

MULTI-POINT GAS TEST REPORT

Test Date : SEP 19, 2024

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : HAMEHU5M

Standard Gas Concentration

Sulphur Dioxide (SO₂) - PPM
Nitric Oxide (NO) - PPM
Methane (CH₄) 39.8 PPM
Carbon Monoxide (CO) - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

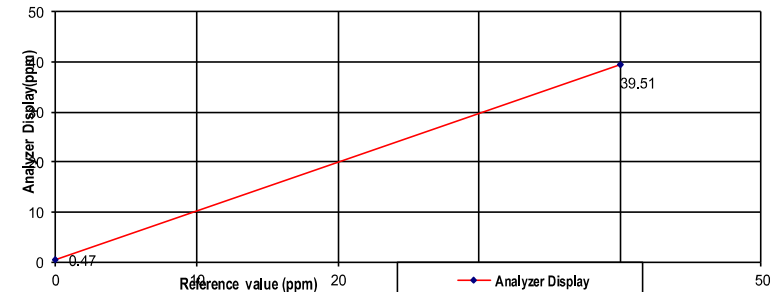
Dilutor Detail

Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	0.47	0.47	0.47	0.47
Level 2	80.00%	40.00	39.51	-0.49	-1.24	1.24
Remark : Measuring Range		50.00 ppm		Average Difference (%)		0.86

Multi-Point Gas Test Chart



Calculate by

19/9/2567

Approve by

19/9/2567

Certificate Of Analysis
Special Gases Mixture

Customer Details

Name: United Analyst & Engineering Co., Ltd.
Address: 3 Soi Udomsuk 41, Sukhumvit Rd., Bang Chak, Khet Phra Khanong, Bangkok 10260
Customer Tag No.:

Certificate Details

Number: 3384/20 Date of issue: 4-Aug-2020 Expiry date: 4-Aug-2028

Material Details

Production Order: 90161442 Material Code: 400400-AL-34 Cylinder No.: D824432
Gas content: 6.60 M³ Filling pressure: 137.0 bar Valve: CGA 590 BRASS
Cylinder Owner: LINDE Cylinder Material: Aluminum Cylinder Size: 50 L

Laboratory Report

Analytical Result

Component	Normal Concentration	Analysis Result ¹	Uncertainty ²	Method of Analysis ³	Assay Date
Methane In Air	40.0 ppm	39.8 ppm	± 1% relative	(6) I-PB-352	4-Aug-2020

Reference Standard used in Assay

Reference Standard	Cylinder number	Concentration	Expiry date
Methane In Nitrogen	25599956	49.29 ± 0.39 ppm	4-Oct-2020

Analytical Instruments used in Assay

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
FTIR Spectrometers Nicolet iS50	FTIR-CH4	4-Aug-2020

Recommend usage condition

Minimum utilization: 5% of actual content or before expiry date whichever comes first.
Storage condition: Keep in well ventilation and secure area.

Comments

When reordering, please quote the material number

Note:

1. All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1.
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzers, (3) Electrochemical Oxygen Analyzers, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

Sukanya Parinyasontorn
Signatory for and on behalf of Linde (Thailand) Co., Ltd.

Page 1 of 1

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บริษัท ลินด์ (ประเทศไทย) จำกัด (มหาชน)

เลขที่ 15 ถนนสุขุมวิท ต. 2/3 หมู่ 14 แขวงคลองเตย เขต คลองเตย กรุงเทพมหานคร 10110
เบอร์โทร (66) 2338-4100 โทรสาร (66) 2338-6333
โทรสาร (66) 2338-4100 โทรสาร (66) 2338-6333
เบอร์โทร (66) 2338-4100 โทรสาร (66) 2338-6333

Linde (Thailand) Public Company Limited
15th Floor, Bangna Tower A, 2/3 Moo 14, Bangna Trad KM. 6.5 Road, Bangnae, Samutprakarn 10540, Tel: (66) 2338-6100 Fax: (66) 2338-6333
Wellgrow Plant: 105 Moo 5, T. Bangnamak, A. Bangpakong, Chachoengsao 24100
Thailand, Tel: (66) 38-570-479-93 Fax: (66) 38-570-323

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 10 March, 2025

Certification No. 146/25

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2205DR0105

Wind Sensor 2205DT0105

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

81 Sol 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 PTB330 No. K4320001

Calibrated by : Watchapol Subwat

Signed :

Mr. Watchapol Subwat

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. 146/25

10 March, 2025

Page : 2 of 5

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
	m/sec	inches H ₂ O	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	-	-	-	17.1	-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 :

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. 146/25

10 March, 2025

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1010.84	1011	-0.16
1010.60	1011	-0.40
1011.71	1012	-0.29
1012.17	1012	0.17
1012.31	1012	0.31
1012.25	1012	0.25
1012.79	1013	-0.21
1012.95	1013	-0.05
1013.52	1014	-0.48
1014.16	1014	0.16
1015.79	1016	-0.21
1016.02	1013	3.02
1015.86	1016	-0.14
1015.69	1016	-0.31
1011.51	1012	-0.49
1011.80	1012	-0.20
1012.06	1012	0.06
1012.81	1013	-0.19
1013.22	1013	0.22
1013.49	1014	-0.51

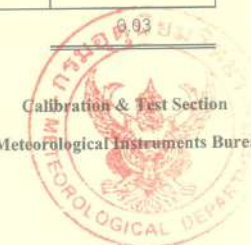
Average

0.93

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. 146/25

10 March, 2025

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
758.19	758	0.19
758.01	758	0.01
758.84	759	-0.16
759.19	759	0.19
759.29	759	0.29
759.25	759	0.25
759.65	760	-0.35
759.77	761	-1.23
760.20	760	0.20
760.68	761	-0.32
761.90	762	-0.10
762.08	762	0.08
761.96	762	-0.04
761.83	762	-0.17
758.69	759	-0.31
758.91	759	-0.09
759.11	759	0.11
759.67	760	-0.33
759.98	760	-0.02
760.18	760	0.18

Average

0.08

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. 146/25

10 March, 2025

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.7	46	-0.3
30.2	30	0.2
15.3	15	0.3

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

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 Sol 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 : Watcharapol Subwat

Signed :

Mr. Watcharapol Subwat

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

เอกสารไม่ควบคุม



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



เอกสารไม่ควบคุม



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



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 : 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



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 : 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. Pisood Promsut

Mr. Watchapol Subwat
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. 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	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 :

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. 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 :

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. 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



เอกสารไม่ควบคุม



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



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 : 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. K4320001

Calibrated by :

Watcharapol

Signed :

Mr. Pisood Promsut

Mr. Watcharapol Subwat

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. 110/25

19 February, 2025

Page : 2 of 5

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure m/sec	Vacuum 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 :

Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม



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

0.09

Calibrated by :

Watchapol

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม



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

0.04

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. 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 :

Wacharapol

Mr. Wacharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau



เอกสารไม่ควบคุม



JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co., Ltd.
63/14-15, 67/35-36
Petchkasem 7,7/1, Rd. Watthapra, Bangkokyai,
Bangkok 10500 (Thailand)
Tel: +6608860812
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

Air speed measurement laboratory
Calibration services department.



NSC-TISI-TIS 17025
CALIBRATION 0367

Certificate Number

CWS-027-67

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: 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,
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 area¹ 900 cm²
Wind direction frontal area² 195 cm²
Diameter of mounting pipe³ - mm
Blockage ratio of test object⁴ 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:

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

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

เอกสารไม่ควบคุม

MEASUREMENT RESULTS⁵

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:

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

¹ Velocity of standard

² 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.



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Certificate Number
CWS-027-67

Jiranatee Associates Co., Ltd.
63/14-15, 67/35-36
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Bangkok 10600 (Thailand)
Tel: +6608680812
Mobile: +66883999453
E-mail: jnac-calibration@jiranatee.com
Web site: www.jiranatee.com

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

Wind direction measurement laboratory
Calibration services department.

Certificate Number
CWD-027-67

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

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 ¹	900	cm ²
	: Wind direction frontal area ²	52	cm ²
	: Diameter of mounting pipe ³	-	mm
	: Blockage ratio of test object ⁴	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 Jitraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

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

เอกสารไม่ควบคุม

MEASUREMENT RESULTS⁵

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^-_{std}	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:

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

² Direction of standard

³ Direction of Unit Under Calibration

End of Certificate of Calibration



เอกสารไม่ควบคุม

Certificate Number
CWD-027-67



Jiranatee Associates Co., Ltd.
63/14-15, 67/35-36
Petchkasem 7,7/1, Rd. Watthapra, Bangkokkai,
Bangkok 10600 (Thailand)
Tel: +6686680812
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

Temperature measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-180-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Temperature sensor with data logger
MANUFACTURER : LSI Lastem
MODEL/TYPE : E-LOG
SERIAL NUMBER : 17037708
ID NUMBER : -
CONDITION AS-RECEIVED : New item
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

RECEIVED DATE : 10 Oct 2024
MEASUREMENT DATE : 21 Oct 2024
ISSUE DATE : 22 Oct 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

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

Traceability:

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0047-24, Certificate number: ER-0101-23

Reference Used During Calibration:

- Standard Temperature Probe
Model: STS-100 AS00, Serial No.: 667682-09
- Digital Temperature Indicator
Model: DTI-1000-A MK II, Serial No.: 671407-00591

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 Jittrapun Lertsomphol
☒ Miss Ruangrumpal Phoommit



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Continuation of Certificate of Calibration Number CDT-180-67

Page 2 of 2 Pages

Result of Calibration: ☐ Without Adjustment ☒ With Adjustment

Calibration Range: 20 °C to 40 °C

Function:

Table 1: This equipment was connected with temperature sensor Model: DMA672.1, S/N: 24070579.
Dimension: Diameter 14.88 mm., Length 140 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (Before) (°C)	UUC Reading (After) (°C)	Error (°C)	Uncertainty (°C)
120	20.031	18.37	19.88	-0.15	0.082
120	25.028	23.31	24.82	-0.21	0.082
120	30.016	28.20	29.72	-0.29	0.082
120	35.004	33.10	34.63	-0.37	0.082
120	39.998	38.01	39.57	-0.43	0.082

UUC*: Unit Under Calibration

End of Certificate of Calibration



Jiranatee Associates Co.,Ltd
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Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Relative humidity and Air Temperature measurement laboratory
Calibration services department.

CERTIFICATE OF CALIBRATION

Certificate No. : CRT-047-67

Page 1 of 2 Pages

**MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE**

: Relative humidity with data logger

: LSI Lastem

: Data Logger: E-LOG

Sensor: DMA672.1

SERIAL NUMBER

: Data Logger: 17037708

Sensor: 24070579

ID NUMBER

: -

CONDITION AS-RECEIVED

: New item

CUSTOMER

: United Analyst and Engineering Consultant Co., Ltd.

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

RECEIVED DATE

: 10 Oct 2024

MEASUREMENT DATE

: 21 Oct 2024

ISSUE DATE

: 22 Oct 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C

Relative Humidity : 55.0 ± 15.0 %RH

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

The Relative humidity and Air Temperature calibration was done by In-House calibration method as WI-CL-009 and WI-CL-010 according to comparison method with Standard Chilled Mirror hygrometer with Temperature sensor and standard Humidity generator chamber.

Traceability:

The measurements are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TH-0079-23 and Jiranatee Associates Co., Ltd. Certificate number: CDT-001-67.

Uncertainty of Measurement:

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

Calibrated by:

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



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Continuation of Certificate of Calibration Number: CRT-047-67

Measurement Results:

The results of calibration and associated measurement uncertainties are reported in the table below.

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Table 1: The results of calibration of relative humidity at 30 °C are reported in table below.
Calibration Range: 20%RH to 80%RH

Air Temperature (°C)	Standard Reading (%RH)	UUC Reading (%RH)	Error (%RH)	Uncertainty ± (%RH)
29.76	19.65	20.5	0.8	0.78
29.78	50.33	51.0	0.7	1.3
29.82	81.61	81.4	-0.2	2.1

UUC*: Unit Under Calibration

End of Certificate of Calibration



JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd
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NSC-TISI-TIS 17025
CALIBRATION 0367

Pressure measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CPR-010-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Digital barometer
MANUFACTURER : LSI Lastem
MODEL/TYPE : Sensor: DQA240.1
Data logger: E-LOG
SERIAL NUMBER : Sensor: R1605260
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
RECEIVED DATE : 02 Aug 2024
MEASUREMENT DATE : 09 Aug 2024
ISSUE DATE : 09 Aug 2024

Calibration procedure:
The Digital barometer was calibrated against Digital pressure calibrator. The WI-CL-003 was used as a calibration guideline.

Traceability:
The measurement results are traceable to the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MP-0009-24

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"

CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date
Absolute Pressure Transducer	CPG2500	4100126P	MP-0009-24	27 Dec 2024

1. Calibration effort for calibration sequence B

2. The UUC* was installed in vertical orientation above reference standard instrument and center of UUC* was used as the reference level.

3. Calibration conditions:

4. Condition : ☒ Normal ☐ Abnormal
Pressure transmitting medium : Air
 ρ_{H_2O} (20°C, 1 bar) : 1.19 kg/m³
 H_{amb} : (55±15) %
 t_{amb} : (23±3) °C
 p_{amb} : (1010±10) mbar

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

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



Approved signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

CERTIFICATE OF CALIBRATION

Certificate No. : CPR-010-67

Page 2 of 2 Pages

MEASUREMENT RESULTS : ☒ Without adjustment ☐ With adjustment

CALIBRATION IN THE RANGE OF : 800 mbar to 1100 mbar

The results of calibration and associated measurement uncertainties are reported in the table below.

STD (mbar)	UUC* (mbar)	Error (mbar)	Uncertainty (k=2) (mbar)
800.16	800.1	0.0	0.28
830.12	830.0	-0.1	0.28
860.13	859.9	-0.2	0.28
890.13	890.0	-0.1	0.28
920.08	920.0	0.0	0.28
950.08	949.9	-0.2	0.28
980.07	979.9	-0.2	0.28
1010.08	1010.0	-0.1	0.28
1040.07	1040.1	0.0	0.28
1070.05	1070.0	-0.1	0.28
1100.07	1100.0	-0.1	0.28

Note: UUC* Unit Under Calibration

: To convert the result in report unit to Pa should be multiply by 100

End of certificate



CERTIFICATE OF CALIBRATION

Certificate No. : CPR-010-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Digital barometer
MANUFACTURER : LSI Lastem
MODEL/TYPE : Sensor: DQA240.1
Data logger: E-LOG
SERIAL NUMBER : Sensor: R1605260
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

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

Calibration procedure:
The Digital barometer was calibrated against Digital pressure calibrator. The WI-CL-003 was used as a calibration guideline.

Traceability:
The measurement results are traceable to the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MP-0009-24

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'

CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date
Absolute Pressure Transducer	CPG2500	4100126P	MP-0009-24	27 Dec 2024

2. Calibration effort for calibration sequence B

3. The UUC* was installed in vertical orientation above reference standard instrument and center of UUC* was used as the reference level.

3. Calibration conditions:

4. Condition : ☒ Normal ☐ Abnormal
Pressure transmitting medium : Air
 ρ_{fl} (20°C, 1 bar) : 1.19 kg/m³
 H_{amb} : (55±15) %
 t_{amb} : (23±3) °C
 p_{amb} : (1010±10) mbar

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

Calibrated by:
☐ Mr. Sorawit Thachalad
☒ Miss Jittraporn Lertsomphol



Approved signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

เอกสารไม่ควบคุม

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

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CALIBRATION REPORT

Calibration Number. : RG-01082024
Page 1 of 2 Pages

CERTIFICATE OF CALIBRATION

Certificate No. : CPR-010-67

Page 2 of 2 Pages

MEASUREMENT RESULTS : ☒ Without adjustment ☐ With adjustment

CALIBRATION IN THE RANGE OF : 600 mmHg to 825 mmHg

The results of calibration and associated measurement uncertainties are reported in the table below.

STD (mmHg)	UUC* (mmHg)	Error (mmHg)	Uncertainty (k=2) (mmHg)
600.18	600.1	0.0	0.21
622.65	622.5	-0.1	0.21
645.16	645.0	-0.2	0.21
667.66	667.6	-0.1	0.21
690.13	690.1	0.0	0.21
712.63	712.5	-0.1	0.21
735.13	735.0	-0.1	0.21
757.63	757.6	0.0	0.21
780.13	780.1	0.0	0.21
802.62	802.5	-0.1	0.21
825.14	825.1	-0.1	0.21

Note: UUC* Unit Under Calibration

: To convert the result in report unit to Pa should be multiply by 133.32

End of certificate



Measurement Item : Rain gauge with data logger

Manufacturer : Data logger: LSI Lastem
Rain gauge: LSI Lastem

Model/Type : Data logger: E-LOG
Rain gauge: DQA230.1#C

Serial Number : Data logger: 17037708
Rain gauge: PC1705209

ID NO : -

Customer : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Environmental Condition:

The measurement was carried out in an ambient temperature of (25±3)°C, and relative humidity of (50±15)%.

Measurement Method:

The Rain gauge, Unit Under Calibration (UUC) was calibrated by Precision reference bottle with flow adjuster at low rate 0.6 mm per minute or 1 tipping every 20 seconds. The tipping number was determined by procedures below.

1. Obtain rain gauge inlet area:

Rain gauge precise diameter in cm = Diameter/2 = R (radius)

Rain gauge area = $R^2 \times 3.14$ (UUC diameter = 20.3 cm, UUC radius = 10.15 cm)

Rain gauge area = 323.6 cm².

2. Obtain theoretical correct rain gauge answer (number of tipplings) using 323.6 cm² inlet area and 0.5 L of rain.

a) 10,000 cmq / 323.6 cm² inlet area = 30.90 (rain gauge area = 1/30.90 of square meter)

b) 30.90 * 0.5 L volume = 15.45 mm (mm of rain over 1 m² surface) 500 ml of rain volume on the rain gauge area = 15.45 mm of rain.

c) Number of tipping = 15.45 / 0.2 mm = 77 tipplings.

Note: Rain gauge is fully cleaned and leveling prior the calibration performed.

Measurement Date : Aug 08, 2023

Issued Date : Aug 09, 2023

Calibrated by:

☐ Mr. Sorawit Thachalad

☒ Miss Jitraporn Lertsomphol



Approved Signatory:

Mr. Parinya Booncharoen

Mr. Parinya Booncharoen
Calibration Department Manager

เอกสารไม่ควบคุม

THIS CALIBRATION REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY. เอกสารไม่ควบคุม

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

The results of calibration are reported in table below.

Quantity of H ₂ O (ml)	Determined Tipping	Tipping count	Acceptable Tipping count
500	77	78	75 - 79
500	77	78	75 - 79
500	77	79	75 - 79
500	77	78	75 - 79
500	77	79	75 - 79

Remark: The procedure is made to verify the correct reading of the Unit under Calibration rain gauge when a precise volume of water falls into its cone. We suggest that the number of tipping should be within $\pm 2\%$ different from the 77 tipping (correct range: 75-79 tipping) it means that the rain gauge meets the manufacturer acceptable limit.

End of calibration report



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 area¹ 900 cm²
Wind direction frontal area² 195 cm²
Diameter of mounting pipe³ - mm
Blockage ratio of test object⁴ 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 Thachaiad
☐ Miss Jitraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Remarks:

¹ Nozzle cross-section area of the wind tunnel

² Projected cross-section area of the tested object include mounting pipe

³ Diameter of mounting pipe

⁴ Ratio ² to ¹

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MEASUREMENT RESULTS⁵

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)
1.101	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

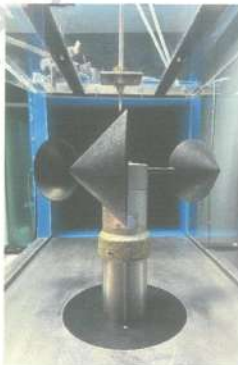
Remark:

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

⁶ Velocity of standard

⁷ 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.



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NSC-TISI-TIS 17025
CALIBRATION 0367

Wind direction measurement laboratory
Calibration services department.

Certificate Number

CWD-028-67

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 area¹ 900 cm²
Wind direction frontal area² 52 cm²
Diameter of mounting pipe³ - mm
Blockage ratio of test object⁴ 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:

Signature
Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

¹ Nozzle cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio² to¹

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MEASUREMENT RESULTS⁵

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:

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

⁶ Direction of standard

⁷ Direction of Unit Under Calibration

End of Certificate of Calibration



เอกสารไม่ควบคุม

Certificate Number
CWD-028-67



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

Temperature measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-181-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Temperature sensor with data logger
MANUFACTURER : LSI Lastem
MODEL/TYPE : E-LOG
SERIAL NUMBER : 17037713
ID NUMBER : -
CONDITION AS-RECEIVED : New item
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

RECEIVED DATE : 10 Oct 2024
MEASUREMENT DATE : 21 Oct 2024
ISSUE DATE : 22 Oct 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

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

Traceability:

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0047-24, Certificate number: ER-0101-23

Reference Used During Calibration:

1. Standard Temperature Probe
Model: STS-100 A500, Serial No.: 667682-09
2. Digital Temperature Indicator
Model: DTI-1000-A MK II, Serial No.: 671407-00591

Uncertainty of Measurement:

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

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



Approved signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

Continuation of Certificate of Calibration Number CDT-181-67

Page 2 of 2 Pages

Result of Calibration: ☐ Without Adjustment ☒ With Adjustment

Calibration Range: 20 °C to 40 °C

Function:

Table 1: This equipment was connected with temperature sensor Model: DMA672.1, S/N: 24070483.
Dimension: Diameter 14.88 mm., Length 140 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (Before) (°C)	UUC Reading (After) (°C)	Error (°C)	Uncertainty (°C)
120	20.021	18.38	20.27	0.25	0.082
120	25.028	23.23	25.20	0.18	0.082
120	30.015	28.11	30.14	0.12	0.082
120	35.004	33.00	35.08	0.07	0.082
120	39.995	37.89	39.99	0.00	0.082

UUC*: Unit Under Calibration

End of Certificate of Calibration



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

Relative humidity and Air Temperature measurement laboratory
Calibration services department.

CERTIFICATE OF CALIBRATION

Certificate No. : CRT-048-67

Page 1 of 2 Pages

**MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE**

: Relative humidity with data logger

: LSI Lastem

: Data Logger: E-LOG

Sensor: DMA672.1

SERIAL NUMBER

: Data Logger: 17037713

Sensor: 24070483

ID NUMBER

: -

CONDITION AS-RECEIVED

: New item

CUSTOMER

: United Analyst and Engineering Consultant Co., Ltd.
81 Sol Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong,
Bangkok 10260

RECEIVED DATE

: 10 Oct 2024

MEASUREMENT DATE

: 21 Oct 2024

ISSUE DATE

: 22 Oct 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C

Relative Humidity : 55.0 ± 15.0 %RH

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

The Relative humidity and Air Temperature calibration was done by In-House calibration method as WI-CL-009 and WI-CL-010 according to comparison method with Standard Chilled Mirror hygrometer with Temperature sensor and standard Humidity generator chamber.

Traceability:

The measurements are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TH-0079-23 and Jiranatee Associates Co., Ltd. Certificate number: CDT-001-67.

Uncertainty of Measurement:

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

Calibrated by:

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



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

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IN WRITING FROM THE LABORATORY

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Continuation of Certificate of Calibration Number: CRT-048-67

Page 2 of 2 Pages

Measurement Results:

The results of calibration and associated measurement uncertainties are reported in the table below.

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Table 1: The results of calibration of relative humidity at 30 °C are reported in table below.

Calibration Range: 20%RH to 80%RH

Air Temperature (°C)	Standard Reading (%RH)	UUC Reading (%RH)	Error (%RH)	Uncertainty ± (%RH)
29.87	19.70	20.3	0.6	0.78
29.80	50.53	51.2	0.7	1.3
29.81	81.69	82.0	0.3	2.1

UUC*: Unit Under Calibration

End of Certificate of Calibration



JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd
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ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Pressure measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CPR-011-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Digital barometer
MANUFACTURER : LSI Lastem
MODEL/TYPE : Sensor: DQA240.1
Data logger: E-LOG
SERIAL NUMBER : Sensor: R1605257
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 : 09 Aug 2024
ISSUE DATE : 09 Aug 2024

Calibration procedure:

The Digital barometer was calibrated against Digital pressure calibrator. The WI-CL-003 was used as a calibration guideline.

Traceability:

The measurement results are traceable to the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MP-0009-24

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'

CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date
Absolute Pressure Transducer	CPG2500	4100126P	MP-0009-24	27 Dec 2024

1. Calibration effort for calibration sequence B

2. The UUC* was installed in vertical orientation above reference standard instrument and center of UUC* was used as the reference level.

3. Calibration conditions:

4. Condition : ☒ Normal ☐ Abnormal
Pressure transmitting medium : Air
 ρ_{fl} (20°C, 1 bar) : 1.19 kg/m³
 H_{amb} : (55±15) %
 t_{amb} : (23±3) °C
 p_{amb} : (1010±10) mbar

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

Calibrated by:

☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen

Mr. Parinya Booncharoen
Calibration Department Manager

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CERTIFICATE OF CALIBRATION

Certificate No. : CPR-011-67

Page 2 of 2 Pages

MEASUREMENT RESULTS : ☒ Without adjustment ☐ With adjustment

CALIBRATION IN THE RANGE OF : 800 mbar to 1100 mbar

The results of calibration and associated measurement uncertainties are reported in the table below.

STD (mbar)	UUC* (mbar)	Error (mbar)	Uncertainty (k=2) (mbar)
800.15	800.1	-0.1	0.28
830.12	830.0	-0.1	0.28
860.13	860.0	-0.2	0.28
890.09	890.0	-0.1	0.28
920.11	920.1	0.0	0.28
950.10	949.9	-0.2	0.28
980.09	980.0	-0.1	0.28
1010.07	1010.0	-0.1	0.28
1040.07	1040.0	0.0	0.28
1070.06	1070.0	-0.1	0.28
1100.06	1099.8	-0.2	0.28

Note: UUC* Unit Under Calibration

: To convert the result in report unit to Pa should be multiply by 100

End of certificate



CERTIFICATE OF CALIBRATION

Certificate No. : CPR-011-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Digital barometer
MANUFACTURER : LSI Lastem
MODEL/TYPE : Sensor: DQA240.1
Data logger: E-LOG
SERIAL NUMBER : Sensor: R1605257
Data logger: 17037713
ID NUMBER : -
CONDITION AS-RECEIVED : Used item
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.,
81 Soi Udumsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

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

Calibration procedure:

The Digital barometer was calibrated against Digital pressure calibrator. The WI-CL-003 was used as a calibration guideline.

Traceability:

The measurement results are traceable to the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MP-0009-24

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'

CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date
Absolute Pressure Transducer	CPG2500	4100126P	MP-0009-24	27 Dec 2024

2. Calibration effort for calibration sequence B

3. The UUC* was installed in vertical orientation above reference standard instrument and center of UUC* was used as the reference level.

3. Calibration conditions:

4. Condition : ☒ Normal ☐ Abnormal
Pressure transmitting medium : Air
 ρ_{H_2O} (20°C, 1 bar) : 1.19 kg/m³
 H_{amb} : (55±15) %
 t_{amb} : (23±3) °C
 p_{amb} : (1010±10) mbar

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

Calibrated by:

☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

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CALIBRATION REPORT

Calibration Number. : RG-01122024

Page 1 of 2 Pages

CERTIFICATE OF CALIBRATION

Certificate No. : CPR-011-67

Page 2 of 2 Pages

MEASUREMENT RESULTS : ☒ Without adjustment ☐ With adjustment

CALIBRATION IN THE RANGE OF : 600 mmHg to 825 mmHg

The results of calibration and associated measurement uncertainties are reported in the table below.

STD (mmHg)	UUC* (mmHg)	Error (mmHg)	Uncertainty (k=2) (mmHg)
600.18	600.1	0.0	0.21
622.65	622.6	-0.1	0.21
645.16	645.0	-0.1	0.21
667.63	667.5	-0.1	0.21
690.15	690.1	0.0	0.21
712.65	712.5	-0.1	0.21
735.14	735.1	0.0	0.21
757.63	757.6	-0.1	0.21
780.13	780.1	0.0	0.21
802.62	802.6	-0.1	0.21
825.13	825.0	-0.2	0.21

Note: UUC* Unit Under Calibration

: To convert the result in report unit to Pa should be multiply by 133.32

End of certificate



Measurement Item : Rain gauge with data logger

Manufacturer : Data logger: LSI Lastem
Rain gauge: LSI Lastem

Model/Type : Data logger: E-LOG
Rain gauge: DQA230.1

Serial Number : Data logger: 17037713
Rain gauge: 19050180

ID NO : -

Customer : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Environmental Condition:

The measurement was carried out in an ambient temperature of (25±3)°C, and relative humidity of (50±15)%.

Measurement Method:

The Rain gauge, Unit Under Calibration (UUC) was calibrated by Precision reference bottle with flow adjuster at low rate 0.6 mm per minute or 1 tipping every 20 seconds. The tipping number was determined by procedures below.

1. Obtain rain gauge inlet area:

Rain gauge precise diameter in cm = Diameter/2 = R (radius)

Rain gauge area = $R^2 \times 3.14$ (UUC diameter = 20.3 cm, UUC radius = 10.15 cm)

Rain gauge area = 323.6 cm².

2. Obtain theoretical correct rain gauge answer (number of tipplings) using 323.6 cm² inlet area and 0.5 L of rain.

a) 10,000 cm³ / 323.6 cm² inlet area = 30.90 (rain gauge area = 1/30.90 of square meter)

b) 30.90 * 0.5 L volume = 15.45 mm (mm of rain over 1 m² surface) 500 ml of rain volume on the rain gauge area = 15.45 mm of rain.

c) Number of tipping = 15.45 / 0.2 mm = 77 tipplings.

Note: Rain gauge is fully cleaned and leveling prior the calibration performed.

Measurement Date : Dec 12, 2024

Issued Date : Dec 13, 2024

Calibrated by:

☐ Mr. Sorawit Thachalad

☒ Miss Jitraporn Lertsomphol



Approved Signatory:

[Signature]

Mr. Parinya Booncharoen
Calibration Department Manager

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Continuation of Calibration of Calibration Number

Calibration Number: RG-01122024
Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment.
The results of calibration are reported in table below.

Quantity of H ₂ O (ml)	Determined Tipping	Tipping count	Acceptable Tipping count
500	77	77	75 - 79
500	77	76	75 - 79
500	77	76	75 - 79
500	77	76	75 - 79
500	77	76	75 - 79

Remark: The procedure is made to verify the correct reading of the Unit under Calibration rain gauge when a precise volume of water falls into its cone. We suggest that the number of tipping should be within $\pm 2\%$ different from the 77 tipping (correct range: 75-79 tipping) it means that the rain gauge meets the manufacturer acceptable limit.

End of calibration report



CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail sale@cal-laboratory.com



Supplement to Calibration Certificate No. Q24135552

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM13539/UM13539 [UAE.EFM.114/2561]
CLID. NO. : 251900390
JOB CONTROL NO. : 241219135552
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK, PHRAKHANONG, BANGKOK 10260

DATE OF RECEIVED : 19 December 2024

DATE OF ISSUED : 29 January 2025

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

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
29 January 2025

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

Certificate No. Q24135552A1

F3-012-05/12-23

page 1 of 4

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Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



Supplement to Calibration Certificate No. Q24135552

REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM13539/UM13539 [UAE.EFM.114/2561]
DATE OF CALIBRATION : 20 December 2024

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$ Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEE-08 based on ISO 16063-21 as calibration guideline.

The calibration was performed by using Digital Multimeter, Programmable Timer/Counter, Vibration Calibrator which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

- Vibration Calibrator, The Modal Shop Model 9110D S/N. 11424.
- Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
- Digital Multimeter, Keysight Technologies Model 3458A S/N. MY59352733.

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0030-24, Due Date 19 July 2025.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0050/24, Due Date 13 May 2025.
- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0060-24, Due Date 26 June 2025.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q24135552A1

F3-012-05/12-23

page 2 of 4

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CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	\pm (% of rdg.)
0.3	50 Hz	peak	0.300	0.305	-0.005	1.9
0.4	50 Hz		0.400	0.407	-0.007	1.6
0.5	50 Hz		0.500	0.509	-0.009	1.6
0.6	50 Hz		0.600	0.611	-0.011	2.5
0.7	50 Hz		0.700	0.713	-0.013	2.5
0.3	100 Hz	peak	0.300	0.304	-0.004	1.9
0.4	100 Hz		0.400	0.406	-0.006	1.6
0.5	100 Hz		0.500	0.508	-0.008	1.6
0.6	100 Hz		0.600	0.611	-0.011	2.5
0.7	100 Hz		0.700	0.713	-0.013	2.5

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	\pm (% of rdg.)
3	50 Hz	peak	3.000	3.042	-0.042	1.8
4	50 Hz		4.000	4.054	-0.054	1.8
5	50 Hz		5.000	5.066	-0.066	1.8
6	50 Hz		6.000	6.079	-0.079	1.8
7	50 Hz		7.000	7.095	-0.095	1.8
*3	100 Hz	peak	3.000	3.039	-0.039	1.6
*4	100 Hz		4.000	4.049	-0.049	1.6
*5	100 Hz		5.000	5.071	-0.071	1.6
*6	100 Hz		6.000	6.088	-0.088	1.5
*7	100 Hz		7.000	7.104	-0.104	1.5

Certificate No. Q24135552

F3-011-05/12-23

page 3 of 4

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CALIBRATION LABORATORY Co.,LTD.

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7/139 MOO 13, SOI SUNTINAKORN 11 TAMBON BANG KAE0,
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: 06610-2116-5860-1 FAX: 06610-2116-7140



Page 1 of 3

CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	\pm (% of rdg.)
0.03	50 Hz	peak	0.030	0.030	0.000	2.5
0.04	50 Hz		0.040	0.040	0.000	2.1
0.05	50 Hz		0.050	0.051	-0.001	1.9
0.06	50 Hz		0.060	0.061	-0.001	1.8
0.07	50 Hz		0.070	0.071	-0.001	1.8
0.03	100 Hz	peak	0.030	0.030	0.000	2.5
0.04	100 Hz		0.040	0.040	0.000	2.1
0.05	100 Hz		0.050	0.051	-0.001	1.9
0.06	100 Hz		0.060	0.061	-0.001	1.8
0.07	100 Hz		0.070	0.071	-0.001	1.8

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 1,2 of 67

* means Calibrations marked " Not ANAB Accredited " in this Certificate have been included for completeness.

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

End of Certificate

Certificate No. Q24135552

F3-011-05/12-23

page 4 of 4

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Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING

Certificate No : 24-ACT-087

CONSULTANT CO.,LTD.

Request No : Req-2024-1365

Address : 81 Soi Udumsuk 41, Sukhumvit Road, Bangehak,
Prakanong, Bangkok 10260

Unit Under Calibration Details

Measurement item : Acoustic Calibrator

Class : 1

Manufacturer : 01dB

Range : 94 dB / 1000 Hz

Model : CAL31

Instrument Status : Used

Serial Number : 84065

ID : UAE.EFM.167/2561

Calibration Environment and Details

Temperature : (23 \pm 2 °C)

Humidity : (50 \pm 20 %RH)

Barometric Pressure : (1013 \pm 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 :
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :
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 Issuing Laboratory.

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

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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 (± dB)	Acceptance limit Class 1 (± 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 (± %)	Acceptance limit Class 1 (± %)	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 (± %)	Acceptance limit Class 1 (± %)	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

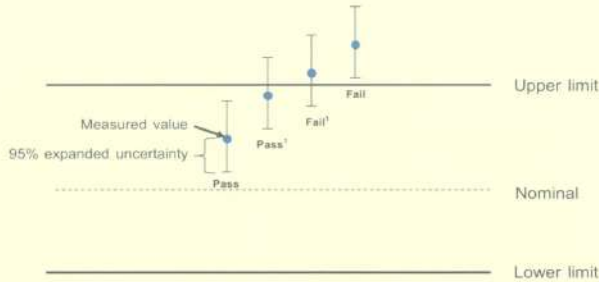
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09:2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ = 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. 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

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	Acceptance	Result
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR		Limit	
Calibrator Setting	(dB)	(dB)	(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 Responce curve			UNCERTAINTY	Acceptance	Result
	A	C	Z		Limit	
FAST / 37-139	(dB)	(dB)	(dB)	(± dB)	(± dB)	
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.0	0.1	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	1.2	1.2	1.2	0.60	3.0	Pass
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			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	0.1	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.0	0.1	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	0.0	-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-234
Request No : Req-2024-1453

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)	(± dB)	(± dB)	
STD 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 (± dB)	Acceptance	Result
FAST / A	REF	UUC	ERR		Limit	
UUC Range	(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		Limit	
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

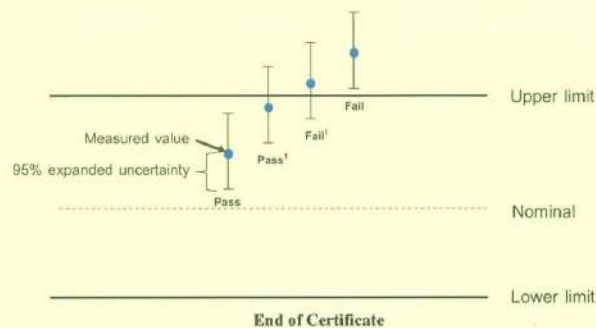
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ = 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.
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	Svanteck	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 : พ.ร.ต.
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 11 July 2024



INNOVATIVE
INSTRUMENT CO., LTD.
บริษัท อินโนวาทึต อิมสตรูเมนต์ จำกัด



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 (\pm dB)	Acceptance Limit (\pm dB)	Result
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR			
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)			
1000 Hz 114 dB	113.76	114.1	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)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance Limit	Result
	FAST / 37-139	A	C			
STD Setting	(dB)	(dB)	(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	Pass



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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	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	Acceptance Limit	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 Limit	Result
FAST / A / 37-139	REF	UUC	ERR			
STD dB	(dB)	(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	Acceptance Limit	Result
FAST / A	REF	UUC	ERR			
UUC Range	(dB)	(dB)	(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	Acceptance Limit	Result
A / 37-139	Toneburst	Ref	UUC	ERR			
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	117.9	-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	Acceptance Limit	Result
FAST / C / 95-142	REF	UUC	ERR			
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-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

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

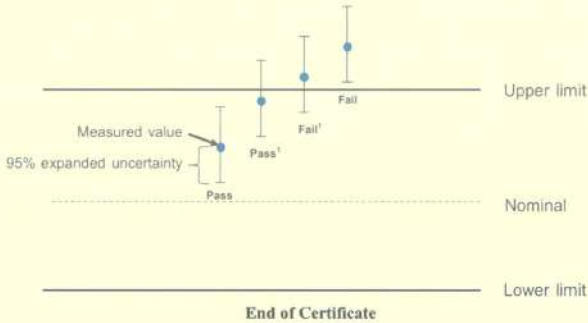
Reporting of Compliance with Specification as following Fig. and statements

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

Pass¹ – The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ – 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-231

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

Request No : Req-2024-1450

Unit Under Calibration Details

Measurement item : Sound Level Meter

Microphone Class : 2

Manufacturer : Larson Davis

Microphone Model : 375B02

Model : LxT2

Microphone S/N : 11792

Serial Number : 0005293

Preamplifier Model : PRMLxT2B

ID : UAE.EFM.108/2562

Preamplifier S/N : 056073

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	TS1
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-231

Request No : Req-2024-1450

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	114.3	0.54	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 (± dB)
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	29.8	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	29.4	0.10
C	28.8	0.10
Z	32.9	0.10

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

UUC Setting	Deviation from various Frequency Weighting Responce curve			UNCERTAINTY	Acceptance Limit (± dB)	Result
	A	C	Z			
FAST/ 37-139	(dB)	(dB)	(dB)	(± dB)		
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.0	0.1	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	0.7	0.7	0.7	0.60	3.0	Pass
8000 Hz	1.4	1.4	1.5	0.70	5.0	Pass1



Certificate No : 24-SLM-231
Request No : Req-2024-1450

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	-0.1	-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
		UUC	ERR			
FAST / 37-139	REF			(± dB)	Limit	
UUC Weighting	(dB)	(dB)	(dB)		(± dB)	
A	114.00	114.0	0.0		0.20	
C	114.00	114.0	0.0		0.20	
Z	114.00	114.0	0.0		0.20	

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



Certificate No : 24-SLM-231
Request No : Req-2024-1450

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			
FAST / A / 37-139	REF	(dB)	(dB)	(± dB)	Limit	
STD 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	98.9	-0.1		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	44.1	0.1		1.1	Pass
39.00	39	39.5	0.5		1.1	Pass

Certificate No : 24-SLM-231
Request No : Req-2024-1450

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	44.80	44.9	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	117.9	-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	109.1	+0.1		+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		Limit	
STD Setting	(dB)	(dB)	(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

Certificate No : 24-SLM-231
Request No : Req-2024-1450

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)		(± dB)	
Positive one-half cycle	143.7			
Negative one-half cycle	143.8			
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-231
Request No : Req-2024-1450

Decision Rule for Statements of Conformity

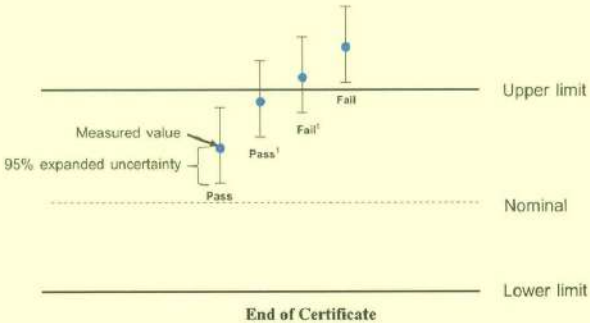
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ = 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-240
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok Request No : Req-2024-1459
10260

Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2
Manufacturer : Larson Davis Microphone Model : 375A04
Model : LxT2 Microphone S/N : 323471
Serial Number : 0005299 Preamplifier Model : PRMLxT2C
ID : UAE.EFM.114/2562 Preamplifier S/N : 071493
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-240
Request No : Req-2024-1459

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)	(± 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 (dB)	UNCERTAINTY (± dB)
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 (dB)	UNCERTAINTY (± dB)
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 Response curve			UNCERTAINTY	Acceptance	Result
	A	C	Z		Limit	
FAST / 37-139	A	C	Z	(± dB)	(± dB)	
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
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 Responce	(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-240
Request No : Req-2024-1459

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
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
FAST / A / 37-139	REF	UUC	ERR		Limit	
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	49.0	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

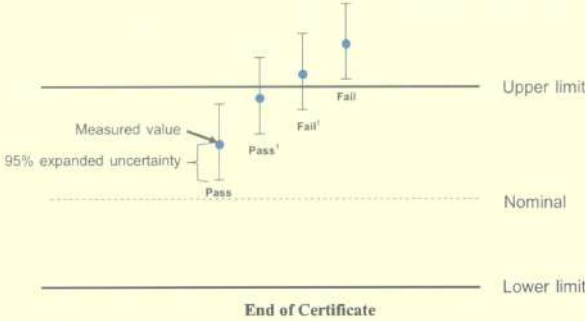
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ = 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-229
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok Request No : Req-2024-1448
10260

Unit Under Calibration Details

Measurement item : Sound Level Meier Microphone Class : 2
Manufacturer : Larson Davis Microphone Model : 375B02
Model : LXT2 Microphone S/N : 11792
Serial Number : 0005372 Preamplifier Model : PRMLxT2B
ID : UAE.EFM.037/2563 Preamplifier S/N : 056132
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 : 9 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	Svante	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 : 9 July 2024



Certificate No : 24-SLM-229
Request No : Req-2024-1448

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	114.7	0.94	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	32.0	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	31.8	0.10
C	31.7	0.10
Z	35.0	0.10

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

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



Certificate No : 24-SLM-229
Request No : Req-2024-1448

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	0.0	0.1	0.0		2.0	Pass
4000 Hz	0.0	0.0	0.0		3.0	Pass
8000 Hz	0.0	0.0	0.1		5.0	Pass
16000 Hz	0.0	0.0	0.0		+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	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-229
Request No : Req-2024-1448

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)	(± dB)	(± dB)	
STD 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	93.6	-0.4		1.1	Pass
89.00	89	88.6	-0.4		1.1	Pass
84.00	84	83.6	-0.4		1.1	Pass
79.00	79	78.6	-0.4		1.1	Pass
74.00	74	73.6	-0.4		1.1	Pass
69.00	69	68.6	-0.4		1.1	Pass
64.00	64	63.6	-0.4		1.1	Pass
59.00	59	58.6	-0.4		1.1	Pass
54.00	54	53.6	-0.4		1.1	Pass
49.00	49	48.7	-0.3		1.1	Pass
44.00	44	43.9	-0.1		1.1	Pass
39.00	39	39.5	0.5		1.1	Pass
34.00	34	34.9	0.9		1.1	Pass1



Certificate No : 24-SLM-229
Request No : Req-2024-1448

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
		UUC	ERR			
FAST / A	REF	(dB)	(dB)	(± dB)	Limit	
UUC Range	(dB)	(dB)	(dB)		(± dB)	
37-139	39.10	39.6	0.5	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
			UUC	ERR			
A / 37-139	Toneburst	Ref	(dB)	(dB)	(± dB)	Limit	
UUC Time Response	(ms)	(dB)	(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	108.8	-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
	200	129.0	129.0	0.0		1.0	Pass
SEL	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
		UUC	ERR			
FAST / C / 95-142	REF	(dB)	(dB)	(± dB)	Limit	
STD Setting	(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-229
Request No : Req-2024-1448

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC			
STD Setting	(dB)	(± dB)	(± dB)	
Positive one-half cycle	140.7			
Negative one-half cycle	140.7			
Deviated	0.0	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC			
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-229
Request No : Req-2024-1448

Decision Rule for Statements of Conformity

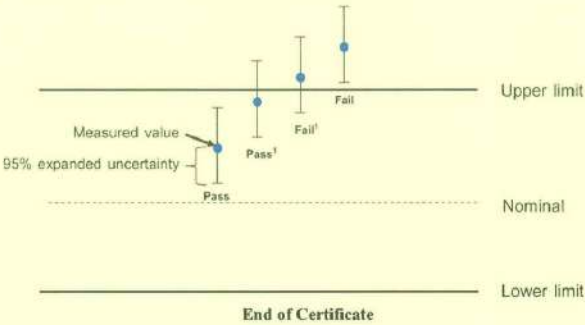
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ = 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-232
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok Request No : Req-2024-1451
10260

Unit Under Calibration Details

Measurement Item : Sound Level Meter Microphone Class : 2
Manufacturer : Larson Davis Microphone Model : 375B02
Model : LX12 Microphone S/N : 11793
Serial Number : 0005341 Preamplifier Model : PRMLXT2B
ID : UAE.EFM.038/2563 Preamplifier S/N : 056133
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-232

Request No : Req-2024-1451

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)	Result
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR			
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)			
1000 Hz 114 dB	113.76	114.3	0.54	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)	(\pm dB)
A	29.7	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(\pm dB)
A	29.4	0.10
C	29.0	0.10
Z	33.0	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (\pm dB)	Acceptance Limit (\pm 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	0.6	0.5	0.6			
8000 Hz	1.0	0.9	1.0	0.70	5.0	Pass

Certificate No : 24-SLM-232

Request No : Req-2024-1451

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 (\pm dB)	Acceptance Limit (\pm dB)	Result
FAST / 37-139	A (dB)	C (dB)	Z (dB)			
STD Setting	(dB)	(dB)	(dB)	0.20	2.0	Pass
63 Hz	-0.2	-0.1	-0.1			
125 Hz	-0.1	0.0	-0.1			
250 Hz	-0.1	0.0	-0.1			
500 Hz	-0.1	0.0	-0.1			
1000 Hz	0.0	0.0	-0.1			
2000 Hz	0.0	0.0	0.0			
4000 Hz	0.0	0.0	0.0			
8000 Hz	-0.1	-0.1	0.0			
16000 Hz	-0.1	-0.1	-0.1		+5, -INF.	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)	Result
FAST / 37-139	REF	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	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)	Result
37-139 / A	REF	UUC	ERR			
UUC Time Response	(dB)	(dB)	(dB)	0.20	0.10	Pass
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-232
Request No : Req-2024-1451

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)			
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
39.00	39	39.5	0.5		1.1	Pass



Certificate No : 24-SLM-232
Request No : Req-2024-1451

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	44.20	44.3	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	117.8	-0.2		+1.0, -2.5	Pass
	0.25	109.0	108.5	-0.5		+1.5, -5.0	Pass
Slow	200	128.6	128.4	-0.2		1.0	Pass
	2	109.0	108.8	-0.2		+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	99.7	-0.3		+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	136.8	-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-232
Request No : Req-2024-1451

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)		(± dB)	
Positive one-half cycle	143.2			
Negative one-half cycle	143.3			
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-232
Request No : Req-2024-1451

Decision Rule for Statements of Conformity

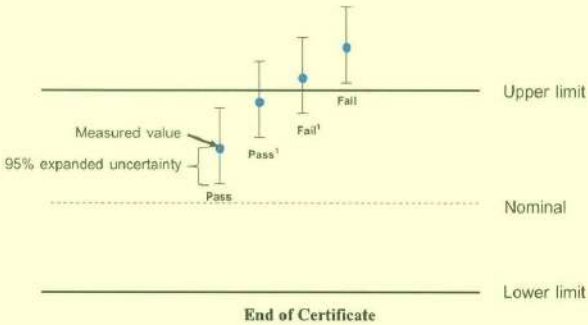
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass¹ – The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ – 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.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 24-SLM-235
Request No : Req-2024-1454

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : Larson Davis
Model : LxT2
Serial Number : 0005346
ID : UAE.EFM.043/2563
Resolution : 0.1 dB

Microphone Class : 2
Microphone Model : 375B02
Microphone S/N : 11798
Preamplifier Model : PRMLxT2B
Preamplifier S/N : 056138
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

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-235
Request No : Req-2024-1454

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 (± dB)
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	31.4	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	31.1	0.10
C	30.5	0.10
Z	35.0	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
FAST / 37-139	A	C	Z			
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.0	0.1	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	1.1	1.1	1.1	0.60	3.0	Pass
8000 Hz	2.6	2.5	2.6	0.70	5.0	Pass



Certificate No : 24-SLM-235
Request No : Req-2024-1454

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	0.1	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	0.1	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.0	0.1	0.0		2.0	Pass
4000 Hz	0.0	-0.1	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
		UUC	ERR		Limit	
FAST / 37-139	REF			(± dB)	(± dB)	
UUC Weighting	(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)			
Fast	114.00	114.0	0.0		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-235
Request No : Req-2024-1454

7. Long Term Stability

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

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)	(± dB)	(± dB)	
STD 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-235
Request No : Req-2024-1454

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	46.40	46.5	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	108.5	-0.5		+1.5, -5.0	Pass
Slow	200	128.6	128.4	-0.2		1.0	Pass
	2	109.0	108.8	-0.2		+1.0, -5.0	Pass
SEL	200	129.0	129.0	0.0		1.0	Pass
	2	109.0	108.8	-0.2		+1.0, -2.5	Pass
	0.25	100.0	99.7	-0.3		+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	136.8	-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-235
Request No : Req-2024-1454

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)	(± dB)	(± dB)	
Positive one-half cycle	145.4			
Negative one-half cycle	145.3			
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-235
Request No : Req-2024-1454

Decision Rule for Statements of Conformity

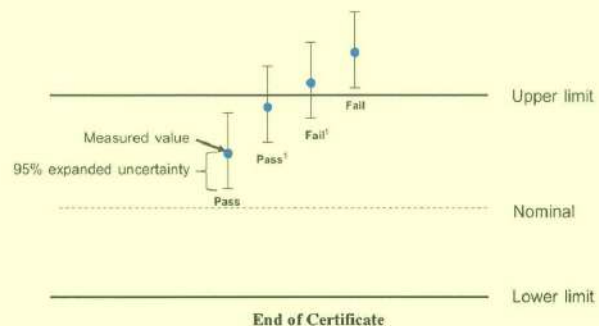
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Passⁱ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Failⁱ = 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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CALIBRATION 0119

Certificate No.: CP20240292EA
Operation No.: CP2024070255

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.: 0005348 (Meter), 11800 (Microphone), 056140 (Preamplifier)
ID No.: UAE.EFM.045/2563
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.: CP20240292EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)
Model/Type: LxT2 (Meter), 375B02 (Microphone), PRMLxT2B (Preamplifier)
Serial No.: 0005348 (Meter), 11800 (Microphone), 056140 (Preamplifier)
ID No.: UAE.EFM.045/2563
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.: CP20240292EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
31.6

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	31.5
C-weighting	31.6
Z-weighting	36.6

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	0.2	0.2	±1.5
1000	-0.2	-0.2	-0.2	±1.0
8000	2.9	2.9	2.9	±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	0.0	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	0.1	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.1	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.1	±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.: CP20240292EA

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
142.0	142.1	0.1	±1.1

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Certificate No.: CP20240292EA

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	42.3	0.3	±1.1
41.0	41.4	0.4	±1.1
40.0	40.5	0.5	±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	136.0	0.0	±1.0
	2	118.8	-0.2	+1.0 ; -2.5
	0.25	109.7	-0.3	+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	100.9	-0.1	+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	134.1	-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		
145.3	145.2	-0.1	±1.5

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Certificate No.: CP20240292EA

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 --

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
โครงการรถไฟฟ้าสายสีเขียว เฉพาะช่วงสะพานใหม่-คูคต									
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Tisch Environmental, Inc.	TE-5025A 3383	Jiranatee Associates Co., Ltd.	COF-039-67	27 Sep 24	26 Sep 25	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	121-36-W/M -	Technology Promotion Association (Thailand-Japan)	25P112	19 Feb 25	18 Feb 26	-
3	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24P1856	4 Jun 24	3 Jun 25	-
4	Digital Thermo - Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	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 1201778107	UAE Consultant Co., Ltd.	26092024	26 Sep 24	25 Sep 25	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778108	UAE Consultant Co., Ltd.	04112024	4 Oct 24	3 Oct 25	-
7	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jun 23	6 Jun 31	-
8	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1200636466	UAE Consultant Co., Ltd.	06122024	6 Dec 24	5 Dec 25	-
9	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201778117	UAE Consultant Co., Ltd.	09092024	9 Sep 24	8 Sep 25	-
10	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jun 23	6 Jun 31	-
11	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DR0041	Thai Meteorological Department	162/25	18 Mar 25	17 Mar 26	-
12	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DR0052	Thai Meteorological Department	112/25	19 Feb 25	18 Feb 26	-

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
โครงการรถไฟฟ้าสายสีเขียว เฉพาะช่วงสะพานใหม่-คูคต									
Ambient									
13	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	-
14	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, $L_{Aeq\ 1\ hr}$, L_{Amax} , L_{A90} , L_{Adn}	Larson Davis	LxT1 0007310	Electrical And Electronics Institute Foundation For Industrial Development	CP20240289EA	5 Aug 24	4 Aug 25	-
15	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, $L_{Aeq\ 1\ hr}$, L_{Amax} , L_{A90} , L_{Adn}	Larson Davis	LxT1 0007312	Electrical And Electronics Institute Foundation For Industrial Development	CP20240288EA	5 Aug 24	4 Aug 25	-

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

CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions
Measurement Condition : The average values during measurement are 23.9 °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 G85/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'

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	Δp_{meter} mmHg	$\Delta p_{Orifice}$ inH ₂ O	γ	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	Δp_{meter} mmHg	$\Delta p_{Orifice}$ inH ₂ O	γ	Standard Flow [Q_s] 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

Calibrated by:

- ☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager





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

Certificate of Calibration

Certificate No. : 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

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

Ambient Temperature: (23 ± 2) °C

81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,

Relative Humidity: (50 ± 15) %

Phrakhanong, Bangkok 10260

Atmospheric Pressure: 1012 mbar

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 inH₂O

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 Prabpaipal

[] 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 inH₂O to 36 inH₂O

Scale Interval: 0.1 inH₂O(The Fifth Estimate)

Applied Pressure (inH ₂ O)	UUC Indication		ΔP (inH ₂ O)	Error (inH ₂ O)
	High-port side (inH ₂ O)	Low-port side (inH ₂ 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 ± 0.11 inH₂O

* 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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL. 0-2717-3000-24 FAX. 0-2719-9484



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

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1006 mbar

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 ± 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.

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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

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

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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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Cert. No.: 24H1487
Page.: 2 of 2

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

Reference Temperature	Standard Humidity	UUC* Reading	Error	Uncertainty of Measurement
(°C)	(%R.H.)	(%R.H.)	(%R.H.)	(±%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	UUC* Reading	Error	Uncertainty of Measurement
(°C)	(°C)	(°C)	(±°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 (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201778107

Standard Gas Concentration

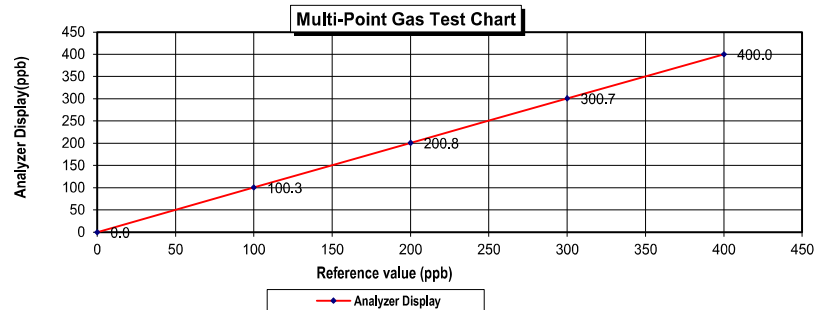
Sulphur Dioxide (SO₂) 42.89 PPM
Nitric Oxide (NO) 46.77 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 965.9
Cylinder No. : EB0159156
Expiration Date : Nov 6, 2026

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	100.3	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



Calculate by

26 / 9 / 2567

Approve by

26 / Sep / 2024

MULTI-POINT GAS TEST REPORT

Test Date : Oct 4, 2024

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201778108

Standard Gas Concentration

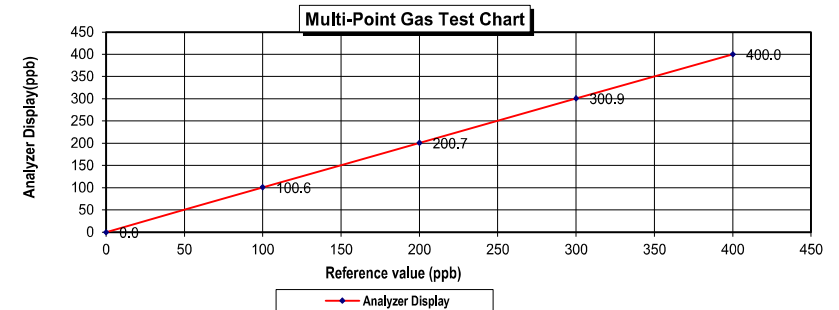
Sulphur Dioxide (SO₂) 42.89 PPM
Nitric Oxide (NO) 46.77 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 965.9
Cylinder No. : EB0159156
Expiration Date : Nov 6, 2026

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	100.6	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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4 / 10 / 2567

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4 / Oct / 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 800/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

Page 1 of 1

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MULTI-POINT GAS TEST REPORT

Test Date : Dec 6, 2024

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1200636466

Standard Gas Concentration

Sulphur Dioxide (SO₂) 42.89 PPM
Nitric Oxide (NO) 46.77 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 965.9 PPM
Cylinder No. : EB01159156
Expiration Date : Nov 06, 2026

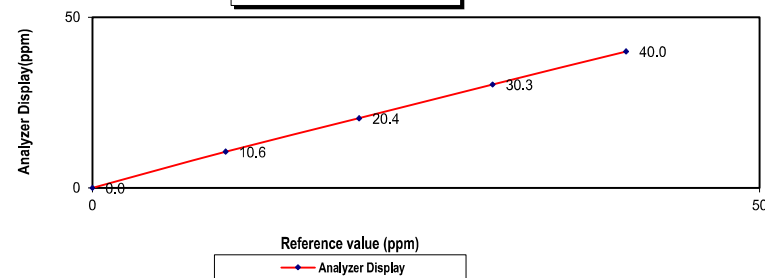
Dilutor Detail

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	10.6	0.6	5.7	5.7
Level 3	40.00%	20.0	20.4	0.4	2.0	2.0
Level 4	60.00%	30.0	30.3	0.3	1.0	1.0
Level 5	80.00%	40.0	40.0	0.0	0.0	0.0
Remark : Measuring Range		50.0 ppm	Average Difference (%)			1.72

Multi-Point Gas Test Chart



Calculate by
.....6...../.....12...../.....2567..

Approve by
.....6...../.....Dec...../.....2024..

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MULTI-POINT GAS TEST REPORT

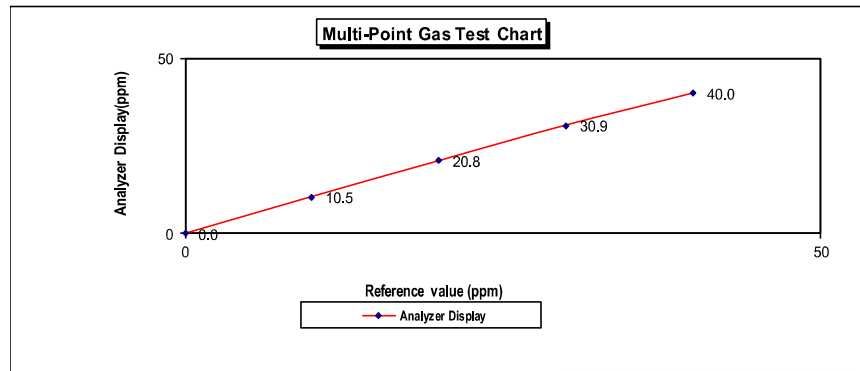
Test Date : Sep 9, 2024

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

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	42.89	PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO)	46.77	PPM	Model : 146i
Methane (CH ₄)	-	PPM	Serial Number : 1180540071
Carbon Monoxide (CO)	965.9	PPM	
Cylinder No. :	EB01159156		
Expiration Date :	Nov 06, 2026		

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



Calculate by

9 / 9 2567

Approve by

9 / Sep 2024

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 18 March, 2025

Certification No. 162/25

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2111DR0041

Wind Sensor 2111DT0041

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 : Vane Angel Bench Stand Model 18112

: 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. 44320001

Calibrated by : Watchapol

Signed :

Mr. Watcharapol Subwat

Mr. Pisood Promsut

Mechanical Engineer

(Authorized Signatory)

for the Chief

Sub-Standard Instrument



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 162/25

18 March, 2025

Page : 2 of 5

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
	m/sec	inches H ₂ O	inches H ₂ 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	-	-	-	8.9	0.12
11.02	-	-	-	11.0	0.02
13.01	-	-	-	12.9	0.11
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 :

Watchapol

Mr. Watchapol 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. 162/25

18 March, 2025

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
756.93	757	-0.07
757.10	757	0.10
757.31	757	0.31
757.72	758	-0.28
757.36	757	0.36
757.81	758	-0.19
758.54	759	-0.46
758.43	758	0.43
754.71	755	-0.29
754.82	755	-0.18
754.88	755	-0.12
755.57	756	-0.43
755.68	756	-0.32
755.99	756	-0.01
757.23	757	0.23
756.06	756	0.06
756.99	757	-0.01
758.09	758	0.09
755.94	756	-0.06
757.19	757	0.19

Average

-0.03

Calibrated by :

Watchapol

Mr. Watchapol 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. 162/25

18 March, 2025

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1009.16	1010	-0.84
1009.39	1009	0.39
1009.66	1009	0.66
1010.21	1010	0.21
1009.73	1010	-0.27
1010.33	1010	0.33
1011.31	1011	0.31
1011.16	1011	0.16
1006.20	1006	0.20
1006.34	1006	0.34
1006.43	1006	0.43
1007.35	1007	0.35
1007.49	1007	0.49
1007.91	1008	-0.09
1009.56	1009	0.56
1008.00	1008	0.00
1009.24	1009	0.24
1010.71	1011	-0.29
1007.84	1008	-0.16
1009.51	1009	0.51

Average

0.19

Calibrated by :

Watchapol

Mr. Watchapol 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. 162/25

18 March, 2025

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.3	45	0.3
30.4	30	0.4
15.4	15	0.4

Calibrated by :

Watchapol

Mr. Watchapol 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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 19 February, 2025

Certification No. 112/25

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2111DR0052

Wind Sensor 2111DT0052

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 1012.3 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 :

Mr. Watchapol Subwat

Signed :

Mr. Pisood Promsut

(Authorised Signatory)

for the Chief

Sub-Standard Instrument

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. 112/25

19 February, 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. Watchapol 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. 112/25

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	1011	-0.57
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	1010	0.57
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 :

Watchapol

Mr. Watchapol 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. 112/25

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	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

0.09

Calibrated by :

Watchapol

Mr. Watchapol 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. 112/25

19 February, 2025

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.5	46	-0.5
30.4	30	0.4
15.6	15	0.6

Calibrated by :

Handwritten signature

Mr. Watcharapol Subwat

Mechanical Engineer



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: 06610-2116-5860-1 FAX: 06610-2116-7140



Page 1 of 3

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING

Certificate No : 24-ACT-087

CONSULTANT CO.,LTD.

Request No : Req-2024-1365

Address : 81 Soi Udomsuk 41, Sukhumvit Road, BANGCHAK,

Prakanong, Bangkok 10260

Unit Under Calibration Details

Measurement item : Acoustic Calibrator

Class : 1

Manufacturer : 01dB

Range : 94 dB / 1000 Hz

Model : CAL31

Instrument Status : Used

Serial Number : 84065

ID : UAE.EFM.167/2561

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 :

Handwritten signature

Mr. Noppadon Luangart

Service Calibration Engineer

Approved By :

Handwritten signature

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.

เอกสารไม่ควบคุม

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 (± dB)	Acceptance limit Class 1 (± 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 (± %)	Acceptance limit Class 1 (± %)	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 (± %)	Acceptance limit Class 1 (± %)	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

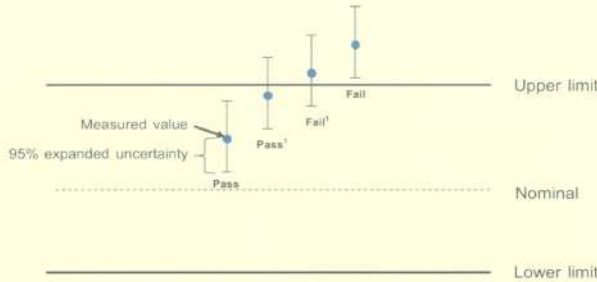
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09:2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ = 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



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

975 Moo 4, Bangpoo Industrial Estate, Soi 8, Sukhumvit Road km 37,

Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

Tel: +66 2709 4860 Fax: +66 2324 0917



Certificate No.: CP20240289EA

Operation No.: CP2024070252

Certificate of Calibration

Equipment: Sound Level Meter

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

Model/Type: LxT1 (Meter), 377B02 (Microphone), PRMLxT1 (Preamplifier)

Serial No.: 0007310 (Meter), 345240 (Microphone), 077645 (Preamplifier)

ID No.: UAE.EFM.042/2566

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.: CP20240289EA

Calibration Report

Equipment: Sound Level Meter

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

Model/Type: LxT1 (Meter), 377B02 (Microphone), PRMLxT1 (Preamplifier)

Serial No.: 0007310 (Meter), 345240 (Microphone), 077645 (Preamplifier)

ID No.: UAE.EFM.042/2566

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.: CP20240289EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
30.3

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	30.1
C-weighting	30.0
Z-weighting	35.7

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	0.2	0.3	±1.0
1000	0.2	0.2	0.2	±0.7
8000	-0.2	-0.1	-0.1	+1.5; -2.5

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Certificate No.: CP20240289EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Function : 6. Long-Term Stability

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

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

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
99.0	99.0	0.0	±0.8
104.0	104.0	0.0	±0.8
109.0	109.0	0.0	±0.8
114.0	114.0	0.0	±0.8
119.0	119.0	0.0	±0.8
124.0	124.0	0.0	±0.8
129.0	129.0	0.0	±0.8
134.0	134.0	0.0	±0.8
139.0	139.0	0.0	±0.8
140.0	140.0	0.0	±0.8
141.0	141.0	0.0	±0.8

Certificate No.: CP20240289EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.1	0.1	±0.8
39.0	39.4	0.4	±0.8

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	135.9	-0.1	±0.5
	2	118.8	-0.2	+1.0 ; -1.5
	0.25	109.8	-0.2	+1.0 ; -3.0
Slow	200	129.5	-0.1	±0.5
	2	109.9	-0.1	+1.0 ; -3.0
LAE	200	130.0	0.0	±0.5
	2	110.0	0.0	+1.0 ; -1.5
	0.25	100.9	-0.1	+1.0 ; -3.0

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	135.4	134.8	-0.6	±2.0
Positive half cycle	134.4	134.0	-0.4	±1.0
Negative half cycle	134.4	134.0	-0.4	±1.0

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Certificate No.: CP20240289EA

Calibration Report

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
144.3	144.2	-0.1	±1.5

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	±0.1

Uncertainty of measurement

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

Remarks:

1. 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 1.
4. The coverage factor $k = 2.00$

-- End of Report --

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ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

Tel: +66 2709 4860 Fax: +66 2324 0917



Certificate No.: CP20240288EA

Operation No.: CP2024070251

Certificate of Calibration

Equipment: Sound Level Meter

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

Model/Type: LxT1 (Meter), 377B02 (Microphone), PRMLxT1 (Preamplifier)

Serial No.: 0007312 (Meter), 345818 (Microphone), 077647 (Preamplifier)

ID No.: UAE.EFM.044/2566

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

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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.: CP20240288EA

Calibration Report

Equipment: Sound Level Meter

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

Model/Type: LxT1 (Meter), 377B02 (Microphone), PRMLxT1 (Preamplifier)

Serial No.: 0007312 (Meter), 345818 (Microphone), 077647 (Preamplifier)

ID No.: UAE.EFM.044/2566

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.: CP20240288EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
28.5

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	28.4
C-weighting	28.3
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	0.2	0.1	0.1	±1.0
1000	0.0	0.0	0.0	±0.7
8000	-0.9	-0.9	-0.8	+1.5; -2.5

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Certificate No.: CP20240288EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Function : 6. Long-Term Stability

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

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

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
99.0	99.0	0.0	±0.8
104.0	104.0	0.0	±0.8
109.0	109.0	0.0	±0.8
114.0	114.0	0.0	±0.8
119.0	119.0	0.0	±0.8
124.0	124.0	0.0	±0.8
129.0	129.0	0.0	±0.8
134.0	134.0	0.0	±0.8
139.0	139.0	0.0	±0.8

Certificate No.: CP20240288EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.1	0.1	±0.8
39.0	39.3	0.3	±0.8

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	136.0	0.0	±0.5
	2	118.8	-0.2	+1.0 ; -1.5
	0.25	109.7	-0.3	+1.0 ; -3.0
Slow	200	129.5	-0.1	±0.5
	2	109.9	-0.1	+1.0 ; -3.0
LAE	200	130.0	0.0	±0.5
	2	110.0	0.0	+1.0 ; -1.5
	0.25	100.9	-0.1	+1.0 ; -3.0

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	135.4	134.8	-0.6	±2.0
Positive half cycle	134.4	134.0	-0.4	±1.0
Negative half cycle	134.4	134.0	-0.4	±1.0

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Certificate No.: CP20240288EA

Calibration Report

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
142.4	142.3	-0.1	±1.5

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	±0.1

Uncertainty of measurement

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

Remarks:

1. 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 1.
4. The coverage factor $k = 2.00$

-- End of Report --

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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 Air Quality Analysis									
1	Analytical Balance (Readability 0.1 mg)	ฝุ่นละอองรวม (TSP) ฝุ่นละอองขนาดไม่เกิน 10 ไมครอน (PM10)	Mettler-Toledo	MS204TS/00 C252436235	National Food Institute, Ministry of Industry, Thailand	2502228-003-01	19 Mar 25	18 Mar 26	-
2	Analytical Balance (Readability 0.001 mg)	ฝุ่นละอองขนาดไม่เกิน 2.5 ไมครอน (PM2.5)	Mettler-Toledo	XP6 / B322373893	National Food Institute, Ministry of Industry, Thailand	2502228-002-01	20 Mar 25	19 Mar 26	-
Equipment for Water Quality Analysis									
3	pH Meter	pH	Mettler-Toledo	SevenCompact S220/ C113432421	National Food Institute, Ministry of Industry, Thailand	2403175-001-01	25 Jun 24	24 Jun 25	-
4	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	-
5	Hot Air Oven		Memmert	UF55 / B216.1666	National Food Institute, Ministry of Industry, Thailand	2500116-001-01	8 Oct 24	7 Oct 25	-
6	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	-
7	BOD Incubator	BOD	Arco	UC4-1320 / (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	25TM205	8 Feb 25	8 Feb 26	-
8	DO Meter		YSI	5100 / 11B101863	Technology Promotion Association (Thailand-Japan)	25TW29	17 Feb 25	16 Feb 26	-
9	Incubator	Total Coliform Bacteria	Memmert	IPP 260 / V618.0033	National Food Institute, Ministry of Industry, Thailand	2502229 003 01	19 Mar 25	18 Mar 26	-
10	Water Bath		Memmert	WNE 14 / L416.0606	National Food Institute, Ministry of Industry, Thailand	25051624-001-01	10 Feb 25	9 Feb 26	-
11	Auto Clave		ALP	CL-40L / 808763	National Food Institute, Ministry of Industry, Thailand	2502229 007 01	19 Mar 25	18 Mar 26	-

List Certificate of Instrument for Environmental Quality Analysis.

No.	Instrument/Equipment	Parameter	Manufacturer	Mode/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
12	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 
 (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.: 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	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:

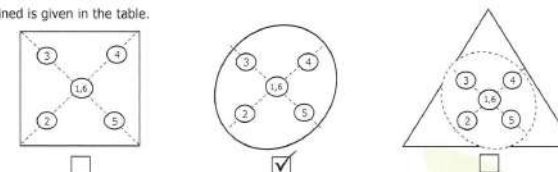
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
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



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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 k
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.: 2502228-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XP6

Serial No.: B322373893

ID No.: UAE.AIR.019/2556


Order No.: 2502228

Operation No.: 2502228-002

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.: 2502228-002-01
Equipment: Electronic Balance
Model: XP6
Serial No.: B322373893
Capacity: 6.1 g
Manufacturer: METTLER TOLEDO
Resolution: 0.000001 g
ID No.: UAE.AIR.019/2556

Date of Calibration: 20 March 2025 Page 2 of 3

Environment Condition: Ambient Temperature: 22.8 ± 0.4 °C Relative Humidity: 48 ± 0.95 %

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	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:

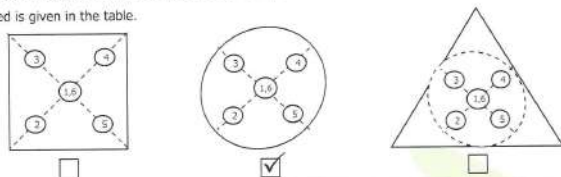
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
3	0.00000079
6	0.00000067

2. Off-Center Error:

A mass of 2 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)
2.000018	2.000017	2.000014	2.000014	2.000024	2.000019	0.000006

for N. Vinyachit

Calibration Report

Certificate No.: 2502228-002-01
Equipment: Electronic Balance
Model: XP6
Serial No.: B322373893
Capacity: 6.1 g
Manufacturer: METTLER TOLEDO
Resolution: 0.000001 g
ID No.: UAE.AIR.019/2556

Date of Calibration: 20 March 2025 Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-6 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	0.0000000	0.000000	0.000000	0.0000032	2.00
0.001	0.0010030	0.001002	0.000001	0.0000032	2.00
0.01	0.0100030	0.010003	0.000000	0.0000034	2.00
0.05	0.0499960	0.050001	-0.000005	0.0000044	2.00
0.10	0.1000110	0.100011	0.000000	0.0000057	2.00
0.15	0.1500070	0.150010	-0.000003	0.0000071	2.00
0.17	0.1700130	0.170012	0.000001	0.0000077	2.00
0.20	0.2000110	0.200015	-0.000004	0.0000065	2.00
1.50	1.5000190	1.500017	0.000002	0.000019	2.00
3.00	3.0000260	3.000017	0.000009	0.000019	2.00
4.50	4.5000610	4.500023	0.000038	0.000023	2.00
6.00	6.0000180	6.000014	0.000004	0.000023	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 -----

for N. Vinyachit

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

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

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.Nuttapol 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



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	NFIBTH 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 Ng.2.1	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0008
3.2 Instruments Ng.2.2	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061
3.3 Instruments Ng.2.3	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0292
3.4 Certified Reference Material Ng.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 Ng.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

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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 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. ingubant

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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. niphobant

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



Calibration Certificate

Certificate No.: 2502226-002-01
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: 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 *N. niphobant*
 (Mr.Pheraphat Tuanjit)

Manager, Division of Calibration Laboratory

Date of Issue: 25 March 2025

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

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	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:

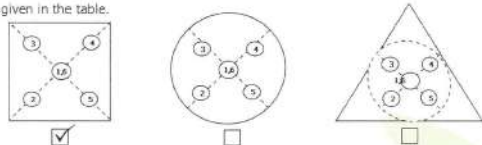
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.0000042
80	0.0000042
100	0.0000000
200	0.0000000

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

for N. Nigrodast

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



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Calibration Report

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

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

for N. Nigrodast

F:CS-012 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 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 -----

for N. myobut

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



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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, Prakhnong, 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



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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.
- 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 ☒
☒ Close Fan 40%
☒ Not Available

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

F-CS-012 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 3 of 3

Calibration point: 104.0,140.0 and 180.0 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	29.3	54	227.0
MAX	31.2	56	232.0

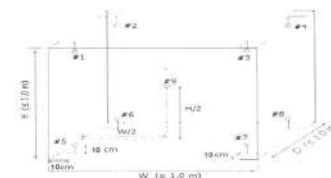


Table1 : Reporting of Temperature

Calibration point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
104.0	103.89	103.66	103.88	103.89	104.40	103.98	103.70	104.10	104.15	0.53
140.0	139.85	139.53	139.87	139.88	140.67	140.00	139.60	140.25	140.23	0.73
180.0	179.63	179.22	179.71	179.76	181.03	180.06	179.41	180.87	180.39	0.90

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
104.0	104.0	104.0	104.0	0.15	0.49	0.88
140.0	140.0	140.0	140.0	0.13	0.71	1.2
180.0	180.0	180.0	180.0	0.13	1.2	1.9

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

Certificate of Calibration

Certificate No.: 250422-1-BL002-25

Code No.: BL002-25

Page: 1 of 3

Customer Name: United Analyst and Engineering Consultant Co., Ltd.
Address: 3 Soi Udom suk 41, Sukhumvit Rd., Bang Chak, Phar Khanong, Bangkok 10260

Equipment: Electronic Balance

Manufacturer: Mettler Toledo

Model: AB204-S/FACT

Serial No.: 1129361010

Asset No.: UAE.WAS.002/2552

Building : N/A **Floor :** 1 **Room :** 107

Received Date: April 22, 2025

Date of Calibration : April 23, 2025

Calibration Conditions: Temperature 22.8 °C to 23.4 °C
Humidity 54.8 % to 68.9 %
Pressure 756.6 mmHg to 758.2 mmHg

Calibrated by: Sakkarin Srirahang

Approved by: Suwit Chotnok

Signature: 

Issued Date: April 25, 2025

Note : 1) The Uncertainties are for a confidence probability of approximately 95%

2) This Certificate is valid only to the item calibrated on date and place of calibration.

3) 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 United Analyst and Engineering Consultant Co.,Ltd. (UAE)

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Certificate No.: 250422-1-BL002-25

Code No.: BL002-25

Page: 2 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 indrument we calibrated

5. This result of calibration wae found accurate as show on date and place of calibration only.

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

Calibron Result:

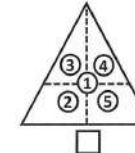
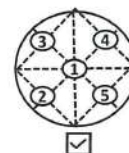
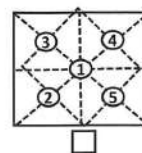
1. **Repeatability of Reading:**

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 position on 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

เอกสารไม่ควบคุม

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

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%.

o--o-End-o--o

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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 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Krisda Malee

Approved by :

Kunchit

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.

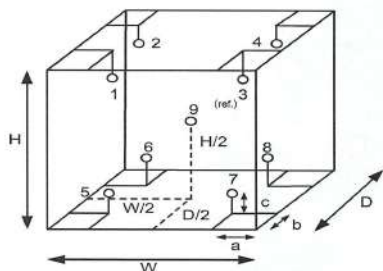
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



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 m³

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

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



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

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

Result of Calibration :-

(*) Without Adjustment

Function of UUC* :

Temperature Source

Fresh air setting :

Not Available

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
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 %.

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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

เอกสารไม่ควบคุม



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

Condition of this result of calibration

1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	24MM131	04 July 2025

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate 5-Hydrate AR	KEMAUS	2203162447	99.6%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 24F100202

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.22	8.22	0.0055

This report was certified only for the instrument we tested. It is allowable to use for study
Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced
other in full, without written approval of the laboratory

-o0o-

เอกสารไม่ควบคุม

ใบพิมพ์ผลการตรวจสอบใบรับรองการสอบเทียบ (Verification of Certificate)							
Certificate No. : 25TW29				Equipment : Do Meter			
Brand : YSI				Model : 5100			
Serial No. : 118 101863				ID No. : UAE.WAO.004/Z554			
Calibration results							
Titration Method	Standard Deviation (mg/L)	Do meter Reading (mg/L)	Error% (mg/L)	Correction% (mg/L)	Error Total Error (mg/L)	Judgement (± mg/L)	(Total Error < Judgement) (mg/L)
	8.22	0.0055	8.22	0.0000	0.0000	0.02	pass
ผู้ปฏิบัติงาน: อิศรา ใหญ่ประกอบ				ผู้ตรวจสอบ: อรุณรัตน์			
วันที่: 28/02/2025				วันที่: 28.02.25			
หมายเหตุ:							

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

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



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

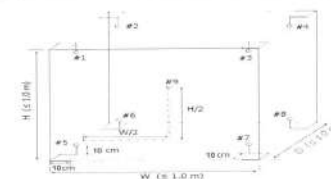


Table 1 : Reporting of Temperature

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 -----



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. Jengphatit*
(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



Uncontrolled Documents

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

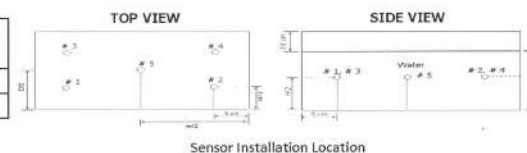


Table 1 : Reporting of Temperature

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



Uncontrolled Documents

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:

1. 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			

3. This certificate is traceable to International System of Units (SI Units).
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.
6. Condition of Calibrated item : Good

UUC Description:

Time of Record 1 Hour 9 Minute At 44.5 °C

- | | | |
|----------------------------|---|--------------------|
| 7. Result of Calibration : | X | Without adjustment |
| | | After adjustment |

A. Grenzhanke
19 Feb. 2025



Calibration Certificate

Certificate No.: 2502229-007-01
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:	Autoclave
Manufacturer:	ALP
Model:	CL-40L
Serial No.:	808763
ID No.:	UAE.MIC.026/2563
Order No.:	2502229
Operation No.:	2502229-007
Date of Receipt:	19 March 2025
Date of Calibration:	19 March 2025

Calibrated by Mr.Jerawut Prapawuttipong
Scientist

Approved by

(Mr.Pheraphat Tuanjit) (for)

Manager, Division of Calibration Laboratory

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.



Calibration Report

Certificate No.:	2502229-007-01		
Equipment:	Autoclave		
	Model:	CL-40L	Serial No.: 808763
	Resolution:	0.1 °C	ID No.: UAE.MIC.026/2563
	Manufacturer:	ALP	
Date of Calibration:	19 March 2025		

Page 2 of 3

Location: LABORATORY, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Environment Condition: Ambient Temperature (23 ± 1) °C
Relative Humidity (60 ± 5) %
Line Voltage (225 ± 1) Volt

Condition of this results of Calibration:

1. This instrument was calibrated by insert 3 standard Data loggers with RTD into its autoclave and calibration according to W-TE-018 based on BS 2646-1:2021, Autoclaves for sterilization in laboratories Part 1: Design, construction, safety and performance - Specification.
- 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.

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with RTD (Data Logger)	HiTemp140-PT	S35646	TE 670370-01	23-Mar-25	NATIONAL FOOD INSTITUTE
	HiTemp140-PT	S33753	TE 670371-01	23-Mar-25	NATIONAL FOOD INSTITUTE
	HiTemp140-PT	S29973	TE 670372-01	23-Mar-25	NATIONAL FOOD INSTITUTE

3. This certificate is traceable to International System of Units (SI Units).
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.
6. This standard does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical.
7. Condition of Calibrated item : Good

UUC Description : Setting program function sterilization : STERILIZE/NORMAL

Time of sterilization 15 Minute At 115.0 aand 121.0 °C

- | | | |
|----------------------------|---|--------------------|
| 8. Result of Calibration : | X | Without adjustment |
| | | After adjustment |

P. Joenghanlit
25 March 2025



Calibration Report

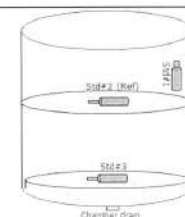
Certificate No.:	2502229-007-01		
Equipment:	Autoclave		
	Model:	CL-40L	Serial No.: 808763
	Resolution:	0.1 °C	ID No.: UAE.MIC.026/2563
	Manufacturer:	ALP	
Date of Calibration:	19 March 2025		

Page 3 of 3

Calibration point: 115.0 and 121.0 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	22.0	55	224
Max	24.0	65	226



Standaid at Poston

Std#1 = Attached to the load temperature probe within 20 mm.
Std#2 = In the upper half of the chamber
Std#3 = In the chamber drain, within 100 mm.

Table1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.2 is REF)			Uncertainty ± (°C)
	Std.# 1	Std.# 2 (Ref)	Std.# 3	
115.0	115.32	115.46	115.22	0.64
121.0	121.31	121.53	121.31	0.64

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading				Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	Min (°C)	Max (°C)	Average (°C)	MPa			
115.0	115.0	115.1	115.0	0.08	0.11	0.12	0.26
121.0	121.0	121.1	121.0	0.12	0.13	0.15	0.29

Note

The quoted uncertainty include " Stability " and " Loading effect (20% of 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 -----



Calibration Certificate

Certificate No.: 2502227-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangchack, Prakanong, Bangkok 10260

Page 1 of 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 
 (Mr.Pheraphat Tuanjit)

Manager, Division of Calibration Laboratory

Date of Issue: 25 March 2025

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

2008 อาคารศูนย์บริการ 36 ถนนสุขุมวิท แขวงคลองเตย เขตวัฒนา กรุงเทพมหานคร 101700

2008 Soi 36, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 101700

Tel: +66(0) 2422 8688 Fax: +66(0) 2422 8545



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

2008 อาคารศูนย์บริการ 36 ถนนสุขุมวิท แขวงคลองเตย เขตวัฒนา กรุงเทพมหานคร 101700

2008 Soi 36, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 101700

Tel: +66(0) 2422 8688 Fax: +66(0) 2422 8545



Calibration Report

Certificate No.: 2502227-001-01

Equipment:

Electronic Balance

Manufacturer: OHAUS

Model: PX623

Resolution: 0.001

Serial No.: C236754745

ID No.: UAE.MIC.055/2565

Capacity: 620

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:

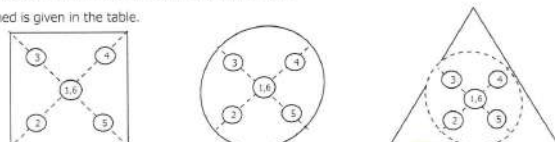
1. Repeatability of Reading:

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	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
200.002	200.003	200.001	200.001	200.002	200.002	0.001

for N. Mueksat

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

2008 ต.บางขุนนนท์ 36 ถนนบางขุนนนท์ แขวงบางขุนนนท์ เขตบางกอกใหญ่ กรุงเทพมหานคร 10700

2008 Soi 36, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700

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