

ภาคผนวก ง

เอกสารสอบเทียบเครื่องมือ

ภาคผนวก ง-1

เอกสารสอบเทียบเครื่องมือเก็บตัวอย่างและวิเคราะห์
คุณภาพอากาศ ระดับเสียง และความสั่นสะเทือน

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Tisch Environmental, Inc.	TE-5025A 3393	Jiranatee Associates Co., Ltd.	COF-041-68	30 Sep 25	29 Sep 26	-
2	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Thermo Scientific	G25A 1270	Jiranatee Associates Co., Ltd.	COF-024-68	26 Jun 25	25 Jun 26	-
3	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	25P1541	24 Apr 25	23 Apr 26	-
4	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	25P3505	9 Sep 25	8 Sep 26	-
5	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	25P1379	17 Apr 25	16 Apr 26	-
6	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	26P876	27 Feb 26	26 Feb 27	-
7	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	25H807	10 Apr 25	9 Apr 26	-
8	Digital Thermo - Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Digicon	TH-02A 435031145	Technology Promotion Association (Thailand-Japan)	25H1369	8 Jul 25	7 Jul 26	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920009	UAE Consultant Co., Ltd.	07052025	7 May 25	6 May 26	-
10	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM22387037	UAE Consultant Co., Ltd.	02052025	20 Feb 26	19 Feb 27	-
11	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778106	UAE Consultant Co., Ltd.	12052025	12 May 25	11 May 26	-
12	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM22387039	UAE Consultant Co., Ltd.	24022026	24 Feb 26	23 Feb 27	-
13	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1200636463	UAE Consultant Co., Ltd.	12052025	12 May 25	11 May 26	-
14	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-67174-356	UAE Consultant Co., Ltd.	27022026	17 Feb 26	16 Feb 27	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
15	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jul 23	6 Jul 31	-
16	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jul 23	6 Jul 31	-
17	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201778117	UAE Consultant Co.,Ltd.	11072025	11 Jul 25	10 Jul 26	-
18	Carbon Monoxide Analyzer	Carbon Monoxide	Horiba	APMA-370 YRLHTB7G	UAE Consultant Co.,Ltd.	11072025	11 Jul 25	10 Jul 26	-
19	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201778118	UAE Consultant Co.,Ltd.	29072025	29 Jul 25	28 Jul 26	-
20	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48C 48C-65506-348	UAE Consultant Co.,Ltd.	24072025	24 Jul 25	23 Jul 26	-
21	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201778119	UAE Consultant Co.,Ltd.	24072025	24 Jul 25	23 Jul 26	-
22	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1182920018	UAE Consultant Co.,Ltd.	24072025	24 Jul 25	23 Jul 26	-
23	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jul 23	6 Jul 31	-
24	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jul 23	6 Jul 31	-
25	Wind Speed/Wind Direction	WS/WD	LSI Lastem	E-LOG 305 / DNA 827 19040403 / 19050233	Thai Meteorological Department	304/25	28 Apr 25	27 Apr 26	-
26	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2311DR0037	Thai Meteorological Department	034/26	20 Jan 26	19 Jan 27	-
27	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	E-LOG 305 / DNA 827 20020300 / 20010094	Thai Meteorological Department	305/25	28 Apr 25	27 Apr 26	-
28	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0008	Thai Meteorological Department	130/26	2 Mar 26	1 Mar 27	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
29	Wind Speed/Wind Direction	WS/WD	LSI Lastem	E-LOG 305 / DNA 827 20020298 / 20010094	Thai Meteorological Department	306/25	28 Apr 25	27 Apr 26	-
30	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0105	Thai Meteorological Department	133/26	2 Mar 26	1 Mar 27	-
31	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12394	Calibration Laboratory Co.Ltd	Q25070066	18 Jun 25	17 Jun 26	-
32	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM14464	Calibration Laboratory Co.Ltd	Q25084759	19 Jul 25	18 Jul 26	-
33	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6171	Innovative Instrument Co.,Ltd.	25-ACT-080	29 May 25	28 May 26	-
34	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6695	Innovative Instrument Co.,Ltd.	25-ACT-135	9 Sep 25	8 Sep 26	-
35	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, $L_{Aeq\ 1\ hr}$, L_{Amax} , L_{A90} , L_{Adn}	Larson Davis	LxT2 0005298	Electrical And Electronics Institute Foundation For Industrial Development	CP20240341EA	23 Sep 24	22 Sep 26	-
36	Sound Level Meter	$L_{Aeq\ 24hrs}$, L_{A90} , L_{Adn} , L_{Amax}	Larson Davis	LxT2 0005341	Innovative Instrument Co.,Ltd.	25-SLM-339	9 Oct 25	8 Oct 26	-

CERTIFICATE OF CALIBRATION

Certificate No. : COF-041-68

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : TISCH
MODEL/TYPE : TE-5025A
SERIAL NUMBER : 3393
ID NUMBER : UAE.EFM.064/2560
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 : 29 Aug 2025
MEASUREMENT DATE : 30 Sep 2025
ISSUE DATE : 30 Sep 2025

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

Traceability:
This certificate provides a traceability of the measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0016-25.

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"

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 23.0 °C and 49.8 %RH.

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☒ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

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	$\Delta p_{\text{Orifice}}$ inH ₂ O	γ	Standard Flow [Q_s] m^3/min
1	0.697	756.886	23.24	22.61	55.851	1.699	1.305	0.648
2	0.994	756.950	23.77	23.29	60.934	3.434	1.853	0.916
3	1.116	756.988	23.90	23.42	42.205	4.570	2.137	1.055
4	1.171	756.994	23.96	23.44	31.000	5.189	2.277	1.124
5	1.421	756.980	24.08	23.56	30.617	7.685	2.771	1.364

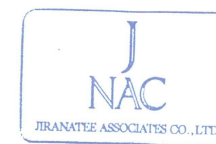
Slope (m): 2.04684
Intercept (b): -0.02236
Correlation coefficient (r): 0.99989
Uncertainty ($k=2$): 0.015 m^3/min

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	$\Delta p_{\text{Orifice}}$ inH ₂ O	γ	Standard Flow [Q_s] m^3/min
1	0.697	756.886	23.24	22.61	55.851	1.699	0.816	0.647
2	0.994	756.950	23.77	23.29	60.934	3.434	1.161	0.916
3	1.116	756.988	23.90	23.42	42.205	4.570	1.339	1.055
4	1.171	756.994	23.96	23.44	31.000	5.189	1.427	1.125
5	1.421	756.980	24.08	23.56	30.617	7.685	1.737	1.365

Slope (m): 1.28197
Intercept (b): -0.01396
Correlation coefficient (r): 0.99989
Uncertainty ($k=2$): 0.015 m^3/min

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No. : COF-024-68

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS-RECEIVED
CUSTOMER

: Top Load Orifice
: Andersen Instruments
: G25A
: 1270
: UAE.ANV.009/2542
: Used item
: United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong,
Bangkok 10260

Calibration procedure:

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

Traceability:

This certificate provides a traceability of the measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0016-25.

Uncertainty of Measurement:

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

RECEIVED DATE : 18 Jun 2025
MEASUREMENT DATE : 26 Jun 2025
ISSUE DATE : 26 Jun 2025

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 22.9 °C and 53.4 %RH.

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☐ Mr. Sorawit Thachalad
☒ Miss Jittrarn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

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

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	754.416	23.21	22.61	47.031	1.691	1.299	0.660
2	1.002	754.401	23.74	23.07	52.009	3.402	1.842	0.932
3	1.118	754.433	23.82	23.28	35.470	4.453	2.107	1.064
4	1.169	754.534	23.79	23.25	26.488	4.991	2.230	1.126
5	1.411	754.354	23.68	23.02	26.272	7.325	2.702	1.360

Slope (m): 2.00231
Intercept (b): -0.02296
Correlation coefficient (r): 0.99986
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	754.416	23.21	22.61	47.031	1.691	0.815	0.661
2	1.002	754.401	23.74	23.07	52.009	3.402	1.157	0.935
3	1.118	754.433	23.82	23.28	35.470	4.453	1.324	1.067
4	1.169	754.534	23.79	23.25	26.488	4.991	1.401	1.130
5	1.411	754.354	23.68	23.02	26.272	7.325	1.698	1.364

Slope (m): 1.25409
Intercept (b): -0.01439
Correlation coefficient (r): 0.99986
Uncertainty ($k=2$): 0.015 m^3/min

End of Certificate of Calibration



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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. : 25P1541

Page : 1 of 2

Equipment : U Tube Manometer

Manufacturer: Dwyer

Model : 1221-36-W/M

Serial No.: -

ID No.: UAE.EFM.077/2566

Condition As-Received: Used Item

Received Date: 04 April 2025

Calibration Date: 24 April 2025

Reference: 2504-0192WSC

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

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1005 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 calibration procedure CP-P04, using " DKD-R 6-1 ; Calibration of Pressure Gauges " as
a guidelines.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-0218-24	24 Sep 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 calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.

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

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

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

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

Calibrated by : Suksan Khankaew
Issue Date : 28 April 2025

Approved Signatory : _____

[] Phalinee Prabpaipal

[] Sura Suwannasri

[✓] Attapol Panurach

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Cert.No.: 25P1541

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 Second Estimate)

Applied Pressure	High-port side	UUC Indication		ΔP	Error
		Low-port side			
0.00	0.00	0.00		0.00	0.00
2.05	1.00	-1.00		2.00	-0.05
4.06	2.00	-2.00		4.00	-0.05
6.05	3.00	-3.00		6.00	-0.05
8.03	4.00	-4.00		8.00	-0.03
9.98	5.00	-5.00		10.00	0.02
11.97	6.00	-6.00		12.00	0.03
13.97	7.00	-7.00		14.00	0.03
15.96	8.00	-8.00		16.00	0.04
17.95	9.00	-9.00		18.00	0.05
19.93	10.00	-10.00		20.00	0.07
21.93	11.00	-11.00		22.00	0.07
23.89	12.00	-12.00		24.00	0.11
25.89	13.00	-13.00		26.00	0.11
27.85	14.00	-14.00		28.00	0.15
29.85	15.00	-15.00		30.00	0.15
31.85	16.00	-16.00		32.00	0.15
33.85	17.00	-17.00		34.00	0.15
35.85	18.00	-18.00		36.00	0.15

The uncertainty of measurement was ± 0.11 inH₂O

* ΔP = High-port side - Low-port side

* UUC = Unit Under Calibration

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

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TEL. 0-2717-3000-24 FAX. 0-2719-9484

Certificate of Calibration

Certificate No. : 25P3505
Page : 1 of 2

Equipment : U-Tube Manometer
Manufacturer: Dwyer
Model : 1221-36-W/M
Serial No.: -
ID No.: UAE.EFM.020/2560

Condition As-Received: Used Item
Received Date: 03 September 2025
Calibration Date: 09 September 2025

Reference: 2509-0144WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1010 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 calibration procedure CP-P04, using " DKD-R 6-1 ; Calibration of Pressure Gauges " as a guidelines.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-0218-24	24 Sep 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 calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.

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

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

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

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

Calibrated by : Suksan Khankaew
Issue Date : 10 September 2025

Approved Signatory : _____

[] Phalinee Prabpaipal

[] Sura Suwannasri

[✓] Attapol Panurach

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Cert.No.: 25P3505
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 Second Estimate)

Applied Pressure	High-port side	UUC Indication		ΔP	Error
		Low-port side			
0.00	0.00	0.00		0.00	0.00
2.00	0.95	-1.05		2.00	0.00
4.00	1.95	-2.05		4.00	0.00
6.00	2.95	-3.05		6.00	0.00
8.00	3.95	-4.05		8.00	0.00
10.00	4.95	-5.05		10.00	0.00
12.00	5.95	-6.05		12.00	0.00
14.00	7.00	-7.05		14.05	0.05
16.00	8.00	-8.05		16.05	0.05
18.00	9.00	-9.10		18.10	0.10
20.00	10.00	-10.10		20.10	0.10
22.00	11.05	-11.10		22.15	0.15
24.00	12.05	-12.10		24.15	0.15
26.00	13.05	-13.10		26.15	0.15
28.00	14.05	-14.10		28.15	0.15
30.00	15.05	-15.05		30.10	0.10
32.00	16.10	-16.05		32.15	0.15
34.00	17.10	-17.05		34.15	0.15
35.70	18.00	-17.90		35.90	0.20

The uncertainty of measurement was ± 0.11 inH₂O

* ΔP = High-port side - Low-port side

* UUC = Unit Under Calibration

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

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Certificate of Calibration

Certificate No. : 25P1379

Page : 1 of 2

Equipment : Aneroid Barometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: UAE.ANV.121/2550

Condition As-Received: Used Item

Received Date: 04 April 2025

Calibration Date: 17 April 2025

Reference: 2504-0196WSC

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

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1005 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 calibration procedure CP-P10, using " DKD-R 6-1 ; Calibration of Pressure Gauges " 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-0133-24	15 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 : Kaerkpon Saivichai
Issue Date : 21 April 2025

Approved Signatory :

[] Phalinee Prabpaipal

[] Sura Suwannasri

[✓] Attapol Panurach

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Cert.No.: 25P1379

Page: 2 of 2

Result of calibration:- Without adjustment

Range : 960 hPa to 1070 hPa

Function:- Absolute Pressure Measurement

Scale Interval : 1 hPa (The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	959.71	971.22	982.18	991.71	1003.10	1006.94	1013.02	1023.08	1034.17	1068.92
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1005.0	1010.0	1020.0	1030.0	1060.0
Error (hPa)	0.29	-1.22	-2.18	-1.71	-3.10	-1.94	-3.02	-3.08	-4.17	-8.92

Decreasing Pressure

Applied Pressure (hPa)	1068.95	1033.45	1022.77	1012.49	1007.16	1002.58	992.32	982.17	970.86	959.47
UUC* Indication (hPa)	1060.0	1030.0	1020.0	1010.0	1005.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-8.95	-3.45	-2.77	-2.49	-2.16	-2.58	-2.32	-2.17	-0.86	0.53

The uncertainty of measurement was ± 0.33 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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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CALIBRATION SERVICES AND ENVIRONMENTAL ANALYSIS DEPARTMENT

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 26P876

Page : 1 of 2

Equipment : Barometer
Manufacturer: Barigo
Model : -
Serial No.: -
ID No.: UAE.ANV.013/2547

This certificate may not be reproduced other than in full,
except with the prior written approval of the head of
Calibration Services and environmental analysis department.

Condition As-Received: Used Item
Received Date: 25 February 2026
Calibration Date: 27 February 2026

Reference: 2602-0927WC
Submitted by: United Analyst and Engineering Consultant Co.,Ltd.
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1012 mbar

3 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 DP1142 1422505046 MP-0053-25 05 Apr 2026

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.Scale and conversion factor is 1 kPa =7.50062 mmHg

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Sakchai Aonta
Issue Date : 05 March 2026

Approved Signatory :

[] Phalinee Prabpaipal

[] Sura Suwannasri

[x] Attapol Panurach

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R 0193404



Cert.No.: 26P876

Page: 2 of 2

Result of calibration:- Without adjustment

Range : 720 mmHg to 780 mmHg

Function:- Absolute Pressure Measurement

Scale Interval : 1 mmHg(The Fifth Estimate)

Increasing Pressure

Applied Pressure (mmHg)	717.96	729.92	739.67	749.99	760.20	770.95	783.21
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0	780.0
Error (mmHg)	2.04	0.08	0.33	0.01	-0.20	-0.95	-3.21

Decreasing Pressure

Applied Pressure (mmHg)	783.20	770.93	759.92	749.66	739.37	728.71	717.76
UUC* Indication (mmHg)	780.0	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-3.20	-0.93	0.08	0.34	0.63	1.29	2.24

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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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. : 25H807
Page : 1 of 2

Equipment : Dial Thermo-Hygrometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: UAE.ANV.003/2548

Condition As-Received: Used Item

Received Date: 04 April 2025

Calibration Date: 10 April 2025
to 17 April 2025

Reference: 2504-0193WSC

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-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) Chilled Mirror Hygrometer	Dew Master	44730	22688	10 Sep 2025
2) Handheld Thermometer With Sensor	1521	A5A339	2411176	25 Oct 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:-

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

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

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Corporate Services 3: Equipment Calibration and Testing Services.



Cert. No.: 25H807

Page.: 2 of 2

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

Reference Temperature	Standard Humidity	UUC* Reading	Correction	Uncertainty of Measurement
(°C)	(%R.H.)	(%R.H.)	(%R.H.)	(±%R.H.)
25.0	40.1	39	1.1	1.7
25.0	60.0	60	0.0	1.8
25.0	80.0	79	1.0	1.9

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

Standard Temperature	UUC* Reading	Correction	Uncertainty of Measurement
(°C)	(°C)	(°C)	(±°C)
20.012	20.0	0.012	0.72
25.034	25.0	0.034	0.72
30.032	30.0	0.032	0.72
35.022	34.5	0.522	0.72
40.040	40.0	0.040	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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Calibrated by : Kraipop Onrat
Issue Date : 21 April 2025

Approved Signatory :

[] Chakrit Waewwanjua

[] Pornthippa Tameyakul

[✓] Viporn Tantiyawutti

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เอกสารไม่ควบคุม



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. : 25H1369
Page : 1 of 2

Equipment : Digital Thermo-Hygrometer
Manufacturer: Digicon
Model : TH-02A
Serial No.: 435031145
ID No.: UAE.EFM.003/2567

Condition As-Received: Used Item

Received Date: 04 July 2025

Calibration Date: 08 July 2025
to 15 July 2025

Reference: 2507-0215WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

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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: 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) Dew Point Hygrometer	Optidew 401	164756	TH-0005-25	05 Feb 2026
2) Handheld Thermometer With Sensor	1523	5717096	2411241	18 Nov 2025

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

3.This measurement result 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 : 21 July 2025

Approved Signatory :

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

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Cert. No.: 25H1369
Page.: 2 of 2

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

Reference Temperature	Standard Humidity	UUC* Reading	Correction	Uncertainty of Measurement
(°C)	(%R.H.)	(%R.H.)	(%R.H.)	(±%R.H.)
25.0	40.1	39	1.1	1.3
25.0	50.1	48	2.1	1.6
25.0	60.0	57	3.0	1.6
25.0	70.2	67	3.2	1.6

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

Standard Temperature	UUC* Reading	Correction	Uncertainty of Measurement
(°C)	(°C)	(°C)	(±°C)
19.953	20.4	-0.447	0.42
25.001	25.4	-0.399	0.42
30.043	30.3	-0.257	0.42
40.023	40.0	0.023	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 : May 7, 2025

Equipment : Gas Analyzer (NO₂) Model : 42i
 Manufacturer : Thermo Scientific Serial Number : 1182920009

Standard Gas Concentration

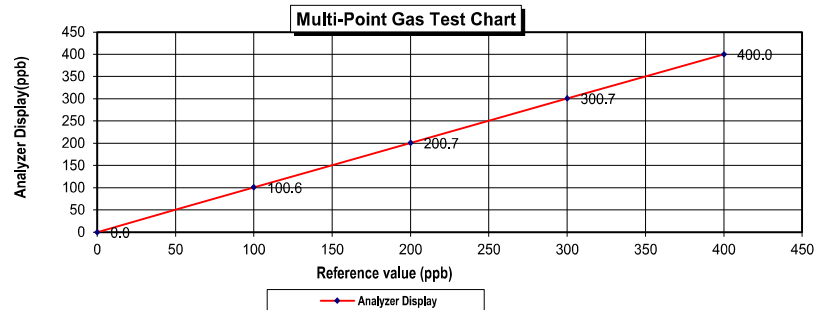
Sulphur Dioxide (SO₂) 42.89 PPM
 Nitric Oxide (NO) 46.77 PPM
 Methane (CH₄) - PPM
 Carbon Monoxide (CO) 965.9 PPM
 Cylinder No. : EB0159156
 Expiration Date : Nov 6, 2026

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	100.6	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	300.7	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 (%)			0.24



Calculate by

7/05/2025

Calculate by

7/May/2025

MULTI-POINT GAS TEST REPORT

Test Date : Feb 20, 2026

Equipment : Gas Analyzer (NO₂) Model : 42i
 Manufacturer : Thermo Scientific Serial Number : CM22387037

Standard Gas Concentration

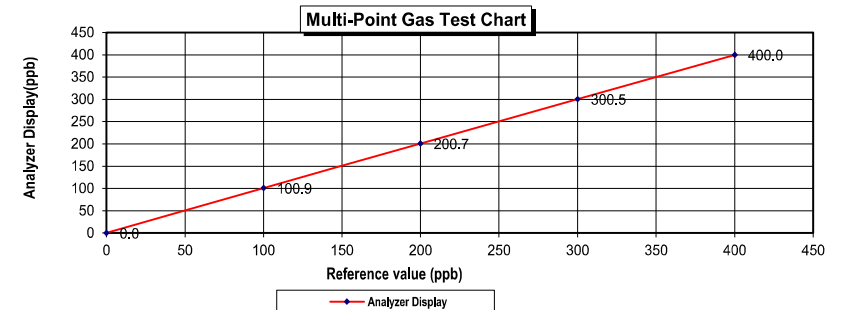
Sulphur Dioxide (SO₂) 42.89 PPM
 Nitric Oxide (NO) 46.77 PPM
 Methane (CH₄) - PPM
 Carbon Monoxide (CO) 965.9 PPM
 Cylinder No. : EB0159156
 Expiration Date : Nov 6, 2026

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	100.9	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	300.5	0.50	0.17	0.17
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

20/02/2569

Calculate by

20/Feb/2026

MULTI-POINT GAS TEST REPORT

Test Date : May 12, 2025

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201778106

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

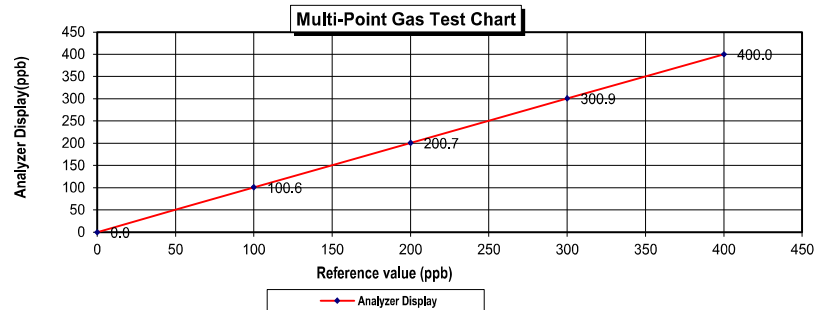
Dilutor Detail

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	100.6	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	

:Acceptable Limit $\pm 5\%$



12 / 05 / 2025

7 May 2025

MULTI-POINT GAS TEST REPORT

Test Date : Feb 24, 2026

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM22387039

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

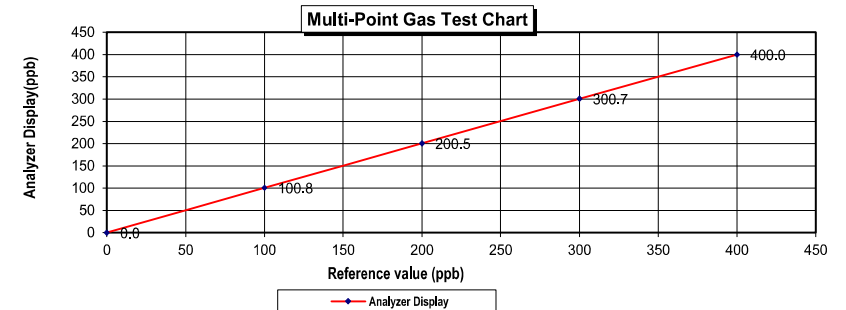
Dilutor Detail

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	100.8	0.80	0.79	0.79
Level 3	40.00%	200.0	200.5	0.50	0.25	0.25
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 (%)		0.26	

:Acceptable Limit $\pm 5\%$



24 / 02 / 2569

24 Feb 2026

MULTI-POINT GAS TEST REPORT

Test Date : May 12, 2025

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1200636463

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

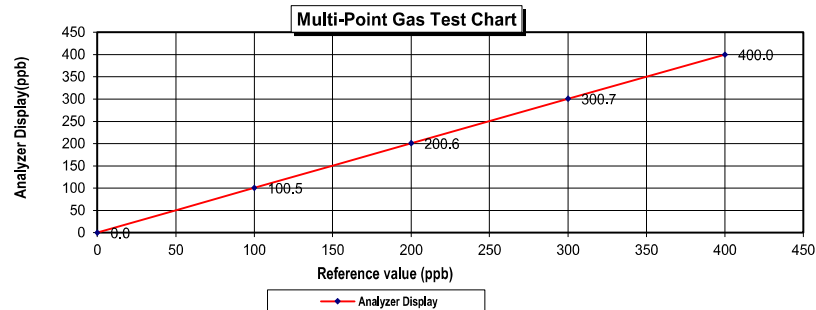
Dilutor Detail

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	100.5	0.50	0.50	0.50
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 (%)		0.21	

:Acceptable Limit $\pm 5\%$



Calculate by

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12 / 05 / 2025
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by

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7 / May / 2025
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MULTI-POINT GAS TEST REPORT

Test Date : Feb 17, 2026

Equipment : Gas Analyzer (NO₂) Model : 42C
Manufacturer : Thermo Environmental Instruments Serial Number : 42C- 67174-356

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

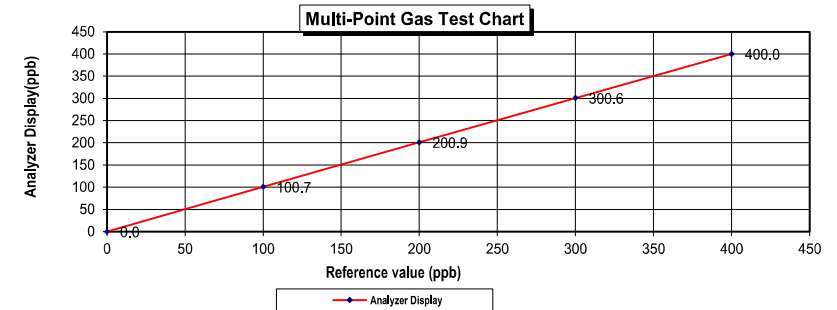
Dilutor Detail

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	100.7	0.70	0.70	0.70
Level 3	40.00%	200.0	200.9	0.90	0.45	0.45
Level 4	60.00%	300.0	300.6	0.60	0.20	0.20
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%)		0.27	

:Acceptable Limit $\pm 5\%$



Calculate by

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17 / 02 / 2569
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by

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17 / Feb / 2026
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CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

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

Expiration Date: Jul 06, 2031

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	100.0 PPM	100.4 PPM	G1	+/- 0.9% NIST Traceable	06/27/2023, 07/06/2023
NITRIC OXIDE	100.0 PPM	100.2 PPM	G1	+/- 0.9% NIST Traceable	06/27/2023, 07/06/2023
SULFUR DIOXIDE	100.0 PPM	100.0 PPM	G1	+/- 1.4% NIST Traceable	06/27/2023, 07/06/2023
CARBON MONOXIDE	200.0 PPM	199.2 PPM	G1	+/- 0.3% NIST Traceable	06/26/2023
CARBON DIOXIDE	8.000 %	7.982 %	G1	+/- 1.2% NIST Traceable	06/27/2023
NITROGEN	Balance				

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

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

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

MULTI-POINT GAS TEST REPORT

Test Date : July 11, 2025

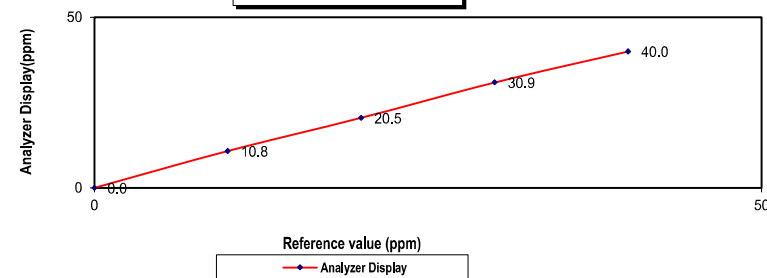
Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo Scientific Serial Number : 1201778117

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	10.8	0.8	7.4	7.4
Level 3	40.00%	20.0	20.5	0.5	2.4	2.4
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 (%)		2.55
			:Acceptable Limit ± 5%			

Multi-Point Gas Test Chart



Approved for Release

Page 1 of 1

เอกสารไม่ควบคุม

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : July 11, 2025

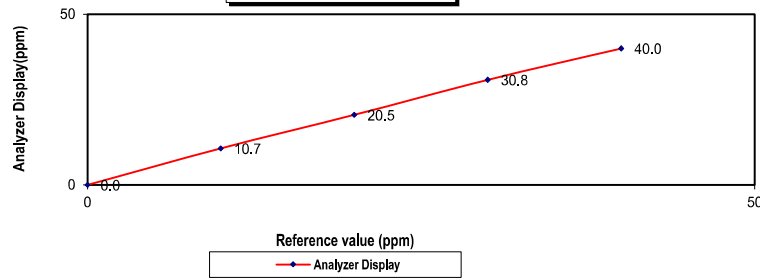
Equipment : Gas Analyzer (CO) Model : APMA-370
Manufacturer : HORIBA Serial Number : YRLHTB7G

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	10.7	0.7	6.5	6.5
Level 3	40.00%	20.0	20.5	0.5	2.4	2.4
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 (%)			2.32

Multi-Point Gas Test Chart



.....
.....11...../.....07...../.....2568.....

.....by
.....11...../.....July...../.....2025.....

MULTI-POINT GAS TEST REPORT

Test Date : July 29, 2025

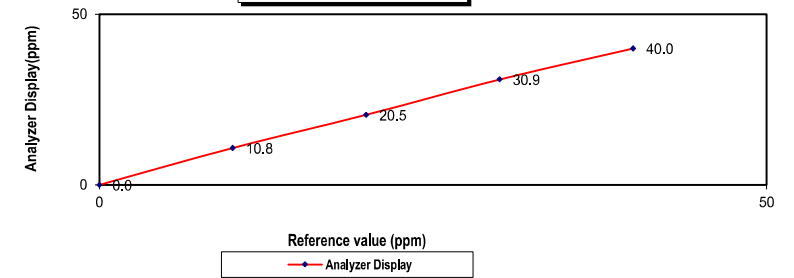
Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778118

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	10.8	0.8	7.4	7.4
Level 3	40.00%	20.0	20.5	0.5	2.4	2.4
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 (%)		2.55

Multi-Point Gas Test Chart



.....by
.....29...../.....07...../.....2568.....

.....by
.....29...../.....July...../.....2025.....

MULTI-POINT GAS TEST REPORT

Test Date : July 24,2025

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

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

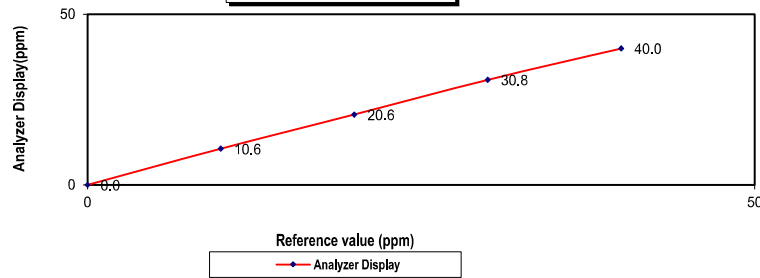
Dilutor Detail

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	20.6	0.6	2.9	2.9
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 (%)			2.23

Multi-Point Gas Test Chart



Calculate by

24 / 07 / 2568

24 July / 2025

MULTI-POINT GAS TEST REPORT

Test Date : July 24,2025

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778119

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

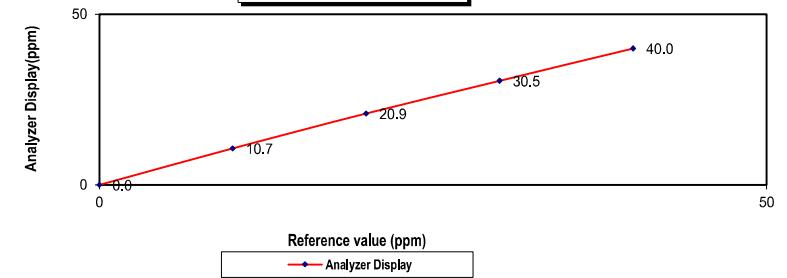
Dilutor Detail

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	10.7	0.7	6.5	6.5
Level 3	40.00%	20.0	20.9	0.9	4.3	4.3
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 (%)			2.50

Multi-Point Gas Test Chart



Calculate by

24 / 07 / 2568

24 July / 2025

MULTI-POINT GAS TEST REPORT

Test Date : July 24, 2025

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

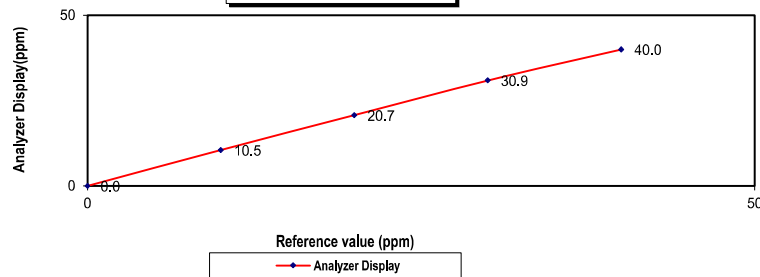
Dilutor Detail

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	0.0
Level 2	20.00%	10.0	10.5	0.5	4.8	4.8
Level 3	40.00%	20.0	20.7	0.7	3.4	3.4
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 (%)			2.21

Multi-Point Gas Test Chart



by
24 / 07 / 2568

by
24 July / 2025



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 28 April, 2025

Certification No. 304/25

Page : 1 of 7

Object : เครื่องมือตรวจวัดอุณหภูมิ

Manufacturer : LSI

Type : Dato Logger E-LOG 305 wind speed and wind direction DNA 827
Thermoigrometers DMA875 Barometer DQA 801
Mfg Code : Dato Logger 19040403 wind speed and wind direction 19050233
Thermoigrometers 19050004 Barometer 19040191
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 1007.1 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
: Thermoschneider No.9188 : testo, testo 645 Serial No. 02848057

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Wind Speed And Wind Direction

Certification No. 304/25

28 April, 2025

Model DNA827 S/N 19050233

Page : 2 of 7

Standard	HOOK GAGE NO. 1425			TESTED 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	-	-	-	2.9	0.12
5.00	-	-	-	5.0	0.00
7.04	-	-	-	6.9	0.14
9.02	-	-	-	9.0	0.02
11.02	-	-	-	10.9	0.12
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.0	0.02
20.02	-	-	-	19.9	0.12

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 20 January, 2026

Certification No. 034/26

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2311DR0037

Wind Sensor 2112DT0102

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 1010.1 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

: Thermoschneider No.9188 : testo, testo 645 Serial No. 02848057

STANDARD BAROMETER : Digital Barometer Type PTB220 No. V1220015

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Sig

Mr. Watcharapol Subwat

(Authorised Signatory)
for the Chief

Sub-Standard Instrument

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 034/26

20 January, 2026

Page : 2 of 5

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	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	-	-	-	20.1	-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. 034/26

20 January, 2026

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1010.35	1010	0.35
1010.05	1010	0.05
1009.76	1009	0.76
1009.43	1009	0.43
1009.14	1009	0.14
1008.84	1009	-0.16
1008.55	1009	-0.45
1008.24	1008	0.24
1008.11	1008	0.11
1007.54	1008	-0.46
1008.16	1008	0.16
1008.52	1008	0.52
1008.91	1009	-0.09
1009.25	1009	0.25
1009.62	1010	-0.38
1009.86	1010	-0.14
1010.05	1010	0.05
1010.53	1010	0.53
1010.94	1011	-0.06
1011.18	1011	0.18

Average

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. 034/26

20 January, 2026

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
757.82	758	-0.18
757.60	758	-0.40
757.38	757	0.38
757.13	757	0.13
756.92	757	-0.08
756.69	757	-0.31
756.47	756	0.47
756.24	756	0.24
756.14	756	0.14
755.72	756	-0.28
756.18	756	0.18
756.45	756	0.45
756.74	757	-0.26
757.00	757	0.00
757.28	757	0.28
757.46	758	-0.54
757.60	758	-0.40
757.96	758	-0.04
758.27	758	0.27
758.45	758	0.45

Average

0.03

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer



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

The Result of Calibration

Certification No. 034/26

20 January, 2026

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.6	45	0.6
30.1	30	0.1
15.7	16	-0.3

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer



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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 28 April, 2025

Certification No. 305/25

Page : 1 of 7

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : LSI

Type : Dato Logger E-LOG 305 wind speed and wind direction DNA 827

Thermoigrometers DMA875 Barometer DQA 801

Mfg Code : Dato Logger 20020300 wind speed and wind direction 20010094

Thermoigrometers 19100290 Barometer 20030066

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 1005.6 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

: Thermoschneider No.9188 : testo, testo 645 Serial No. 02848057

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

Calibrated by

Sig

Mr. Watcharapol Subwat

Mr

Mechanical Engineer



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Wind Speed And Wind Direction

Certification No. 305/25

28 April, 2025

Model DNA827 S/N 20010094

Page : 2 of 7

Standard	HOOK GAGE NO. 1425			TESTED 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	-	-	-	2.9	0.12
5.00	-	-	-	5.0	0.00
7.04	-	-	-	6.9	0.14
9.02	-	-	-	9.0	0.02
11.02	-	-	-	10.9	0.12
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.0	0.02
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



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 2 March, 2026

Certification No. 130/26

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2205DR0008

Wind Sensor 2205DT0008

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 1005.1 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

Barometer Vaisala Type PTB330 No. K4320001

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

(Authorised Signatory)

for the Chief

Sub-Standard Instrument



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 130/26

2 March, 2026

Page : 2 of 5

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	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	-	-	-	15.1	-0.09
17.02	-	-	-	17.0	0.02
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. 130/26

2 March, 2026

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1005.83	1006	-0.17
1006.10	1006	0.10
1006.34	1006	0.34
1006.69	1007	-0.31
1007.09	1007	0.09
1007.43	1007	0.43
1007.93	1008	-0.07
1008.57	1008	0.57
1008.05	1008	0.05
1008.94	1009	-0.06
1009.34	1009	0.34
1009.06	1009	0.06
1008.75	1009	-0.25
1008.54	1008	0.54
1007.98	1008	-0.02
1007.62	1007	0.62
1006.87	1007	-0.13
1005.48	1005	0.48
1004.81	1005	-0.19
1003.82	1004	-0.18

Average

0.11

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. 130/26

2 March, 2026

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
754.43	754	0.43
754.64	755	-0.36
754.82	755	-0.18
755.08	755	0.08
755.38	755	0.38
755.63	756	-0.37
756.01	756	0.01
756.49	756	0.49
756.10	756	0.10
756.77	757	-0.23
757.07	757	0.07
756.86	757	-0.14
756.62	757	-0.38
756.47	756	0.47
756.05	756	0.05
755.78	756	-0.22
755.21	755	0.21
754.17	754	0.17
753.67	754	-0.33
752.93	753	-0.07

Average

0.01

Calibrated by :

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. 130/26

2 March, 2026

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.2	45	0.2
30.2	30	0.2
15.4	15	0.4

Calibrated by :

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 28 April, 2025

Certification No. 306/25

Page : 1 of 7

Object : เครื่องมือตรวจวัดอุณหภูมิมวล

Manufacturer : LSI

Type : Dato Logger E-LOG 305 wind speed and wind direction DNA 827
Thermoigrometers DMA875 Barometer DQA 801
Mfg Code : Dato Logger 20020298 wind speed and wind direction 20010094
Thermoigrometers 19100288 Barometer 20030053

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1007.2 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

: Thermoschneider No.9188 : testo, testo 645 Serial No. 02848057

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Wind Speed And Wind Direction

Certification No. 306/25

28 April, 2025

Model DNA827 S/N 20010094

Page : 2 of 7

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	2.9	0.12
5.00	-	-	-	5.0	0.00
7.04	-	-	-	6.9	0.14
9.02	-	-	-	9.0	0.02
11.02	-	-	-	10.9	0.12
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



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 2 March, 2026

Certification No. 133/26

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 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1004.1 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

Barometer Vaisala Type PTB330 No. K4320001

Calibrated by :

Mr. Watchapol Subwat

Mechanical Engineer

Sig

Mr.

(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. 133/26

2 March, 2026

Page : 2 of 5

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	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



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 133/26

2 March, 2026

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1005.83	1006	-0.17
1006.10	1006	0.10
1006.34	1006	0.34
1006.69	1006	0.69
1007.09	1007	0.09
1007.43	1007	0.43
1007.93	1008	-0.07
1008.57	1009	-0.43
1008.05	1008	0.05
1008.94	1009	-0.06
1009.34	1009	0.34
1009.06	1009	0.06
1008.75	1009	-0.25
1008.54	1008	0.54
1007.98	1008	-0.02
1007.62	1008	-0.38
1006.87	1007	-0.13
1005.48	1005	0.48
1004.81	1005	-0.19
1003.82	1004	-0.18

Average

0.06

Calibrated by :

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. 133/26

2 March, 2026

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
754.43	754	0.43
754.64	755	-0.36
754.82	755	-0.18
755.08	755	0.08
755.38	755	0.38
755.63	755	0.63
756.01	756	0.01
756.49	756	0.49
756.10	756	0.10
756.77	757	-0.23
757.07	757	0.07
756.86	757	-0.14
756.62	757	-0.38
756.47	756	0.47
756.05	756	0.05
755.78	756	-0.22
755.21	755	0.21
754.17	754	0.17
753.67	754	-0.33
752.93	753	-0.07

Average

0.06

Calibrated by :

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. 133/26

2 March, 2026

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.2	45	0.2
30.2	30	0.2
15.4	15	0.4

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

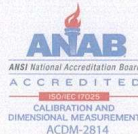
Calibration & Test Section
Meteorological Instruments Bureau

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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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12394/UM12394 [UAE.EFM.091/2560]
CLID. NO. : 251801348
JOB CONTROL NO. : 250617070066
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 : 17 June 2025

DATE OF ISSUED : 20 June 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
20 June 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. Q25070066

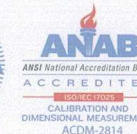
F3-011-05/12-23

เอกสารไม่ควบคุม



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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12394/UM12394 [UAE.EFM.091/2560]
DATE OF CALIBRATION : 18 June 2025

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, Universal Counter,
Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Universal Counter, Hewlett Packard Model 5315A S/N. 2448A13042.
2. Digital Multimeter, Keysight Technologies Model 3458A S/N. MY59352733.
3. Accelerometer with Measuring Amplifier, Bruel & Kjaer Model 8305, 2525 S/N. 397018, 2434988.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd.
Certificate No. 07-0006/25, Due Date 20 January 2026.
2. 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.
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand)
Certificate No. AV-0056-24, Due Date 14 December 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. Q25070066

F3-011-05/12-23

เอกสารไม่ควบคุม





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



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 (g)	DUC Reading (g)	Correction (g)	Uncertainty ± (% of rdg.)
(g)	(frequency)					
0.3	50 Hz	peak	0.300	0.301	-0.001	1.9
0.4	50 Hz		0.400	0.402	-0.002	1.3
0.5	50 Hz		0.500	0.503	-0.003	1.3
0.6	50 Hz		0.600	0.604	-0.004	2.5
0.7	50 Hz		0.700	0.705	-0.005	2.5
0.3	100 Hz		0.300	0.302	-0.002	1.9
0.4	100 Hz	peak	0.400	0.404	-0.004	1.3
0.5	100 Hz		0.500	0.505	-0.005	1.3
0.6	100 Hz		0.600	0.607	-0.007	2.5
0.7	100 Hz		0.700	0.708	-0.008	2.5

2. VELOCITY RESULT

Test point		Mode	STD Reading (mm/s)	DUC Reading (mm/s)	Correction (mm/s)	Uncertainty ± (% of rdg.)
(mm/s)	(frequency)					
3	50 Hz	peak	3.000	3.021	-0.021	1.8
4	50 Hz		4.000	4.030	-0.030	1.8
5	50 Hz		5.000	5.039	-0.039	1.8
6	50 Hz		6.000	6.047	-0.047	1.8
7	50 Hz		7.000	7.056	-0.056	1.8
3	100 Hz	peak	3.000	3.035	-0.035	2.7
4	100 Hz		4.000	4.046	-0.046	1.3
5	100 Hz		5.000	5.056	-0.056	1.3
6	100 Hz		6.000	6.067	-0.067	1.0
7	100 Hz		7.000	7.077	-0.077	1.0

Certificate No. Q25070066

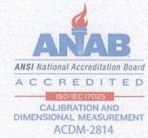
F3-011-05/12-23

เอกสารไม่ควบคุม



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



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading (mm)	DUC Reading (mm)	Correction (mm)	Uncertainty ± (% of rdg.)
(mm)	(frequency)					
0.03	50 Hz	peak	0.030	0.030	0.000	2.1
0.04	50 Hz		0.040	0.040	0.000	1.7
0.05	50 Hz		0.050	0.051	-0.001	1.4
0.06	50 Hz		0.060	0.061	-0.001	1.3
0.07	50 Hz		0.070	0.071	-0.001	1.1
0.03	100 Hz	peak	0.030	0.030	0.000	2.1
0.04	100 Hz		0.040	0.040	0.000	1.7
0.05	100 Hz		0.050	0.051	-0.001	1.4
0.06	100 Hz		0.060	0.061	-0.001	1.3
0.07	100 Hz		0.070	0.071	-0.001	1.1

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 015 Page 1,2 of 68

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

End of Certificate

Certificate No. Q25070066

F3-011-05/12-23

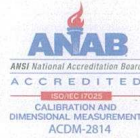
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CALIBRATION LABORATORY Co., LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM14464/UM14464 [UAE.EFM.093/2562]
CLID. NO. : 252000711
JOB CONTROL NO. : 250719084759
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 July 2025

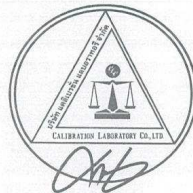
DATE OF ISSUED : 24 July 2025

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

24 July 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. Q25084759

F3-011-05/12-23

เอกสารไม่ควบคุม



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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM14464/UM14464 [UAE.EFM.093/2562]
DATE OF CALIBRATION : 19 July 2025

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 and Accelerometer with Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Digital Multimeter, Wavetek Model 1281 S/N. 29320.
2. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
3. Accelerometer with Measuring Amplifier, Bruel & Kjaer Model 8305, 2625 S/N. 397018, 2434988.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 05-0316/23 , Due Date 21 July 2025.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0054/25 , Due Date 11 June 2026.
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0056-24, Due Date 14 December 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. Q25084759

F3-011-05/12-23

เอกสารไม่ควบคุม





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



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 (g)	DUC Reading (g)	Correction (g)	Uncertainty $\pm$ (% of rdg.)
(g)	(frequency)					
0.3	50 Hz	peak	0.300	0.299	+0.001	1.9
0.4	50 Hz		0.400	0.400	0.000	1.3
0.5	50 Hz		0.500	0.501	-0.001	1.3
0.6	50 Hz		0.600	0.603	-0.003	2.5
0.7	50 Hz		0.700	0.705	-0.005	2.5
0.3	100 Hz	peak	0.300	0.301	-0.001	1.9
0.4	100 Hz		0.400	0.401	-0.001	1.3
0.5	100 Hz		0.500	0.503	-0.003	1.3
0.6	100 Hz		0.600	0.605	-0.005	2.5
0.7	100 Hz		0.700	0.706	-0.006	2.5

2. VELOCITY RESULT

Test point		Mode	STD Reading (mm/s)	DUC Reading (mm/s)	Correction (mm/s)	Uncertainty $\pm$ (% of rdg.)
(mm/s)	(frequency)					
3	50 Hz	peak	3.000	2.989	+0.011	1.8
4	50 Hz		4.000	3.981	+0.019	1.8
5	50 Hz		5.000	4.977	+0.023	1.8
6	50 Hz		6.000	5.972	+0.028	1.8
7	50 Hz		7.000	6.966	+0.034	1.8
3	100 Hz	peak	3.000	2.996	+0.004	2.7
4	100 Hz		4.000	3.993	+0.007	1.3
5	100 Hz		5.000	4.988	+0.012	1.3
6	100 Hz		6.000	5.982	+0.018	1.0
7	100 Hz		7.000	6.980	+0.020	1.0

Certificate No. Q25084759

F3-011-05/12-23

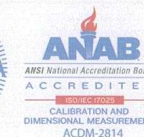
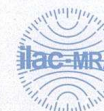
page 3 of 4

เอกสารไม่ควบคุม



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



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading (mm)	DUC Reading (mm)	Correction (mm)	Uncertainty $\pm$ (% of rdg.)
(mm)	(frequency)					
0.03	50 Hz	peak	0.030	0.030	0.000	2.1
0.04	50 Hz		0.040	0.040	0.000	1.7
0.05	50 Hz		0.050	0.049	+0.001	1.4
0.06	50 Hz		0.060	0.059	+0.001	1.3
0.07	50 Hz		0.070	0.069	+0.001	1.1
0.03	100 Hz	peak	0.030	0.030	0.000	2.1
0.04	100 Hz		0.040	0.040	0.000	1.7
0.05	100 Hz		0.050	0.050	0.000	1.4
0.06	100 Hz		0.060	0.059	+0.001	1.3
0.07	100 Hz		0.070	0.069	+0.001	1.1

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 015 Page 1,2 of 68

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

End of Certificate

Certificate No. Q25084759

F3-011-05/12-23

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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 : 25-ACT-080
Request No : Req-2025-1160

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 2
Manufacturer : LARSON DAVIS Range : 94 , 114 dB / 1000 Hz
Model : CAL150 Instrument Status : Used
Serial Number : 6171
ID : UAE.EFM.117/2562

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 26 May 2025
Calibration Date : 29 May 2025
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	4 February 2026

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 : 29 May 2025

เอกสารไม่ควบคุม

Certificate No : 25-ACT-080

Request No : Req-2025-1160

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)
	Measured	Deviated value	Measured	Deviated value	
94 dB / 1000 Hz	94.02	0.02	-	-	0.12
114 dB / 1000 Hz	114.08	0.08	-	-	0.11

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)
	Measured (Hz)	Deviated value	Measured (Hz)	Deviated value	
94 dB / 1000 Hz	1000.0	0.00	-	-	0.01
114 dB / 1000 Hz	1000.0	0.00	-	-	0.010

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

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)
	Measured (%)	Measured (%)	
94 dB / 1000 Hz	2.12	-	0.17
114 dB / 1000 Hz	0.44	-	0.17

Note :

- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT
CO.,LTD. **Certificate No** : 25-ACT-135
Request No : Req-2025-1826
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong,
Bangkok 10260

Unit Under Calibration Details

Measurement item : Acoustic Calibrator **Class** : 2
Manufacturer : LARSON DAVIS **Range** : 94 , 114 dB 1000 Hz
Model : CAL150 **Instrument Status** : Used
Serial Number : 6695
ID : UAE.EFM.140/2565

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 7 August 2025
Calibration Date : 9 September 2025
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	20 June 2026
THD Multimeter	2015	1047765	NIMT	4 February 2026

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 : 9 September 2025

Certificate No : 25-ACT-135

Request No : Req-2025-1826

Sound pressure level Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)
	Measured	Deviated value	Measured	Deviated value	
94 dB / 1000 Hz	93.88	-0.12	-	-	0.11
114 dB / 1000 Hz	113.99	-0.01	-	-	0.11

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)
	Measured (Hz)	Deviated value	Measured (Hz)	Deviated value	
94 dB / 1000 Hz	1000.00	0.00	-	-	0.01
114 dB / 1000 Hz	1000.00	0.00	-	-	0.01

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

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)
	Measured (%)	Measured (%)	
94 dB / 1000 Hz	1.44	-	0.17
114 dB / 1000 Hz	0.67	-	0.17

Note :

- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

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.: CP20240341EA

Operation No.: CP2024090312

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.: 0005298 (Meter), 011741 (Microphone), 056088 (Preamplifier)

ID No.: UAE.EFM.113/2562

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

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

Received Date: 3 September 2024

Calibrated Date: 23 - 25 September 2024

Issued Date: 26 September 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.: CP20240341EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)
Model/Type: LxT2 (Meter), 375B02 (Microphone), PRMLxT2B (Preamplifier)
Serial No.: 0005298 (Meter), 011741 (Microphone), 056088 (Preamplifier)
ID No.: UAE.EFM.113/2562
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	F0640002	CL1-P240022 CD20240180EA	20 March 2025 7 August 2025
6) Performance Audio Analyzer	U8903B	MY56510003	CB20240035EB CK20240069EA	13 February 2025 19 September 2025

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)
 - Electrical and Electronics Institute; NSC Accredited Calibration No.0119
- 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.: CP20240341EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
31.1

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	31.1
C-weighting	31.0
Z-weighting	36.5

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	±1.5
1000	0.3	0.3	0.3	±1.0
8000	1.3	1.2	1.3	±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	-0.1	±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	0.0	±5.0

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

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

Certificate No.: CP20240341EA

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
143.0	143.1	0.1	±1.1

Certificate No.: CP20240341EA

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	44.2	0.2	±1.1
43.0	43.3	0.3	±1.1
42.0	42.4	0.4	±1.1
41.0	41.5	0.5	±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	118.9	-0.1	+1.0 ; -2.5
	0.25	109.8	-0.2	+1.5 ; -5.0
Slow	200	129.5	-0.1	±1.0
	2	109.9	-0.1	+1.0 ; -5.0
	0.25	101.0	0.0	+1.5 ; -5.0
LAE	200	130.0	0.0	±1.0
	2	110.0	0.0	+1.0 ; -2.5
	0.25	101.0	0.0	+1.5 ; -5.0

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	135.4	134.8	-0.6	±3.0
Positive half cycle	134.4	134.1	-0.3	±2.0
Negative half cycle	134.4	134.2	-0.2	±2.0

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
145.0	145.2	0.2	±1.5

Certificate No.: CP20240341EA

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	0.24	0.25
11) High-Level Stability	0.10	0.10

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

-- End of Report --

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 25-SLM-339
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok Request No : Req-2025-2019
10260

Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2
Manufacturer : LARSON DAVIS Microphone Model : 375B02
Model : LxT2 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 : 5 September 2025
Calibrated Date : 9 October 2025
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	Bruel&Kjaer	4226	3412381	7 May 2026	NIMT
Audio Generator	Svantek	Svan401	131	27 September 2026	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 October 2025

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Certificate No : 25-SLM-339
Request No : Req-2025-2019

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY (± dB)
FAST / A / 37-139	Level (dB)	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)	
Calibrator Setting						
1000 Hz 114 dB	113.75	113.9	0.15	113.7	-0.05	0.20

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		
A	29.3	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		
A	28.9	0.10
C	28.6	0.10
Z	32.8	0.10

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

UUC Setting	Deviation from various Frequency Weighting Responce curve			UNCERTAINTY (± dB)
	A (dB)	C (dB)	Z (dB)	
FAST / 37-139				
STD Setting				
125 Hz	0.2	0.2	0.2	0.60
1000 Hz	0.0	0.0	0.0	0.60
4000 Hz	1.1	1.2	1.1	0.60
8000 Hz	0.4	0.4	0.4	0.70

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Certificate No : 25-SLM-339
 Request No : Req-2025-2019

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

UUC Setting		Deviation from various Frequency			UNCERTAINTY
FAST / 37-139		Weighting Response curve			
STD Setting		A (dB)	C (dB)	Z (dB)	(± dB)
63 Hz		-0.2	-0.1	-0.1	0.20
125 Hz		-0.1	0.0	-0.1	
250 Hz		-0.1	-0.1	-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	

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY
FAST / 37-139	REF	UUC	ERR	
UUC Weighting	(dB)	(dB)	(dB)	($\pm$ dB)
A	114.00	114.0	0.0	0.20
C	114.00	114.0	0.0	
Z	114.00	114.0	0.0	

UUC Setting	STD	Measured		UNCERTAINTY
37-139 / A	REF	UUC	ERR	
UUC Time Response	(dB)	(dB)	(dB)	($\pm$ dB)
Fast	114.00	114.0	0.0	0.20
Slow	114.00	114.0	0.0	
Leq	114.00	114.0	0.0	

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

FM-708-SLM-01 Rev.06 Issue date 17/2/25

Certificate No : 25-SLM-339
 Request No : Req-2025-2019

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY
FAST / A / 37-139	UUC	
STD Setting	(dB)	($\pm$ dB)
Initial	114.0	
Final	114.0	
Deviated	0.0	0.10

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY
FAST / A / 37-139	REF	UUC	ERR	
STD dB	(dB)	(dB)	(dB)	($\pm$ dB)
139.00	139	139.0	0.0	0.30
134.00	134	134.0	0.0	
129.00	129	129.0	0.0	
124.00	124	124.0	0.0	
119.00	119	119.0	0.0	
114.00	114	114.0	0.0	
109.00	109	109.0	0.0	
104.00	104	104.0	0.0	
99.00	99	99.0	0.0	
94.00	94	94.0	0.0	
89.00	89	89.0	0.0	
84.00	84	84.0	0.0	
79.00	79	79.0	0.0	
74.00	74	74.0	0.0	
69.00	69	69.0	0.0	
64.00	64	64.0	0.0	
59.00	59	59.0	0.0	
54.00	54	54.0	0.0	
49.00	49	49.1	0.1	
44.00	44	44.2	0.2	
39.00	39	39.5	0.5	
38.00	38	38.7	0.7	

เอกสารไม่ควบคุม

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

FM-708-SLM-01 Rev.06 Issue date 17/2/25

Certificate No : 25-SLM-339
 Request No : Req-2025-2019

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY
FAST / A	REF	UUC	ERR	
UUC Range	(dB)	(dB)	(dB)	($\pm$ dB)
37-139	43.70	43.9	0.2	0.30
	114	114.0	0.0	

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY
A / 37-139	Toneburst	Ref	UUC	ERR	
UUC Time Response	(ms)	(dB)	(dB)	(dB)	($\pm$ dB)
Fast	200	135.0	134.9	-0.1	0.20
	2	118.0	117.6	-0.4	
	0.25	109.0	108.6	-0.4	
Slow	200	128.6	128.4	-0.2	
	2	109.0	108.8	-0.2	
SEL	200	129.0	129.0	0.0	
	2	109.0	109.0	0.0	
	0.25	100.0	99.9	-0.1	

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY
FAST / C / 95-142	REF	UUC	ERR	
STD Setting	(dB)	(dB)	(dB)	($\pm$ dB)
Complete cycle	137.4	136.8	-0.60	0.20
Positive half cycle	136.4	136.2	-0.20	
Negative half cycle	136.4	136.2	-0.20	

เอกสารไม่ควบคุม

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

FM-708-SLM-01 Rev.06 Issue date 17/2/25

Certificate No : 25-SLM-339
 Request No : Req-2025-2019

12. Overload indication

UUC Setting	Measured	UNCERTAINTY
FAST / A / 37-139	UUC	
STD Setting	(dB)	($\pm$ dB)
Positive one-half cycle	142.7	
Negative one-half cycle	142.7	
Deviated	0.0	0.20

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY
FAST / A / 37-139	UUC	
STD Setting	(dB)	($\pm$ dB)
Initial	138.0	
Final	138.0	
Deviated	0.0	0.10

End of Certificate

เอกสารไม่ควบคุม

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

FM-708-SLM-01 Rev.06 Issue date 17/2/25

ภาคผนวก ง-2

เอกสารสอบเทียบเครื่องมือเก็บตัวอย่างและวิเคราะห์
คุณภาพน้ำผิวดิน

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Atomic Absorption Spectrometer	CADMIUM IRON LEAD	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	26/1/2026	25/1/2027
2	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	United Analyst and Engineering Consultant Co., Ltd.	260318-1-BL007-26	3/4/2026	2/4/2027
3	Analytical Balance	TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	United Analyst and Engineering Consultant. Co., Ltd. (UAE)	260311-2-BL002-26	12/3/2026	11/3/2027
4	Auto Clave	TOTAL COLIFORM BACTERIA	ALP Co.,Ltd. (Japan)	CL-40L / 810010	National Food Institute Ministry of Industry (Thailand)	2503287-001-01	5/6/2025	4/6/2026
5	BOD Incubator	BIOCHEMICAL OXYGEN DEMAND	ARCO	UC4-1320 / 1021	Technology Promotion Association (Thailand-Japan)	25TM1001	7/7/2025	6/7/2026
6	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	26TW50	2/3/2026	1/3/2027
7	SCT Meter	CONDUCTIVITY (umhos/cm)	Horiba	LAQUA-EC210 / HC9L0015	Technology Promotion Association (Thailand-Japan)	26CH235	26/2/2026	26/2/2027
8	SCT Meter	SALINITY	Horiba	LAQUA-EC210 / HC9L0013	Technology Promotion Association (Thailand-Japan)	26CH144	2/2/2026	2/2/2027
9	Hot Air Oven	TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B212.0411	National food intitute ministry of Industry	2602300 001 01	11/3/2026	11/3/2027
10	Cooled Incubator	TOTAL COLIFORM BACTERIA	Binder	KB400 / WTB20200000015535	National Food Institute, Ministry of Industry, Thailand	2602303-006-01	11/3/2026	10/3/2027
11	Incubator	FECAL COLIFORM BACTERIA	Memmert	IPP260 / V615.0187	National Food Institute, Ministry of Industry, Thailand	2602303 001 01	11/3/2026	10/3/2027
12	pH Meter	pH	Horiba	LAQUA-PH210 / HA9M0047	technology promotion association (thailand-japan)	26CH231	26/2/2026	26/2/2027
13	Water Bath	FECAL COLIFORM BACTERIA	Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	26TM194	2/2/2026	1/2/2027

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



Agilent AA Series Spectrometers

Preventative Maintenance Checklist

Foreword

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results.

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the installation.

NOTE

While non-current production AA instrument and or accessory models are not covered specifically in this document it can be used as a basic reference.

For more information about Agilent Technologies services please visit our web site using the following URL <http://www.agilent.com/en-us/services>

Agilent AA Series Spectrometers Preventative Maintenance Checklist

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Customer information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Confirm the ability of the instrument to deliver continued safe operation as established via the Agilent AA safe operation flow chart. (Refer directly to the AA 55/240/280 Preventive Maintenance Scope of Work to make this decision.)
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Complete the total number of pages field in the Service Completion section
- Ask the customer to sign the Service Completion section including the customer's and your signature.

This information is subject to change without notice.

Other important Customer Web links

- How to get information on your product: Literature Library – <http://www.agilent.com/chem/library>
- Need to know more? www.agilent.com/chem/education
- Need technical support, FAQs? www.agilent.com/chem/techsupp
- Need supplies? www.agilent.com/chem/supplies

System information

- ☐ Check this box if an instrument configuration report is attached instead of completing this table.

Instrument system name and ID	240 FS AAS
Instrument system site and location	United Analyst and Engineering Consultant
List system component product numbers	List the serial numbers of each component
1 G 8432 A	1 MY 13160001
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10

Preparation, Safe operation and Initial performance checks

- ☐ Agilent AA safe operation flow chart inspections (to determine if the PM can be performed).

NOTE

If by following the flow chart the instrument is deemed to be unsafe for continued use you MUST NOT continue PM work. Inform the customer immediately of the Agilent recommendation that use of the instrument be discontinued.

- ☒ Discuss any specific questions or issues with the customer prior to starting.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. *WIR*
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes

- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Use SVD to perform a Full Wavelength Scan for Cu HCL - "As found test_1"
- ☒ Perform a Basic Cu ABS test - "As found test_2"
- ☒ Print the Details page or screen captures of the test results and attach to the end of this checklist.

Preventative maintenance procedures

Flame systems

- ☐ Section NOT applicable.

Electronic components

- ☒ Review and confirm instrument configuration data in SVD
- ☒ Confirm power supply voltages using the SVD Power Supply diagnostic.
- ☒ For Dual Beam instruments - Confirm RBC frequency using the SVD RBC frequency diagnostic.

Mechanical components

- ☒ Check the burner adjuster controls for complete and free movement. If the burner adjuster needs lubrication, use Molykote 321 or mineral-based molybdenum disulphide grease.
- ☒ Run SVD tests to exercise all motor drives over the full range of their travel:
 - ☒ Monochromator drive
 - ☒ Slit drive
 - ☒ Lamp selector
- ☐ Automatic Burner Adjuster

Optics components

- ☒ Check that external optical surfaces are clean – Clean or replace as required.
- ☒ Use SVD and perform Mono Wavelength Correction.
- ☒ Use SVD and perform Slit Calibration.
- ☒ Use SVD and perform Grating Squareness Diagnostic.
- ☒ Use SVD and perform Zero Order Offset/Mono Correction.
- ☒ Use SVD and perform Wavelength Repeatability.
- ☒ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.
- ☒ Check that the signal energy of the D2 and HC lamps track properly. Advise customer if their D2 lamp is showing emission degradation due to age.

Sample introduction and Atomization

- ☒ Inspect the burner interlock plate to ensure that the interlock pin is secure and correct for the burner type.
- ☒ Clean the burner slot with a clean white card.
- ☒ Check the uniformity of the slot width.
- ☒ Clean the burner if required.
- ☒ Change the burner o-ring and lubricate with PFPE grease.
- ☒ Clean the nebulizer, spray chamber and liquid trap.
- ☒ Change all o-rings and seals in the nebulizer, nebulizer block and spray chamber and lubricate.
- ☒ Check that the pressure relief bung releases readily.
- ☒ Change o-rings on the fuel and oxidant delivery barbs and lubricate.
- ☒ Leave the liquid trap EMPTY and verify the flame will not ignite in this state.
- ☒ Refill liquid trap and check that overfill drains freely into the drain/waste tube.
- ☒ Check the drain/waste tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.
- ☒ Check and clean the igniter electrode.

Gas handling components and safety interlocks

- ☒ Pressure test for leaks
- ☒ Leak test gasbox internal components using gasbox leak tester G8434-67013
- ☒ Check safety interlock status and operation using the SVD interlock monitoring diagnostic.

Analytical performance for Flame systems

- ☒ Ignite a flame.
- ☒ Check that you can adjust the nebulizer uptake rate from 4 to 6.5 mL per minute.
- ☒ Optimize the instrument ready to perform Cu sensitivity test.
- ☒ Create a manual method to perform a Basic Cu ABS test - "Final Performance Testing"
- ☒ Run a PM completed sensitivity test for a 5 ppm copper sample and record the results in the AA PM Performance test results and measurements table.

Furnace systems

- ☒ Section NOT applicable.

Electronic components

- ☐ Review and confirm instrument configuration data in SVD
- ☐ Confirm power supply voltages using the SVD Power Supply diagnostic.

Mechanical components

- ☐ Run SVD tests to exercise all motor drives over the full range of their travel:
 - ☐ Monochromator drive
 - ☐ Slit drive

- ☐ Lamp selector

Optics components

- ☐ Check that external optical surfaces are clean – Clean or replace as required.
- ☐ Use SVD and perform **Mono Wavelength Correction**.
- ☐ Use SVD and perform **Slit Calibration**.
- ☐ Use SVD and perform **Grating Squareness Diagnostic**.
- ☐ Use SVD and perform **Zero Order Offset/Mono Correction**.
- ☐ Use SVD and perform **Wavelength Repeatability**.
- ☐ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.

Gas handling, water system, and workhead component checks

- ☐ Inspect the GTA workhead gas hoses and connections for leaks.
- ☐ Pressure test for gas leaks
- ☐ If the cooler system is accessible (stand-alone) check for correct operation and coolant/water level – this includes any temperature and pressure settings plus filter cleaning (air flow and water).
- ☐ Inspect the GTA workhead water hoses and connections for leaks.
- ☐ Check all graphite components and replace if necessary.
 - ☐ Tube
 - ☐ Electrodes
 - ☐ Shroud
- ☐ Check and clean the end windows on the workhead.
- ☐ Check safety interlock operation.

Analytical performance for Furnace systems

- ☐ Optimize the instrument ready to perform Cu sensitivity test.
- ☐ Run the sensitivity test for a 25 ppb copper sample and record the results in the results table.

PSD autosampler accessory for Furnace systems

- ☒ Section NOT applicable.
- ☐ Check condition of the PSD capillary – replace if necessary
- ☐ Check condition and operation of PSD syringe – ensure it does not have air locks and bubbles.
- ☐ Change PSD rinse bottle o-ring.
- ☐ Check and clean the rinse vessel.
- ☐ Check the drain tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.
- ☐ Ensure that the waste vessel is suitable for use with the furnace system.

Accessories

- ☐ Section NOT applicable.

Sample introduction pump system (SIPS) accessory

- ☒ Section NOT Applicable.
- ☐ Re-torque screws securing the hubs, presser arms and pump rotors.
- ☐ Adjust each roller so that it rotates freely.
- ☐ Wipe clean the pump rotor rollers and pump bands with a dry clean cloth.
- ☐ Ensure that the presser arms and the surfaces near the pump are free from dirt and spills.
- ☐ Remove the pump module rear cover and check for the incursion of liquids and any signs of corrosion.
- ☐ Re-torque the nuts that fasten the motor mounting plates to the chassis.
- ☐ Check clips securing the diluents holder and replace if necessary.
- ☐ Disconnect, clean T-piece, and reassemble the tubing using the following steps.
- ☐ Remove the T-piece by disconnecting the pump tubes, the pump bands and all other tubing.
- ☐ Place the T-piece in an ultrasonic bath containing strong detergent 1-5% Decon 30 or similar, for approximately 5-10 minutes.
- ☐ Wash the T-piece under a tap with a strong flow of water.
- ☐ Rinse with distilled water through all of the inlets in the reverse direction to normal sample flow.
- ☐ Reassemble.

Sample preparation system (SPS 4) accessory

- ☒ Section NOT Applicable.

The Agilent SPS 4 autosampler is designed to need minimal maintenance.

The following maintenance requirements are suggested to maintain the performance of the autosampler.

- ☐ Cleaning the spill tray, rack location mat, end frames and chassis accessories with a damp soft cloth and diluted mild detergent.
- ☐ Cleaning the autosampler cover panels with domestic window cleaner.
- ☐ Checking the X- axis and Z- axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☐ Check the X- axis, Theta- axis and Z- axis FFC cables for cracks, incorrect positioning, damaged edge or damaged connectors.

NOTE

The autosampler requires no extra lubrication throughout its lifetime.

For further details refer to the SPS 4 service manual G8410-90050.

Vapor generation accessory VGA (hydride generator)

- ☐ Section NOT Applicable.
- ☐ Inspect VGA gas supply hose.
- ☐ Inspect/replace VGA pump tubing.
- ☐ Check low gas pressure interlock setting– adjust if required.
- ☐ Check precision orifice gas flow setting – adjust if required.
- ☐ Check gas regulator pressure to 46 psi (325 kPa) – adjust if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

UltraAA Lamp Accessory (external)

- ☒ Section NOT Applicable.
- ☐ Check the condition of the power cable.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

Restore System

- ☐ If you have altered the customer’s instrumentation during the course of PM, restore to the original status to allow the customer to conduct their normal activities (e.g., reload the customer’s method.)

Guidance

If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Signature Page

Service Review

- ☐ Attach available reports/printouts of all tests to this documentation.
- ☐ Record the Preventive Maintenance service activity in the customer’s records/logbook.
- ☐ Update/reset instrument maintenance counters as appropriate.
- ☐ Affix the PM sticker to the system or instrument logbook based on the customer’s request.
- ☐ Complete the Service Engineer Comments section if there are additional comments.
- ☐ Review this service, parts replaced, and test results obtained with the customer.
- ☐ If the instrument firmware was updated, record the details of the change in the Service Engineer’s Comments box or if necessary, in the customer’s IQ records.

Test Results

Test description	Expected test result	Actual test result
Flame optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	46.1.
Flame performance test with 5 ppm copper sample		
Air /acetylene, mixing paddle removed	Abs value > 0.5	0.6331
Air /acetylene, mixing paddle installed. 10 replicates	%RSD < 1.0	0.71.
Deuterium furnace optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	-
Deuterium furnace performance test with 25 ppb copper sample (324.8 nm)		
Precision %RSD	≤ 4.0%	-
Abs value	≥ 0.15	-
Zeeman furnace analytical performance: 25 ppb copper sample (324.8 nm)		
Precision %RSD	≤ 4.0%	-
Abs value	≥ 0.15	-
MSR% (327.4 nm)	≥70 %	-

AA consumable and parts list

Part Description	Part Number	Product/Model # where used	PM supplied or Consumable	Instrument-Type
Test Solution – Cu 5ppm solution	6610030100	55 240 280	PM supplied	Common
Test Solution - Blank solution	5190-7001	55 240 280	PM supplied	Common
Copper, 1000 ug/ml, 100ml	5190-8279	55 240 280	*	Common
Kit, Mk 7 O-rings, aqueous, complete set	9910093400	55 240 280	PM supplied	Flame
Organic Kit	9910093500	55 240 280	PM supplied	Flame
Wire Nebulizer Cleaning	9910024700	55 240 280	consumable	Flame
Tubing-Capillary Std Nebs	9910024800	55 240 280	consumable	Flame
Capillary Tube Hivac Neb (3) (organics only)	9910044000	55 240 280	consumable	Flame
Glass impact beads (5/pk)	9910025700	55 240 280	consumable	Flame

Agilent AA Series Spectrometers Preventative Maintenance Checklist

Teflon impact beads (5/pk): (organics only)	9910053300	55 240 280	consumable	Flame
Burner cleaning strip (100/pk)	9910053900	55 240 280	consumable	Flame
Window UV silica – round (right side)	2010082600	55 240 280	PM supplied	Common
Window UV silica – rectangular (left side)	2010082500	55 240 280	PM supplied	Common
Pad adhesive window (round)	4910012700	55 240 280	PM supplied	Common
Pad adhesive window (rectangular)	4910012800	55 240 280	PM supplied	Common
Electrode kit (1 pr) (D2)	6310003400	GTA120	PM supplied	Furnace
Shroud (D2)	6310003100	GTA120	PM supplied	Furnace
Zeeman electrode kit (1 pr)	6310003500	GTA120	PM supplied	Furnace
Zeeman shroud	6310003600	GTA120	PM supplied	Furnace
O-ring PSD rinse bottle	6910025900	PSD120	PM supplied	Furnace

* For engineers who only service AA instruments 5190-8279 can be used as a cheaper alternative for 6610030100.

Items classified as PM supplied in the above table are included in the standard PM.

Those classified as consumable should be provided by the customer or charged to the customer if supplied by the Agilent service engineer.

Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the installation or other items of interest for the customer, please write them in this box.

Agilent AA Series Spectrometers Preventative Maintenance Checklist

Service Completion

Service Request Number:
6008058466

Service Engineer Name:
[Redacted]

Service Engineer Signature:
[Redacted]

Date of Service Completion:
26 Jan 2026

Customer Name:
[Redacted]

Customer Signature:
[Redacted]

SVD Results Report



Report ID:3 Diagnostic Start Time:1/26/2026 8:39:56 AM Diagnostic End Time:1/26/2026 9:05:49 AM

Customer: UAE

Service Engineer: Kanyakorn S.

Address:

Contact Details: 026376363#1

Instrument Configuration

Configuration:

Serial Number: MY13160001 Turret Type: Automatic
Instrument Model: Varian AA140/240/280 Number Of Lamps: 4
Flame Instrument: True Mono Type: Automatic
Furnace Instrument: True Gasbox Type: 'Y' Gas Box
Zeeman Present: False Auto Burner Adjuster: False
Internal Zeeman: False Mains Frequency: 50
Internal UltrAA: False Firmware Version: 2.11
Optics Type: Double Beam Photomultiplier Type: Normal(900nm)
D2 BG Correction Fitted: True PWB Version: 45
Boot Block Version: 1.09

EEPROM Data:

Instrument Run Hours: 79270.602 D2 Run Hours: 58906.000
Zero Wavelength Offset: 30.095 D2 Serial Number: not set !
Mono Correction: 0.765 D2 Install Date: 1/1/1970
Flame Hours: 35125.582 D2 Original Intensity: 1.000
D2 Last Intensity: 475.000

Frequency:

Averaging Period: 30.0

Datapoint Count: 20

Upper Limit:
51.00

Average Frequency:
50.00

Highest Measured Frequency:
50.00

Lower Limit:
49.00

Lowest Measured Frequency:
50.00

Result: **Passed**

Power Supply:

Averaging Period: 30.0

Datapoint Count: 20

	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	12.20	13.20	Passed
-12.00 V Rail	-13.20	-11.90	-10.80	Passed
5.00 V Rail	4.50	5.02	5.50	Passed
310.00 V Rail	279.00	320.00	341.00	Passed

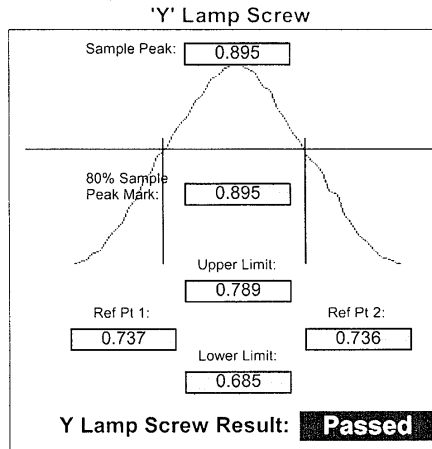
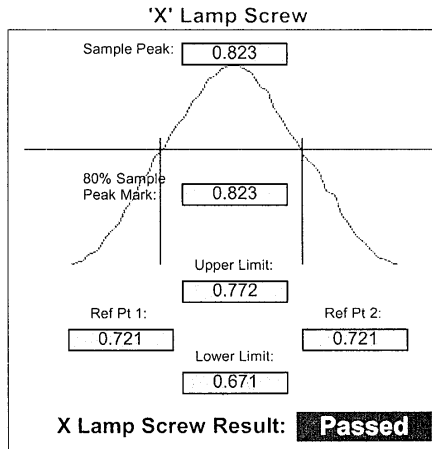


Optics

Beam Balance:

Lamp Type: Copper
Lamp Socket Used: 3

Peak Selected: 324.80
Lamp Alignment: **Performed**



Grating Squareness:

Lamp Element(s): Copper
Lamp Turret Position: 3
Lamp Current(mA): 4.00
Slit Width(nm): 0.5
1st Order Wavelength(nm): 324.80
Lamp Alignment: **Performed**

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	Passed
First Order	324.45	324.74	325.15	Passed
Second Order	649.23	649.50	649.97	Passed

Wavelength Repeatability:

Lamp Used: Copper
Peak Used(nm): 324.750
Connected to Socket: 3
Lamp Current(mA): 4
Slit Width(nm): 0.2
Slit Height: Normal

Lamp Alignment: **Performed**

Lower Limit(nm) 324.768 324.888 Upper Limit(nm)

(Approach from Zero Order)

Sample 1: 324.828

Sample 3: 324.823

Sample 5: 324.823

Sample 7: 324.823

Sample 9: 324.819

Mean: 324.823

(Approach from end)

Sample 2: 324.823

Sample 4: 324.823

Sample 6: 324.819

Sample 8: 324.819

Sample 10: 324.819

Standard Deviation: 0.003

Result: **Passed**

Mechanical

Wavelength Drive:

Passed

Slit Drive:

Passed

Turret Drive:

Passed

Auto Burner Adjuster Drive:

Untested

Miscellaneous

Signal Processing Linearity:

Calculate Mode: New Calc Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	114	261	297	Passed
S1	156	165	191	Passed
S2	271	296	332	Passed
S3	474	508	579	Passed
S4	825	919	1008	Passed
S5	1435	1529	1754	Passed
S6	2498	2771	3053	Passed
S7	4347	4755	5313	Passed

Interlocks:

Burner Fitted:	Working	Flame Detect:	Working
N2O Burner Fitted:	Untested	GCU Active:	Working
Flame Shield Closed:	Working	Oxidant Pressure:	Working
Gas Control Fitted:	Untested	Oxidant Changeover:	Untested
Pressure Release Bung Fitted:	Working	Ignition:	Working
Liquid Trap Fitted:	Working		



Auto Lamp Recognition:

Lamp 1: 87 - Silver/Cadmium/Lead/Zinc(UltrAA) (Ag/CLamp 5: Not Supported

Lamp 2: 68 - Zinc (Zn)

Lamp 6: Not Supported

Lamp 3: 14 - Copper (Cu)

Lamp 7: Not Supported

Lamp 4: Uncoded Lamp/Not Connected

Lamp 8: Not Supported

Result: **Passed**

GTA Temperature Monitoring:

Not Performed

Notes:

Signatures:

[Redacted Signature]

UAE

26 Jan 21

Date

[Redacted Signature]

Kanyakorn S.

26 Jan 2026

Date



Analyst
Date Started 1/26/2026 9:07 AM GMT: 1/26/2026 2:07 AM
Worksheet Sensitivity Test
Comment
Methods Cu
Computer name DESKTOP-R9UIFRS
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Exp Abs	%RSD	Mean Abs
5 ppm Cu	0.633	1.4	0.6331
Readings			
	0.6413	0.6340	0.6241 1/26/2026

เอกสารไม่ควบคุม

Analyst
Date Started 1/26/2026 9:07 AM GMT: 1/26/2026 2:07 AM
Worksheet Precision Test
Comment
Methods Cu
Computer name DESKTOP-R9UIFRS
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Exp Abs	%RSD	Mean Abs
5 ppm Cu	0.618	0.7	0.6180
Readings			
	0.6145	0.6187	0.6081 0.6168 0.6253 0.6196
	0.6197	0.6195	0.6188 0.6189 1/26/2026

เอกสารไม่ควบคุม

Certificate of Calibration

Certificate No.: 260318-1-BL007-26

Code No.: BL007-26

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 : UAE No.3 Floor : 1 Room : 107

Received Date: April 2, 2026

Date of Calibration : April 3, 2026

Calibration Conditions: Temperature start 21.9 °C end 22.1 °C
Humidity start 60.6 % end 60.1 %
Pressure start 756.6 mmHg end 755.1 mmHg

Calibrated by: Thanachat Chatpahol

Approved by: Suwit Chotnok

Signature: _____

Issued Date: April 7, 2026

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)

เอกสารไม่ควบคุม

Certificate No.: 260318-1-BL007-26

Code No.: BL007-26

Page: 2 of 3

Equipment: Electronic Balance Manufacturer: Mettler Toledo
Model: AB204-S/FACT Readability: 0.0001 g
Serial No.: 1129361010 ID No.: UAE.WAS.002/2552
Max. Capacity: 220 g
Calibration Date: April 3, 2026
Condition As-Received: In Condition

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	C510641605	METTLER TOLEDO GmbH	C510641605	Mettler-Toledo	3-Mar-27

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Traceability	Due Date
Thermo-Hygro-Baro Meter	MHB-382SD	AK.46457	SUCCESS	SG-H-00992/68	Success Gateway	26-Nov-26
Thermo-Hygro-Baro Meter	MHB-382SD	AK.46457	TPA	25P4464	TPA	18-Dec-26

3. This certification is traceable to SI Unit

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

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

6. Through the reference standard laboratory of Mettler-Toledo GmbH C510641605, SAS accreditation number SCS 0032

Calibration Result:

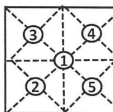
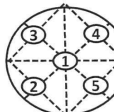
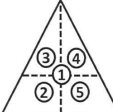
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
200*	0.00010

2. Eccentric or off-center loading

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

The Balance reading obtained is given in the table.

					
1 (g)	2 (g)	3 (g)	4 (g)	5 (g)	Maximum Difference (g)
100.0025	100.0022	100.0022	100.0029	100.0030	0.0005

เอกสารไม่ควบคุม

Certificate No.: 260318-1-BL007-26

Code No.: BL007-26

Page: 3 of 3

Equipment: Electronic Balance
 Model: AB204-S/FACT
 Serial No.: 1129361010
 Max. Capacity: 220 g
 Calibration Date: April 3, 2026

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

Calibrator Result: (Continued)
 Calibrator Range: 0 - 200 g
 Calibrator 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	0.17	2.37
0.01	0.0100005	0.0099	0.0001	0.17	2.32
0.05	0.0500003	0.0499	0.0001	0.17	2.32
0.1	0.1000083	0.0999	0.0001	0.17	2.32
0.5	0.5000121	0.5000	0.0000	0.17	2.32
1.0	1.0000119	1.0000	0.0000	0.17	2.32
10.0	10.000033	10.0003	-0.0003	0.17	2.32
40.0	40.000054	40.0010	-0.0010	0.18	2.23
50.0	50.000037	50.0013	-0.0012	0.18	2.23
80.0	80.000098	80.0020	-0.0019	0.19	2.11
100.0	100.000042	100.0025	-0.0024	0.20	2.10
120.0	120.000068	120.0028	-0.0027	0.22	2.06
150.0	150.000079	150.0035	-0.0035	0.24	2.04
160.0	160.000112	160.0036	-0.0035	0.25	2.03
200.0	200.000146	200.0049	-0.0047	0.28	2.00

4. Effect of Tare test:

Tare Load (g)	Test Load (g)	Indication (g)	Correction (g)
100	20.000028	20.0004	-0.0003
	40.000054	40.0009	-0.0008
	60.000070	60.0013	-0.0012
	80.000098	80.0017	-0.0016
	100.000042	100.0021	-0.0021

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

Certificate of Calibration

Certificate No.: 260311-2-BL002-26

Code No.: BL002-26

Page: 1 of 4

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: XSR205DU
 Serial No.: C009071872
 Asset No.: UAE.WAO.012/2563

Building : UAE number 3 Floor : 2 Room : 208

Received Date: March 11, 2026

Date of Calibration : March 12, 2026

Calibration Conditions: Temperature 23.8 °C to 24.1 °C
 Humidity 50.0 % to 59.0 %
 Pressure 755.5 mmHg to 755.6 mmHg

Calibrated by: Thanachat Chatpahol

Approved by: Suwit Chotnok

Signature: 

Issued Date: March 16, 2026

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)

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Certificate No.: 260311-2-BL002-26

Code No.: BL002-26

Page: 2 of 4

Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C009071872
Max. Capacity: 81 g / 220 g
Calibration Date: March 12, 2026
Condition As-Received: In Condition

Manufacturer: Mettler Toledo
Readability: 0 to 81 (g): 0.01 mg > 80 to 200 (g): 0.1 mg
ID No.: UAE.WAO.012/2563

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	C510641605	METTLER TOLEDO GmbH	C510641605	Mettler-Toledo GmbH	3-Mar-27
Standard Weight Class E2 (OIML)	1 mg to 1 kg	B749109122	AMARC	25-009359	Mettler-Toledo	21-Jan-27

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Traceability	Due Date
Thermo-Hygro-Baro Meter	MHB-382SD	AK.46457	SUCCESS	SG-H-00992/68	Success Gateway	26-Nov-26
Thermo-Hygro-Baro Meter	MHB-382SD	AK.46457	TPA	25P4464	TPA	18-Dec-26

3. This certification is traceable to SI Unit

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

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

6. Through the reference standard laboratory of Mettler-Toledo GmbH C510641605, SAS accreditation number SCS 0032

7. Through the reference standard laboratory of AMARC 25-009359, TISI accreditation number 0152

Calibration Result:

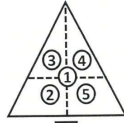
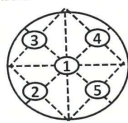
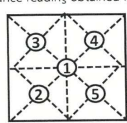
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
80	0.000008
200*	0.000045

2. Eccentric or off-center loading

A mass of 100 g was placed and moved to various positions 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	100.0000	100.0000	100.0000	100.0000	0.0000

เอกสารไม่ควบคุม

Certificate No.: 260311-2-BL002-26

Code No.: BL002-26

Page: 3 of 4

Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C009071872
Max. Capacity: 81 g / 220 g
Calibration Date: March 12, 2026

Manufacturer: Mettler Toledo
Readability: 0 to 81 (g): 0.01 mg > 80 to 200 (g): 0.1 mg
ID No.: UAE.WAO.012/2563

Calibration Result: (Continued)

Calibration Range: 0 to 80 (g)

Calibration Adjustment: Internal Calibration

3. Error of indication from nominal or conventional mass value: (Range: 0 to 81 (g); Resolution: 0.00001 g)

Nominal Value (g)	Reference Value (g)	Indication (g)	Correction (g)	Uncertainty (± mg)	Coverage Factor k
Unload	0.0000000	0.0000	0.0000	0.015	2.25
0.001	0.0010020	0.0010	0.00000	0.015	2.23
0.005	0.0050025	0.0050	-0.00002	0.015	2.23
0.01	0.0100005	0.0100	-0.00002	0.015	2.23
0.05	0.0500003	0.0500	-0.00001	0.015	2.21
0.10	0.1000083	0.1000	-0.00001	0.015	2.20
0.50	0.5000121	0.5000	-0.00002	0.016	2.15
1	1.0000119	1.0000	0.00000	0.016	2.12
2	2.0000125	2.0000	-0.00001	0.017	2.09
5	5.0000146	5.0000	-0.00002	0.020	2.05
10	10.0000330	10.0001	-0.00002	0.023	2.00
20	20.000028	20.0001	-0.00005	0.033	2.00
30	30.000061	30.0001	-0.00004	0.051	2.00
40	40.000054	40.0001	-0.00004	0.063	2.00
50	50.000037	50.0001	-0.00005	0.064	2.00
60	60.000070	60.0001	-0.00004	0.081	2.00
80	80.000098	80.0001	-0.00001	0.11	2.00

เอกสารไม่ควบคุม

Certificate No.: 260311-2-BL002-26

Code No.: BL002-26

Page: 4 of 4

Calibration Certificate

Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C009071872
Max. Capacity: 81 g / 220 g
Calibration Date: March 12, 2026

Manufacturer: Mettler Toledo
Readability: 0 to 81 (g): 0.01 mg > 80 to 200 (g) : 01 mg
ID No.: UAE.WAO.012/2563

Calibration Result: (Continued)
Calibration Range: > 80 to 200 (g)
Calibration Adjustment: Internal Calibration

3. Error of indication from nominal or conventional mass value: (Range: > 80 to 200 (g) ; Resolution: 0.0001 g)

Nominal Value (g)	Reference Value (g)	Indication (g)	Correction (g)	Uncertainty ($\pm$ mg)	Coverage Factor <i>k</i>
Unload	0.0000000	0.0000	0.0000	0.02	2.25
90	90.0000910	90.0000	0.0000	0.16	2.00
100	100.0000420	100.0000	0.0000	0.16	2.00
110	110.0000750	110.0000	0.0000	0.17	2.00
120	120.0000680	120.0000	0.0001	0.18	2.00
130	130.0001010	130.0000	0.0000	0.20	2.00
140	140.0000960	140.0003	0.0001	0.21	2.00
150	150.0000790	150.0003	0.0001	0.21	2.00
160	160.0001120	160.0003	0.0001	0.23	2.00
170	170.0001050	170.0003	-0.0002	0.24	2.00
200	200.0001460	200.0004	-0.0002	0.26	2.00

4. Effect of Tare test:

Tare Load (g)	Test Load (g)	Indication (g)	Correction (g)
100	20.000028	20.0000	0.0000
	40.000054	40.0002	-0.0001
	60.000070	60.0002	-0.0001
	80.000098	80.0002	-0.0001
	100.000042	100.0003	-0.0002

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

เอกสารไม่ควบคุม

Certificate No.:

2503287-001-01

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: Autoclave

Manufacturer: ALP

Model: CL-40L

Serial No.: 810010

ID No.: UAE.MIC.032/2565

Order No.: 2503287

Operation No.: 2503287-001

Date of Receipt: 5 June 2025

Date of Calibration: 5 June 2025

Calibrated by

Mr.Pheraphat Tuanjit
Scientist

Approved by

(Miss Preeyaporn Jaengkarnkit)

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

Date of Issue: 11 June 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

2008 ซอยอุรุพงษ์ 36 ถนนอุรุพงษ์ แขวงบางยี่สิบ เขตบางพลี กรุงเทพมหานคร 10700
2008 Soi 36, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8688 Fax: +66(0) 2422 8545

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nfi.or.th

Calibration Report

Certificate No.: 2503287-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 810010
Resolution: 1 °C ID No.: UAE.MIC.032/2565
Manufacturer: ALP
Date of Calibration: 5 June 2025

Page 2 of 3

Location: Room 301 Media Preparation, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Environment Condition: Ambient Temperature (26 ± 1) °C
Relative Humidity (55 ± 5) %
Line Voltage (230 ± 5) Volt

Condition of this results of Calibration:

- 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.

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with RTD (Data Logger)	HiTemp140-PT	T20627	NC-25-03-18-181	11-Mar-26	MADGETECH, INC.
	OM-CP-HITEMP-140	R56916	2502081-002-01	11-Mar-26	NATIONAL FOOD INSTITUTE
	PRTemp140	R38546	2501835-001-01	22-Feb-26	NATIONAL FOOD INSTITUTE

- 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.
- This standard does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical.
- Condition of Calibrated item : Good

UUC Description : Setting program function sterilization : STERILIZE/NORMAL
Time of sterilization 20 Minute At 115 and 121 °C

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



Calibration Report

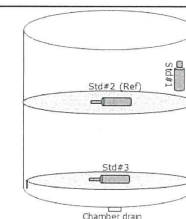
Certificate No.: 2503287-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 810010
Resolution: 1 °C ID No.: UAE.MIC.032/2565
Manufacturer: ALP
Date of Calibration: 5 June 2025

Page 3 of 3

Calibration point: 115 and 121 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	25.8	50	225
Max	26.8	59	235



Standard at Position

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	115.46	115.43	115.42	0.70
121	121.59	121.54	121.51	0.70

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	115	115	115	0.08	0.24	0.17	0.50
121	121	121	121	0.12	0.24	0.19	0.52

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 -----





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert. No.: 25TM1001
Page : 1 of 3

Equipment : BOD Incubator
Manufacturer : ARCO
Model : UC4-1320
Serial No. : -
ID No. : UAE.WAO.018/2559
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 : 07 July 2025
Calibration Date : 07 July 2025
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Man Pattanapongpaiboon

Approved by :

Approved Signatory

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

Issue Date : 17 July 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.

เอกสารไม่ควบคุม



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2507-0146OC-2

Cert. No.: 25TM1001
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	MY59003411	24LM192	TPA	24 Dec 2025

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

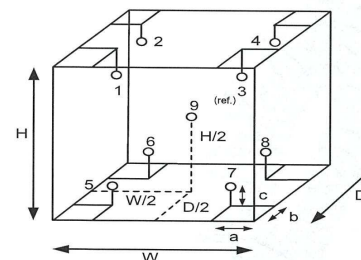
3. This measurement result is traceable to the International System of Unit maintained through :

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	28
REL.Humid. (%)	54	57
AC Supply (Volt)	224	226

Position :	Ref. Std. ID No.:
1	25-20RTD-2/1
2	25-20RTD-2/2
3	25-20RTD-2/3
4	20RTD-2/4
5	20RTD-2/5
6	20RTD-2/6
7	20RTD-2/7
8	20RTD-2/8
9 (ref.)	20RTD-2/9

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

เอกสารไม่ควบคุม



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2507-0146OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 25TM1001
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>
20.0	20.0	19.9	0.18	0.60	0.83	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.202	19.900	20.390	20.077	20.111	20.044	20.275	20.173	19.835	0.38

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

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

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

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

UUC* : Unit Under Calibration

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

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

-o0o-

เอกสารไม่ควบคุม



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.: 26TW50
Page.: 1 of 2

Equipment : DO Meter
Manufacturer : YSI
Model : 5100
Serial No. : 11B 101863
ID No. : UAE.WAO.004/2554
Received Date : 27 February 2026
Test Date : 02 March 2026
Reference : 2602-0915DSC-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 : 03 March 2026

เอกสารไม่ควบคุม



Cert.No.: 26TW50
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

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

<u>Instruments</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1. Burette	130BU10	25CG1126	18 Mar 2027
2. Balance	110RC001	25MM316	02 July 2026

2. Standard Material :-

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

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

<u>Titration Method</u> (Azide Modification Method) (mg/L)	<u>DO Meter</u> <u>Reading</u> (mg/L)	<u>Standard Deviation</u> (mg/L)
8.20	8.20	0.0084

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

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เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert.No.: 26CH235
Page.: 1 of 3

Equipment : Conductivity Meter
Manufacturer : Horiba
Model : LAQUA-EC210
Serial No. : HC9L0015
ID No. : UAE.EFM.010/2563(EFM.SCT.04/63)
Condition As-Received: Used Item
Received Date : 24 February 2026
Calibration Date : 26 February 2026
Reference : 2602-0799WSC-2
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure: In -house method :
- CP-CH6 by direct measurement
with certified reference material (CRM)
- CP-CH8 by comparison with temperature standard
Calibrated by : Walalak Sirithean
Approved by : _____
Approved Signatory
() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saithip Meangmai
Issue Date : 27 February 2026

The Uncertainties are for a confidence probability of approximately 95%

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



Cert.No.: 26CH235

Page.: 2 of 3

Condition of this result of calibration

1. Reference Standard Instrument :-

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1) Thermometer	9549224	130RC003	25I440	16 Apr 2026
2) Ref. Std. Thermometer	4982054	110RC044	25I708	03 July 2026

- This measurement result is traceable to SI through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Conductivity Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
1413.3 μ S/cm	CPA Chem	1187337	18 Jan 2027
12.882 mS/cm	CPA Chem	1135362	16 Aug 2026

- Control Conductivity calibration solution temperature by Water bath (25 ± 0.1) °C

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1413.3 μ S/cm

Conductivity Electrode Serial No.: 9B9F0277

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement ($\pm$)	Coverage factor k
1413.3 μ S/cm	1462 μ S/cm	1413 μ S/cm	9.2 μ S/cm	2.00
12.882 mS/cm	13.25 mS/cm	12.81 mS/cm	0.086 mS/cm	2.00

Remark : - UUC* = Unit Under Calibration



Cert.No.: 26CH235

Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model :	9383
- Serial No. :	9B9F0277

Dimension of probe;

- Length :	110 mm
- Diameter :	16 mm
- Immersion Depth :	90 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement ($\pm$ °C)	Coverage factor k
15.0	15.002	15.0	-0.002	0.13	2.00
30.0	30.001	30.0	-0.001	0.13	2.00
45.0	45.001	45.0	-0.001	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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Certificate of Calibration

Cert.No.: 26CH144

Page.: 1 of 3

Equipment : Conductivity Meter
Manufacturer : Horiba
Model : LAQUA-EC210
Serial No. : HC9L0013
ID No. : UAE.EFM.011/2563(EFM.SCT.05/63)
Condition As-Received: Used Item
Received Date : 02 February 2026
Calibration Date : 03 February 2026
Reference : 2602-0038WSC-3
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure: In -house method :
- CP-CH6 by direct measurement
with certified reference material (CRM)
- CP-CH8 by comparison with temperature standard
Calibrated by : Walalak Sirithean
Approved by : _____
() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saithip Meangmai
Issue Date : 04 February 2026

Approved Signatory

Condition of this result of calibration

1. Reference Standard Instrument :-

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1) Thermometer	9549224	130RC003	25I440	16 Apr 2026
2) Ref. Std.Thermometer	4982054	110RC044	25I708	03 July 2026

- This measurement result is traceable to SI through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Conductivity Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
1413.5 µS/cm	CPA Chem	1150497	30 Oct 2026
12.881 mS/cm	CPA Chem	1081099	11 Mar 2026

- Control Conductivity calibration solution temperature by Water bath (25 ± 0.1) °C

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1413.5 µS/cm

Conductivity Electrode Serial No.: 9B9F0286

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
1413.5 µS/cm	1431 µS/cm	1413 µS/cm	9.2 µS/cm	2.00
12.881 mS/cm	12.92 mS/cm	12.76 mS/cm	0.086 mS/cm	2.00

Remark : - UUC* = Unit Under Calibration

The Uncertainties are for a confidence probability of approximately 95%

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



Cert.No.: 26CH144
Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9383
- Serial No. : 9B9F0286

Dimension of probe;

- Length : 110 mm
- Diameter : 16 mm
- Immersion Depth : 100 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)	Coverage factor k
15.0	15.002	15.0	-0.002	0.13	2.00
30.0	30.001	30.0	-0.001	0.13	2.00
45.0	45.001	45.0	-0.001	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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



Calibration Certificate

Certificate No.: 2602300-001-01

Page : 1 of 2

Equipment: CHAMBER (Hot Air Oven)
Manufacturer: MEMMERT
Model: UF55
Serial No.: B212.0411
ID No.: UAE.WAO.005/2556
Order No.: 2602300
Operation No.: 2602300-001
Date of Receipt: 11 March 2026
Date of Calibration: 11 March 2026

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

Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

Metrological traceability:

1. Calibration Method:

- This instrument was calibrated by inserting 9 standard thermometers into its chamber, in accordance with 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 in this laboratory is the International Temperature Scale of 1990 (ITS-90).
- All data shown below are final values, and the initial data may be obtained upon request.

2. Reference Standard Instrument:

Instrument	Model/Type	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A RTD	MY59002902 CH#201-209/ RTD#201-209	2502797-002-01	3 May 2026	NATIONAL FOOD INSTITUTE

3. This certificate is traceable to the International System of Units (SI).

4. This certificate is valid only for the instrument that was calibrated.

5. The result of this calibration was found to be accurate only on the date and at the place of calibration shown.

Calibrated by Mr.Manas Somsak
Specialist

Approved by
(Mr.Pheraphat Tuanjit)

Manager, Division of Calibration Laboratory

Date of Issue: 18 March 2026

Responsible for the Technical Management Team

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: 02 Date: 01-10-68

2008 ๒๕๖๑ ๒๕๖๒ ๒๕๖๓ ๒๕๖๔ ๒๕๖๕ ๒๕๖๖ ๒๕๖๗ ๒๕๖๘ ๒๕๖๙ ๒๕๗๐ ๒๕๗๑ ๒๕๗๒ ๒๕๗๓ ๒๕๗๔ ๒๕๗๕ ๒๕๗๖ ๒๕๗๗ ๒๕๗๘ ๒๕๗๙ ๒๕๘๐ ๒๕๘๑ ๒๕๘๒ ๒๕๘๓ ๒๕๘๔ ๒๕๘๕ ๒๕๘๖ ๒๕๘๗ ๒๕๘๘ ๒๕๘๙ ๒๕๙๐ ๒๕๙๑ ๒๕๙๒ ๒๕๙๓ ๒๕๙๔ ๒๕๙๕ ๒๕๙๖ ๒๕๙๗ ๒๕๙๘ ๒๕๙๙ ๒๖๐๐ ๒๖๐๑ ๒๖๐๒ ๒๖๐๓ ๒๖๐๔ ๒๖๐๕ ๒๖๐๖ ๒๖๐๗ ๒๖๐๘ ๒๖๐๙ ๒๖๑๐ ๒๖๑๑ ๒๖๑๒ ๒๖๑๓ ๒๖๑๔ ๒๖๑๕ ๒๖๑๖ ๒๖๑๗ ๒๖๑๘ ๒๖๑๙ ๒๖๒๐ ๒๖๒๑ ๒๖๒๒ ๒๖๒๓ ๒๖๒๔ ๒๖๒๕ ๒๖๒๖ ๒๖๒๗ ๒๖๒๘ ๒๖๒๙ ๒๖๓๐ ๒๖๓๑ ๒๖๓๒ ๒๖๓๓ ๒๖๓๔ ๒๖๓๕ ๒๖๓๖ ๒๖๓๗ ๒๖๓๘ ๒๖๓๙ ๒๖๔๐ ๒๖๔๑ ๒๖๔๒ ๒๖๔๓ ๒๖๔๔ ๒๖๔๕ ๒๖๔๖ ๒๖๔๗ ๒๖๔๘ ๒๖๔๙ ๒๖๕๐ ๒๖๕๑ ๒๖๕๒ ๒๖๕๓ ๒๖๕๔ ๒๖๕๕ ๒๖๕๖ ๒๖๕๗ ๒๖๕๘ ๒๖๕๙ ๒๖๖๐ ๒๖๖๑ ๒๖๖๒ ๒๖๖๓ ๒๖๖๔ ๒๖๖๕ ๒๖๖๖ ๒๖๖๗ ๒๖๖๘ ๒๖๖๙ ๒๖๗๐ ๒๖๗๑ ๒๖๗๒ ๒๖๗๓ ๒๖๗๔ ๒๖๗๕ ๒๖๗๖ ๒๖๗๗ ๒๖๗๘ ๒๖๗๙ ๒๖๘๐ ๒๖๘๑ ๒๖๘๒ ๒๖๘๓ ๒๖๘๔ ๒๖๘๕ ๒๖๘๖ ๒๖๘๗ ๒๖๘๘ ๒๖๘๙ ๒๖๙๐ ๒๖๙๑ ๒๖๙๒ ๒๖๙๓ ๒๖๙๔ ๒๖๙๕ ๒๖๙๖ ๒๖๙๗ ๒๖๙๘ ๒๖๙๙ ๒๗๐๐ ๒๗๐๑ ๒๗๐๒ ๒๗๐๓ ๒๗๐๔ ๒๗๐๕ ๒๗๐๖ ๒๗๐๗ ๒๗๐๘ ๒๗๐๙ ๒๗๑๐ ๒๗๑๑ ๒๗๑๒ ๒๗๑๓ ๒๗๑๔ ๒๗๑๕ ๒๗๑๖ ๒๗๑๗ ๒๗๑๘ ๒๗๑๙ ๒๗๒๐ ๒๗๒๑ ๒๗๒๒ ๒๗๒๓ ๒๗๒๔ ๒๗๒๕ ๒๗๒๖ ๒๗๒๗ ๒๗๒๘ ๒๗๒๙ ๒๗๓๐ ๒๗๓๑ ๒๗๓๒ ๒๗๓๓ ๒๗๓๔ ๒๗๓๕ ๒๗๓๖ ๒๗๓๗ ๒๗๓๘ ๒๗๓๙ ๒๗๔๐ ๒๗๔๑ ๒๗๔๒ ๒๗๔๓ ๒๗๔๔ ๒๗๔๕ ๒๗๔๖ ๒๗๔๗ ๒๗๔๘ ๒๗๔๙ ๒๗๕๐ ๒๗๕๑ ๒๗๕๒ ๒๗๕๓ ๒๗๕๔ ๒๗๕๕ ๒๗๕๖ ๒๗๕๗ ๒๗๕๘ ๒๗๕๙ 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Calibration Certificate

Certificate No.: 2602300-001-01

Page : 2 of 2

Calibration Condition:

Equipment: CHAMBER (Hot Air Oven) Place of Calibration: Laboratory
UUC* Resolution: 0.1 °C UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Condition of the item: Normal & Good Environment Conditions: Ambient Temperature (29.8 ± 1.0) °C
Without adjustment / As Found Relative Humidity (47.8 ± 4) %
- Time of record 1 hour 9 minute / point Line Voltage (222 ± 3) V.

Calibration Results:

Table1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Measurement Uncertainty (±°C)
104.0	104.22	103.87	103.90	104.17	103.56	103.58	104.22	104.17	104.00	0.53
120.0	120.21	119.76	119.86	120.18	119.53	119.58	120.24	120.20	119.96	0.73
180.0	180.27	179.37	179.73	180.31	178.91	179.13	180.35	180.25	179.84	0.90

Table 2 : Reporting of Characterization Results

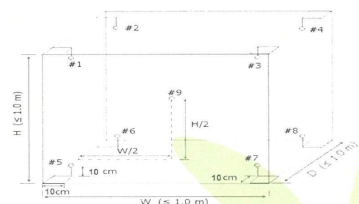
UUC* Setting (°C)	Max	UUC* Reading (°C) Min	Average	Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
104.0	104.0	104.0	104.0	0.05	0.44	0.75
120.0	120.0	120.0	120.0	0.06	0.43	0.79
180.0	180.0	180.0	180.0	0.07	0.93	1.56

Note

- UUC* : Unit Under Calibration
- The quoted uncertainty includes contributions from 'Stability' and 'Loading Effect' (20% of Temperature Uniformity).
- 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.

For more information, details of the sensor installation should be reported.

Fresh air Damper	- Open	- Position
	X Close	100% Fan speed
	- Not Available	
Dimension of inside chamber and sensor installation location (cm)		
W x H x D	40 x 40 x 33	
a x b x c	10 x 10 x 10	



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 of Report -----



Calibration Certificate

Certificate No.: 2602303-006-01

Page : 1 of 2

Equipment: CHAMBER (Incubator)
Manufacturer: BINDER
Model: KB 400
Serial No.: 2020000015535
ID No.: UAE.MIC.018/2564
Order No.: 2602303
Operation No.: 2602303-006
Date of Receipt: 11 March 2026
Date of Calibration: 11 March 2026
Customer Name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhnong, Bangkok 10260

Metrological traceability:

1. Calibration Method:

- This instrument was calibrated by inserting 9 standard thermometers into its chamber, in accordance with 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 in this laboratory is the International Temperature Scale of 1990 (ITS-90).
- All data shown below are final values, and the initial data may be obtained upon request.

2. Reference Standard Instrument:

Instrument	Model/Type	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	DAQ973A RTD	MY59008964 CH#201-209/ RTD#201-209	2502244-001-01	29 March 2026	NATIONAL FOOD INSTITUTE

- This certificate is traceable to the International System of Units (SI).
- This certificate is valid only for the instrument that was calibrated.
- The result of this calibration was found to be accurate only on the date and at the place of calibration shown.

Calibrated by Mr.Nuttapol Niyomchat
Specialist

Date of Issue: 19 March 2026

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

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 Certificate

Certificate No.: 2602303-006-01

Page : 2 of 2

Calibration Condition:

Equipment: CHAMBER (Incubator) Place of Calibration: Microbiology Laboratory
UUC* Resolution: 0.1 °C UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD
Condition of the item: Normal & Good Environment Conditions: Ambient Temperature (17.2 ± 1) °C
Without adjustment / As Found Relative Humidity (51.5 ± 4) %
- Time of record 1 hour 9 minute / point Line Voltage (229 ± 2) V.

Calibration Results:

Table1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Measurement Uncertainty (±°C)
35.0	34.78	34.86	34.81	34.83	35.22	35.21	35.22	35.12	34.83	0.28

Table 2 : Reporting of Characterization Results

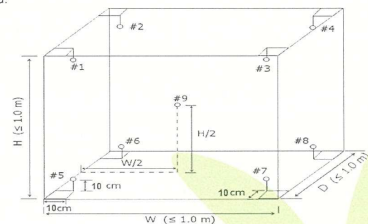
UUC* Setting (°C)	Max	UUC* Reading (°C) Min	Average	Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
35.0	35.0	35.0	35.0	0.034	0.39	0.52

Note

- UUC* : Unit Under Calibration
- The quoted uncertainty includes contributions from 'Stability' and 'Loading Effect' (20% of Temperature Uniformity).
- 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.

For more information, details of the sensor installation should be reported.

Fresh air Damper	-	Open	-	Position
	X	Close	100%	Fan speed
	-	Not Available		
Dimension of inside chamber and sensor installation location (cm)				
W x H x D	65	x	125	x 48
a x b x c	10	x	10	x 10



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 of Report -----



Calibration Certificate

Certificate No.: 2602303-001-01

Page : 1 of 2

Equipment: CHAMBER (Incubator)
Manufacturer: MEMMERT
Model: IPP260
Serial No.: V615.0187
ID No.: UAE.MIC.003/2559
Order No.: 2602303
Operation No.: 2602303-001
Date of Receipt: 11 March 2026
Date of Calibration: 11 March 2026

Customer Name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udumsuk 41, Sukhumvit Road, Bangchack, Prakanong, Bangkok 10260

Metrological traceability:

1. Calibration Method:

- This instrument was calibrated by inserting 9 standard thermometers into its chamber, in accordance with 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 in this laboratory is the International Temperature Scale of 1990 (ITS-90).
- All data shown below are final values, and the initial data may be obtained upon request.

2. Reference Standard Instrument:

Instrument	Model/Type	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	DAQ973A RTD	MY59008964 CH#101-109/ RTD#101-109	2502244-001-01	29 March 2026	NATIONAL FOOD INSTITUTE

- This certificate is traceable to the International System of Units (SI).
- This certificate is valid only for the instrument that was calibrated.
- The result of this calibration was found to be accurate only on the date and at the place of calibration shown.

Calibrated by Mr.Nuttapol Niyomchat Specialist

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

Date of Issue: 19 March 2026

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 Certificate

Certificate No.: 2602303-001-01

Page : 2 of 2

Calibration Condition:

Equipment: CHAMBER (Incubator) Place of Calibration: Microbiology Laboratory
UUC* Resolution: 0.1 °C UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD
Condition of the item: Normal & Good Environment Conditions: Ambient Temperature (17.2 ± 1) °C
Without adjustment / As Found Relative Humidity (51.5 ± 4) %
- Time of record 1 hour 9 minute / point Line Voltage (229 ± 2) V.

Calibration Results:

Table1 : Reporting of Temperature

Calibration Point (°C)	Std.#1	Std.#2	Std.#3	Std.#4	Std.#5	Std.#6	Std.#7	Std.#8	Std.#9	Measurement Uncertainty (±°C)
35.0	35.01	34.94	35.20	35.15	35.26	34.99	34.79	34.83	35.02	0.28

Table 2 : Reporting of Characterization Results

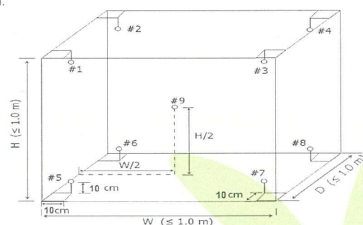
UUC* Setting (°C)	Max	UUC* Reading (°C) Min	Average	Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
35.0	35.0	35.0	35.0	0.069	0.24	0.53

Note

- UUC* : Unit Under Calibration
- The quoted uncertainty includes contributions from 'Stability' and 'Loading Effect (20% of Temperature Uniformity).
- 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.

For more information, details of the sensor installation should be reported.

Fresh air Damper	- Open	- Position
	X Close	100% Fan speed
	- Not Available	
Dimension of inside chamber and sensor installation location (cm)		
W x H x D	64 x 80 x 50	
a x b x c	10 x 10 x 10	



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 of Report -----

Certificate of Calibration

Cert.No.: 26CH231

Page.: 1 of 3

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA9M0047
ID No. : UAE.EFM.005/2563 (EFM.pH.05/63)
Condition As-Received: Used Item
Received Date : 24 February 2026
Calibration Date : 26 February 2026
Reference : 2602-0796WSC-2
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage
standard and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by : Walalak Sirirthean

Approved by : _____
Approved Signatory

() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 27 February 2026

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.



Cert.No.: 26CH231
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	25E2743	25 Aug 2026
2) Ref. Standard Thermometer	4982054	110RC044	25I708	03 July 2026

- This measurement result is traceable to SI through Technology Promotion Association (Thailand - Japan)

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	1187328	18 Jan 2028
pH 7.000	Hach Lenge GmbH	C03319	17 Oct 2027
pH 10.010	CPA chem	1187332	18 Jan 2027

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: HA9M0047	4.00	177.48	177.3	4.01	0.058	2.00
	7.00	0.00	0.0	7.02	0.058	2.00
	7.00	0.00	0.0	7.02	0.058	2.00
	10.00	-177.48	-177.2	10.01	0.058	2.00



Cert.No.: 26CH231
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor k
pH Electrode S/N.: -	4.008	4.01	161.1	0.0079	2.00
	7.000	7.00	-10.4	0.0096	2.00
	7.000	7.00	-9.9	0.0095	2.00
	10.010	10.02	-177.9	0.0095	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -

- Serial No. : -

Dimension of probe

- Length : 103 mm.

- Diameter : 16 mm.

- Immersion Depth : 90 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
15.0	15.001	15.0	-0.001	0.13	2.00
30.0	30.001	30.0	-0.001	0.13	2.00
45.0	45.001	44.9	-0.101	0.13	2.00

Remark - UUC* = Unit Under Calibration

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert. No.: 26TM194

Page : 1 of 3

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L416.0612
ID No. : MIC.003/2560
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory (302)
Received Order : 02 February 2026
Calibration Date : 02 February 2026
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by :

Krisda Malee

Approved by :

Approved Signatory

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

Issue Date :

17 February 2026

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.

เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2602-0004OC-2

Cert. No.: 26TM194

Page : 2 of 3

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

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	MY57013711	25LM117	TPA	17 Jul 2026

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

3. This measurement result is traceable to the International System of Unit maintained through :

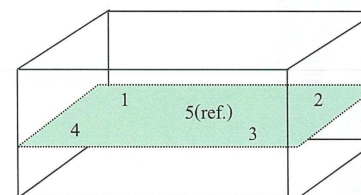
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	25	52	221
Finished of Calibration	24	51	220



Front

Position :	Ref. Std. ID No.:
1	4803988-001
2	4803988-002
3	4803988-003
4	4803988-004
5(ref.)	4803988-005

เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2602-0004OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 26TM194
Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			Position					
			1	2	3	4	5 (ref.)	
44.5	44.6	44.6	44.518	44.463	44.472	44.508	44.521	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor <i>k</i>
44.5	0.11	0.044	2

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

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.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

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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