

ภาคผนวก ง

เอกสารสอบเทียบเครื่องมือ

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# ภาคผนวก ง-1

## เอกสารเครื่องมือตรวจวัด

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## 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
<b>Ambient</b>									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Tisch Environmental, Inc.	TE-5025A 3383	Jiranatee Associates Co., Ltd.	COF-039-67	27 Sep 24	26 Sep 25	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Dwyer	121-36-W/M -	Technology Promotion Association (Thailand-Japan)	25P112	19 Feb 25	18 Feb 26	-
3	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24P1856	4 Jun 24	3 Jun 25	-
4	Digital Thermo - Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Digicon	TH-02 435031148	Technology Promotion Association (Thailand-Japan)	24H1487	15 Jul 24	14 Jul 25	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050148	UAE Consultant Co., Ltd.	20092024	20 Sep 24	19 Sep 25	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050149	UAE Consultant Co., Ltd.	17092024	17 Sep 24	16 Sep 25	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050150	UAE Consultant Co., Ltd.	17092024	17 Sep 24	16 Sep 25	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778105	UAE Consultant Co., Ltd.	26092024	26 Sep 24	25 Sep 25	-
9	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05N91E15A0014	6 Jun 23	6 Jun 31	-
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387061	UAE Consultant Co., Ltd.	06092024	6 Sep 24	5 Sep 25	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387063	UAE Consultant Co., Ltd.	19062024	19 Jun 24	18 Jun 25	-
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387065	UAE Consultant Co., Ltd.	06092024	6 Sep 24	5 Sep 25	-
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920014	UAE Consultant Co., Ltd.	04092024	4 Sep 24	3 Sep 25	-
14	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05N91E15A0014	6 Jun 23	6 Jun 31	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
15	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201497733	UAE Consultant Co.,Ltd.	14062024	14 Jun 24	13 Jun 25	-
16	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201778117	UAE Consultant Co.,Ltd.	09092024	9 Sep 24	8 Sep 25	-
17	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201778118	UAE Consultant Co.,Ltd.	12122024	12 Dec 24	11 Dec 25	-
18	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201778119	UAE Consultant Co.,Ltd.	06122024	6 Dec 24	5 Dec 25	-
19	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05N91E15A0014	6 Jun 23	6 Jun 31	-
20	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DT0072	Thai Meteorological Department	001/25	3 Jan 25	2 Jan 26	-
21	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0113	Thai Meteorological Department	002/25	3 Jan 25	2 Jan 26	-
22	Wind Speed/Wind Direction	WS/WD	LSI Lastern	DNA202/E-LOG BQ1705627/17037708	Jiranaatee Associates Co., Ltd.	CW5-027-67	7 Aug 24	6 Aug 25	-
23	Wind Speed/Wind Direction	WS/WD	LSI Lastern	DNA202/E-LOG BQ1705626/17037713	Jiranaatee Associates Co., Ltd.	CW5-028-67	7 Aug 24	6 Aug 25	-
24	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	01dB	CAL31 84065	Innovative Instrument Co.,Ltd.	24-ACT-087	25 Jun 24	24 Jun 25	-
25	Sound Level Meter	$L_{Aeq} 24 \text{ hrs}$ , $L_{Aeq} 1 \text{ hr}$ , $L_{Amax}$ , $L_{A90}$ , $L_{A10}$	Larson Davis	LxT2 0005396	Electrical And Electronics Institute Foundation For Industrial Development	CP20240291EA	5 Aug 24	4 Aug 25	-
26	Sound Level Meter	$L_{Aeq} 24 \text{ hrs}$ , $L_{Aeq} 1 \text{ hr}$ , $L_{Amax}$ , $L_{A90}$ , $L_{A10}$	Larson Davis	LxT2 0005398	Innovative Instrument Co.,Ltd.	24-SLM-214	2 Jul 24	1 Jul 25	-
27	Sound Level Meter	$L_{Aeq} 24 \text{ hrs}$ , $L_{Aeq} 1 \text{ hr}$ , $L_{Amax}$ , $L_{A90}$ , $L_{A10}$	Larson Davis	LxT2 0005399	Electrical And Electronics Institute Foundation For Industrial Development	CP20240293EA	6 Aug 24	5 Aug 25	-

### List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
<b>Stack</b>									
1	Pre-Test Console	Total Suspended Particulate Hydrogen Chloride	Apex Instruments, USA.	XC-572-V 0707048	Envl Equipment Service Co., Ltd.	E24-060049	25 Jun 24	24 Jun 25	-
2	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide Carbon Monoxide	Testo	Testo 350 60899615	Entech Industrial Sulation Co., Ltd.	G 670490	17 Jul 24	16 Jul 25	-

### List of Opacity Training Certification for Opacity Mesurement

No.	Name	Training Couse	Train	Date	Remark
1	Mr.Apiwich Toungttee	Opacity	Pollution Control Department	12-13 March 2015	-
2	Mr.Kannikorn Raso	Opacity	Pollution Control Department	30-31 March 2017	-

### List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
<b>Water</b>									
1	pH Meter	pH	Horiba	LAQUA-PH210 HA1G0008	Technology Promotion Association (Thailand-Japan)	24CH1153/1	18 Sep 24	17 Sep 25	-
2	DO Meter	DO	Horiba	LAQUA-DO210 HE1D0010	Technology Promotion Association (Thailand-Japan)	24TW200	18 Sep 24	17 Sep 25	-
3	Conductivity Meter	Conductivity	YSI	Pro30 17A102921	Technology Promotion Association (Thailand-Japan)	24CH1158	18 Sep 24	17 Sep 25	-



NSC – TISI – TIS 17025  
CALIBRATION 0367

## CERTIFICATE OF CALIBRATION

Certificate No. : COF-039-67

MEASUREMENT ITEM : Top Load Orifice  
MANUFACTURER : TISCH  
MODEL/TYPE : TE-5025A  
SERIAL NUMBER : 3383  
ID NUMBER : UAE.EFM.063/2560  
CONDITION AS-RECEIVED : Used Item  
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong,  
Bangkok 10260

RECEIVED DATE : 16 Sep 2024  
MEASUREMENT DATE : 27 Sep 2024  
ISSUE DATE : 27 Sep 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature :  $23.0 \pm 3.0$  °C  
Relative Humidity :  $55.0 \pm 15.0$  %RH  
Atmospheric Pressure :  $1010 \pm 10$  hPa

### CALIBRATION CONDITION:

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

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

### TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphon



Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

*(Signature)*

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

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Continuation of Certificate of Calibration Number COF-039-67

Page 2 of 2 Pages

### 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 <sup>3</sup> /min	Pressure [Pa] mmHg	Temperature [T <sub>a</sub> ] °C	Temperature [T <sub>m</sub> ] °C	Δp_orifice mmHg	Δp_orifice inH <sub>2</sub> O	γ	Standard Flow [Q <sub>s</sub> ] m <sup>3</sup> /min
1	0.703	758.131	23.92	22.49	56.556	1.738	1.319	0.654
2	1.000	758.205	23.70	22.81	63.034	3.473	1.865	0.920
3	1.121	758.284	23.64	22.69	42.633	4.642	2.157	1.064
4	1.167	758.274	23.64	22.65	31.359	5.197	2.282	1.123
5	1.409	758.325	24.00	23.14	30.402	7.654	2.768	1.357

Slope (m): 2.05577

Intercept (b): -0.02807

Correlation coefficient (r): 0.99985

Uncertainty (k=2): 0.015 m<sup>3</sup>/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m <sup>3</sup> /min	Pressure [Pa] mmHg	Temperature [T <sub>a</sub> ] °C	Temperature [T <sub>m</sub> ] °C	Δp_orifice mmHg	Δp_orifice inH <sub>2</sub> O	γ	Standard Flow [Q <sub>s</sub> ] m <sup>3</sup> /min
1	0.703	758.131	23.92	22.49	56.556	1.738	0.825	0.653
2	1.000	758.205	23.70	22.81	63.034	3.473	1.166	0.920
3	1.121	758.284	23.64	22.69	42.633	4.642	1.348	1.061
4	1.167	758.274	23.64	22.65	31.359	5.197	1.426	1.123
5	1.409	758.325	24.00	23.14	30.402	7.654	1.732	1.357

Slope (m): 1.28763

Intercept (b): -0.01756

Correlation coefficient (r): 0.99985

Uncertainty (k=2): 0.015 m<sup>3</sup>/min

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



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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484

## Certificate of Calibration

Certificate No.: 25P112  
Page: 1 of 2

Equipment: U-Tube Manometer  
Manufacturer: Dwyer  
Model: 121-36-W/M  
Serial No.:  
ID No.: UAE.EFM.181/2561  
Condition As-Received: Used Item  
Received Date: 10 February 2025  
Calibration Date: 19 February 2025

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except with the prior written approval of the head of  
Corporate Services 3: Equipment Calibration and Testing Services.

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

Reference: 2502-0083WSC  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1012 mbar  
81 Soi Udornasuk 41, Sukhumvit Road, Bangkok,  
Phrakhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments  
Standard according to in-house calibration procedure CP-P04, using "DKD-R 6-1 : Calibration of Pressure  
Gauges, Edition 03/2014 " as a guidelines.

### Condition of this result of calibration

1. Reference standards instruments :

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

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

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Nopparat Phongam  
Issue Date: 21 February 2025

Approved Signatory: Altapol P.  
[ ] Phalinee Prabpaijal  
[ ] Sura Suwanasri  
[x] Altapol Panurach

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B 0250406



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

Result of calibration:- Without adjustment  
Function:- Pressure Measurement  
Increasing Pressure  
Range: 0 inH<sub>2</sub>O to 36 inH<sub>2</sub>O  
Scale Interval: 0.1 inH<sub>2</sub>O (The Fifth Estimate )

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

The uncertainty of measurement was ± 0.11 inH<sub>2</sub>O

\* UUC = Unit Under Calibration

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

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

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Altapol P.  
เอกสารไม่ควบคุม  
a 1037943



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



## Certificate of Calibration

Certificate No. : 24P1856  
Page : 1 of 2

Equipment : Aneroid Barometer  
Manufacturer: Barigo  
Model : -  
Serial No.: -  
ID No.: UAE.EMAZ.1102555  
Condition As-Received: Used Item  
Received Date: 24 May 2024  
Calibration Date: 04 June 2024  
Reference: 2405-0919WSC  
Submitted by: United Analyst and Engineering Consultant Co., Ltd.  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1006 mbar  
81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

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.

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

### Condition of this result of calibration

1. Reference standards instruments :

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

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

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew  
Issue Date : 06 June 2024

Approved Signatory : Ahtapol P.  
[ ] Phallinee Prabpaijal  
[ ] Sura Suwanasri  
✓ [ ] Ahtapol Panurach

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B 0316956



Cert.No.: 24P1856  
Page: 2 of 2

Result of calibration:- Without adjustment  
Function:- Absolute Pressure Measurement  
Range : 720 mmHg to 800 mmHg  
Scale Interval : 1 mmHg ( The Fifth Estimate )

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

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

The uncertainty of measurement was ± 0.24 mmHg

\* UUC = Unit Under Calibration

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

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Ahtapol P.  
เอกสารไม่ควบคุม  
B 1165502



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.: 24H1487  
Page : 1 of 2

**Equipment :** Digital Thermo-Hygrometer  
**Manufacturer:** Digicon  
**Model :** TH-02A  
**Serial No.:** 435031148  
**ID No.:** UAE.EFM.006/2567  
**Condition As-Received:** New Item  
**Received Date:** 10 July 2024  
**Calibration Date:** 15 July 2024  
to 17 July 2024  
**Reference:** 2407-0393WSC  
**Ambient Temperature:** ( 25 ± 3 ) °C  
**Relative Humidity:** ( 50 ± 20 ) %  
**Submitted by:** United Analyst and Engineering Consultant Co.,Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Prakhnong, Bangkok 10260

**Procedure used:** Calibration were conducted using in-house calibration procedure CP-H03 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

### Condition of this result of calibration

1.Reference standards instruments :

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

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

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

-Thunder Scientific Corporation, NV/LAB Accreditation No. Calibration 200582-0

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

**Calibrated by :** Surasit Phansudnoi  
**Issue Date :** 17 July 2024

**Approved Signatory :**

Viporn

[ ] Chakrit Waewwanjua  
[✓] Viporn Tantiyawutti  
[ ] Unnopphol Harachai

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

**Result of Calibration:-**  
**Function:** Humidity Measurement.

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

**Result of Calibration:-**  
**Function:** Temperature Measurement.

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

**UUC\* :** Unit Under Calibration

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

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

UNITED ANALYST AND ENGINEERING  
CONSULTANT COMPANY LIMITED

Test Date : May 7, 2025

Test Date : May 7, 2025

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i

Manufacturer : Thermo Scientific Serial Number : CM19050149

Standard Gas Concentration

Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM Manufacturer : Thermo Scientific

Nitric Oxide (NO) 46.77 PPM Model : 146i

Methane (CH<sub>4</sub>) - PPM Serial Number : 1180540071

Carbon Monoxide (CO) 965.9 PPM

Cylinder No. : EB0159156

Expiration Date : Nov 06, 2026

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error ]
Level 1 Zero	0.0	0.00	0.00	0.00
Level 2 20.00%	100.0	100.7	0.70	0.70
Level 3 40.00%	200.0	201.3	1.30	0.65
Level 4 60.00%	300.0	300.5	0.50	0.17
Level 5 80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb

Average Difference (%) 0.30

Acceptable Limit  $\pm$  5%

Multi-Point Gas Test Chart

Calculate by  
7 05 2025

Approve by  
7 May 2025



United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260  
Tel. 0 2763 2828 Fax 0 2763 2800 www.uaiconsultant.com E-mail: uae@uaiconsultant.com

UNITED ANALYST AND ENGINEERING  
CONSULTANT COMPANY LIMITED

Test Date : May 7, 2025

Test Date : May 7, 2025

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i

Manufacturer : Thermo Scientific Serial Number : CM19050148

Standard Gas Concentration

Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM Manufacturer : Thermo Scientific

Nitric Oxide (NO) 46.77 PPM Model : 146i

Methane (CH<sub>4</sub>) - PPM Serial Number : 1180540071

Carbon Monoxide (CO) 965.9 PPM

Cylinder No. : EB0159156

Expiration Date : Nov 6, 2026

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error ]
Level 1 Zero	0.0	0.00	0.00	0.00
Level 2 20.00%	100.0	100.5	0.50	0.50
Level 3 40.00%	200.0	200.7	0.35	0.35
Level 4 60.00%	300.0	300.3	0.10	0.10
Level 5 80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb

Average Difference (%) 0.19

Acceptable Limit  $\pm$  5%

Multi-Point Gas Test Chart

Calculate by  
7 05 2025

Approve by  
7 May 2025



United Analyst and Engineering Consultant Co., Ltd.  
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### MULTI-POINT GAS TEST REPORT

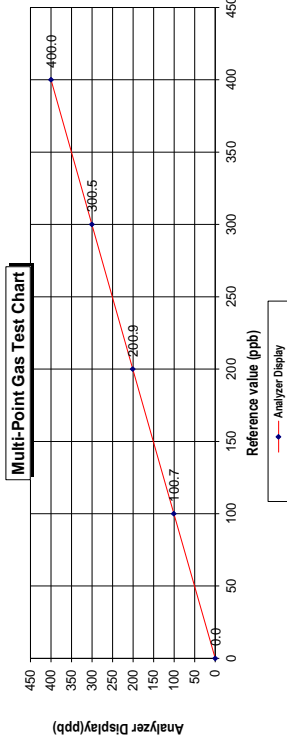
Test Date : May 7, 2025

Equipment : Gas Analyzer (NO<sub>2</sub>)  
Manufacturer : Thermo Scientific  
Model : 42i  
Serial Number : CM19050150

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

### Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1 Zero	0.0	0.00	0.00	0.00
Level 2 20.00%	100.0	100.7	0.70	0.70
Level 3 40.00%	200.0	200.9	0.45	0.45
Level 4 60.00%	300.0	300.5	0.17	0.17
Level 5 80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)	
			:Acceptable Limit $\pm$ 5%	
			0.26	



Calculate by  
Sukhvit C.  
7 05 2025

Approve by  
Sukhvit C.  
7 May 2025

### MULTI-POINT GAS TEST REPORT

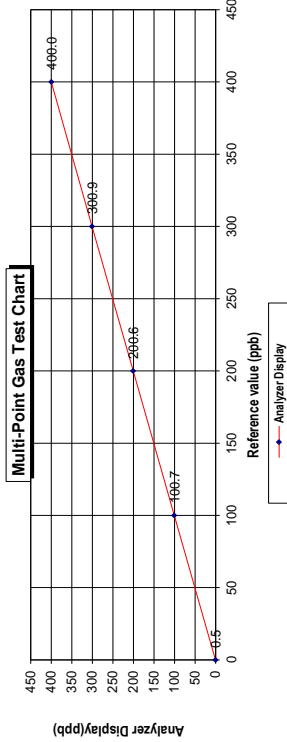
Test Date : Sep 26, 2024

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

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	42.89	PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO)	46.77	PPM	Model : 146i
Methane (CH <sub>4</sub> )	-	PPM	Serial Number : 1180540071
Carbon Monoxide (CO)	965.9		
Cylinder No. :	EB0159156		
Expiration Date :	Nov 6, 2026		

### Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1 Zero	0.0	0.50	0.50	0.50
Level 2 20.00%	100.0	100.7	0.70	0.70
Level 3 40.00%	200.0	200.6	0.30	0.30
Level 4 60.00%	300.0	300.9	0.30	0.30
Level 5 80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)	
			:Acceptable Limit $\pm$ 5%	
			0.36	



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Sukhvit C.  
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Sukhvit C.  
26 Sep 2024

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)  
Part Number: E05N191E15A0014  
Cylinder Number: EB0162121  
Laboratory: 124 - Plumsteadville - PA  
PGVP Number: A12023  
Gas Code: CO, CO2, NO, NOX, SO2, BALN  
Reference Number: 160-402772205-1  
Cylinder Volume: 144.0 CF  
Cylinder Pressure: 2016 PSIG  
Valve Outlet: 660  
Certification Date: Jul 06, 2023  
Expiration Date: Jul 06, 2031

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities in this lot of this calibration standard and the results are a true representation of the gas mixture. The results are not to be used for any other purpose 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
NOX	100.0 PPM	100.4 PPM	G1	+/- 0.9% NIST Traceable
NITRIC OXIDE	100.0 PPM	100.2 PPM	G1	+/- 0.9% NIST Traceable
SULFUR DIOXIDE	100.0 PPM	100.0 PPM	G1	+/- 1.4% NIST Traceable
CARBON MONOXIDE	200.0 PPM	199.2 PPM	G1	+/- 0.3% NIST Traceable
CARBON DIOXIDE	8.000 %	7.962 %	G1	+/- 1.2% NIST Traceable
NITROGEN	Balance			
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
GMIS	104202308	CC754364	98.36 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%
PRM	C2219101	APET1514048	100.19 PPM NITRIC OXIDE/NITROGEN	+/- 0.3%
GMIS	2023042525	CC754381	98.52 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%
PRM	12409	D913660	15.01 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%
GMIS	15340020202	EB0130037	9.693 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.5%
NTRM	160102-22	KAL003820	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%
CO	230601	CC745902	249.47 PPM CARBON MONOXIDE/NITROGEN	+/- 0.3%
NTRM	130606-02	CC411730	13.359 % CARBON DIOXIDE/NITROGEN	+/- 0.6%
The SRM, NTRM, PRM, or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.				
ANALYTICAL EQUIPMENT				
Instrument/Make/Model	Analytical Principle		Last Multipoint Calibration	
Nicolet IS50 FTIR AUP2010245 CO2	FTIR		Jun 15, 2023	
SIEMENS ULTRAMAT6E N1-C8-180	NDIR		Jun 14, 2023	
Nicolet IS50 FTIR AUP2010245 NO	FTIR		Jun 29, 2023	
Nicolet IS50 FTIR AUP2010245 NO2	FTIR		Jun 15, 2023	
Nicolet IS50 FTIR AUP2010245 SO2	FTIR		Jun 08, 2023	

Approved for Release

### MULTI-POINT GAS TEST REPORT

Test Date : May 15, 2025

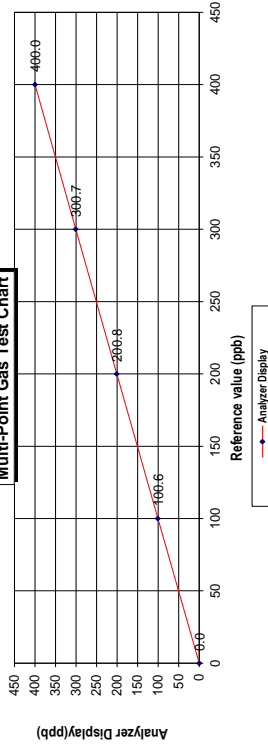
Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387061

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

### Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[ % Error ]
Zero	0.0	0.0	0.00	0.00	0.00
Level 1	100.0	100.6	0.60	0.60	0.60
Level 2	200.0	200.8	0.80	0.40	0.40
Level 3	300.0	300.7	0.70	0.23	0.23
Level 4	400.0	400.0	0.00	0.00	0.00
Level 5	500.0	500.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb					0.25
:Acceptable Limit ± 5%					

### Multi-Point Gas Test Chart



Calculate by

Approve by

15 / 05 / 2025

15 / May / 2025



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### Multi-Point Gas Test Report

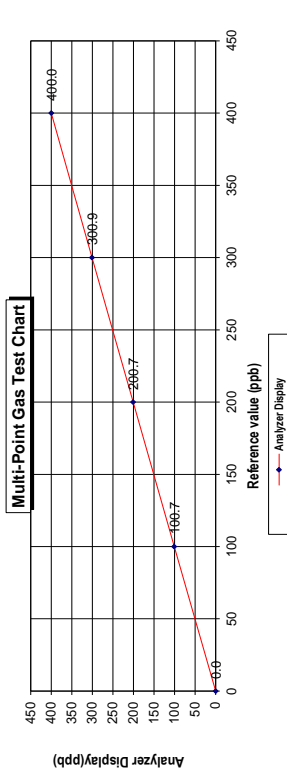
Test Date : May 12, 2025

Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387063

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

### Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error ]
Level 1 Zero	0.0	0.00	0.00	0.00
Level 2 20.00%	100.7	0.70	0.70	0.70
Level 3 40.00%	200.7	0.70	0.35	0.35
Level 4 60.00%	300.9	0.90	0.30	0.30
Level 5 80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)	
			:Acceptable Limit ± 5%	
			0.27	



Calculate by  
Chiraphan C.  
12/...../.....05...../.....2025.

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Chiraphan C.  
12/...../.....May...../.....2025

### Multi-Point Gas Test Report

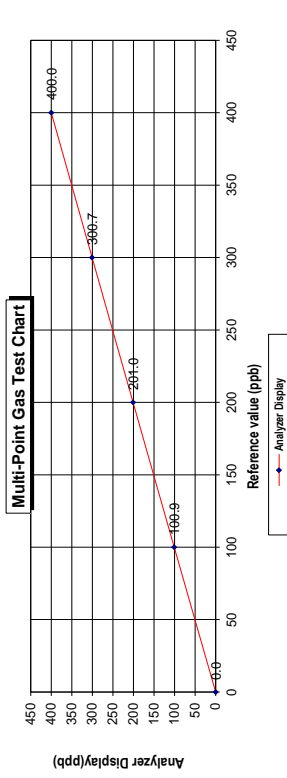
Test Date : May 15, 2025

Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387065

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

### Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error ]
Level 1 Zero	0.0	0.00	0.00	0.00
Level 2 20.00%	100.0	0.90	0.89	0.89
Level 3 40.00%	201.0	1.00	0.50	0.50
Level 4 60.00%	300.7	0.70	0.23	0.23
Level 5 80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)	
			:Acceptable Limit ± 5%	
			0.32	



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Chiraphan C.  
15/...../.....05...../.....2025

Approve by  
Chiraphan C.  
15/...../.....May...../.....2025



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### Multi-Point Gas Test Report

Test Date : May 12, 2025

Equipment : Gas Analyzer (SO<sub>2</sub>)  
Manufacturer : Thermo Scientific  
Model : 431  
Serial Number : 1182920014

### Standard Gas Concentration

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

### Dilutor Detail

Manufacturer : Thermo Scientific  
Model : 1461  
Serial Number : 1180540071

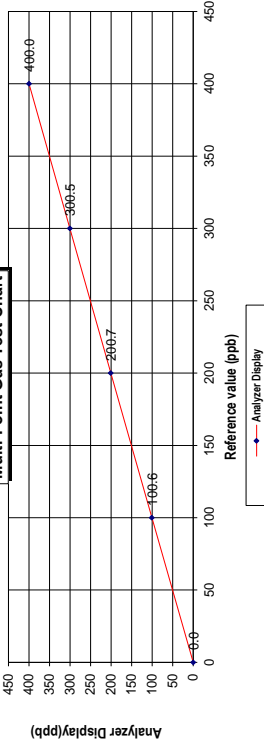
### Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Zero	0.0	0.00	0.00	0.00
Level 1	100.0	100.6	0.60	0.60
Level 2	200.0	200.7	0.35	0.35
Level 3	300.0	300.5	0.17	0.17
Level 4	400.0	400.0	0.00	0.00
Level 5	500.0	500.0	0.00	0.00
Measuring Range	500.0 ppb			
Average Difference (%)				0.22

Remark : Measuring Range

:Acceptable Limit  $\pm$  5%

### Multi-Point Gas Test Chart



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.....12...../.....May...../.....2025



United Analyst and Engineering Consultant Co., Ltd.

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### Multi-Point Gas Test Report

Test Date : June 14, 2024

Equipment : Gas Analyzer (CO)  
Manufacturer : Thermo Scientific  
Model : 481  
Serial Number : 1201497733

### Standard Gas Concentration

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

### Dilutor Detail

Manufacturer : Thermo Scientific  
Model : 1461  
Serial Number : 1180540071

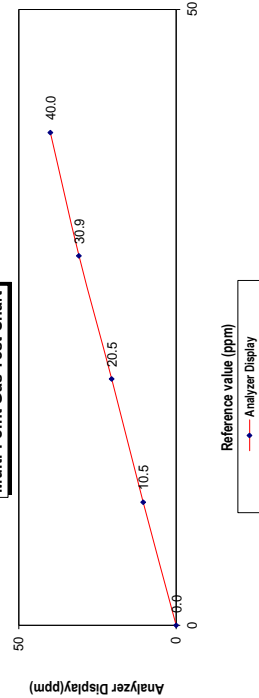
### Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error ]
Zero	0.0	0.0	0.0	0.0
Level 1	10.0	10.5	0.5	4.8
Level 2	20.0	20.5	0.5	2.4
Level 3	30.0	30.9	0.9	2.9
Level 4	40.0	40.0	0.0	0.0
Level 5	50.0	50.0	0.0	0.0
Measuring Range	50.0 ppm			
Average Difference (%)				2.02

Remark : Measuring Range

:Acceptable Limit  $\pm$  5%

### Multi-Point Gas Test Chart



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14...../.....06...../.....2567.

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.....14...../.....June.....2024.....



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MULTI-POINT GAS TEST REPORT

Test Date : Dec 12, 2024

Equipment : Gas Analyzer (CO)

Model : 48i

Manufacturer : Thermo SCIENTIFIC

Serial Number : 1201778118

Standard Gas Concentration

Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM

Nitric Oxide (NO) 46.77 PPM

Methane (CH<sub>4</sub>) - PPM

Carbon Monoxide (CO) 965.9 PPM

Cylinder No. : EB01159156

Expiration Date : Nov 06, 2026

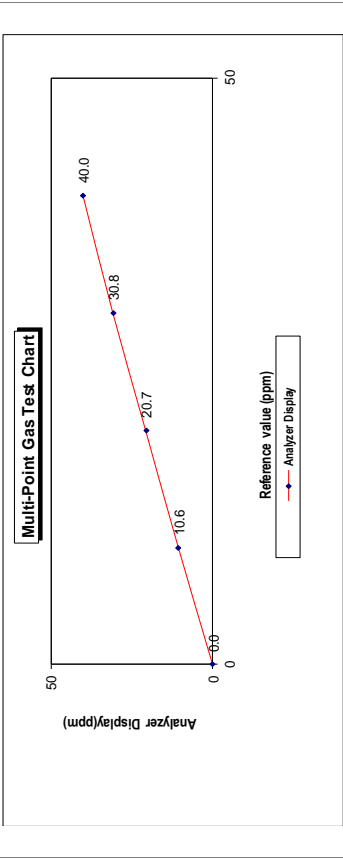
Dilutor Detail

Manufacturer : Thermo Scientific

Model : 146i

Serial Number : 1180540071

Multi-point gas test data					
Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error	[% Error ]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.6	0.6	5.7	5.7
Level 3	40.00%	20.7	0.7	3.4	3.4
Level 4	60.00%	30.8	0.8	2.6	2.6
Level 5	80.00%	40.0	0.0	0.0	0.0
Remark : Measuring Range			Average Difference (%)		2.33
:Acceptable Limit ± 5%					



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Chirchai Cj  
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Approve by  
K. Glem  
...../...../.....12 Dec 2024



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MULTI-POINT GAS TEST REPORT

Test Date : Sep 9, 2024

Equipment : Gas Analyzer (CO)

Model : 48i

Manufacturer : Thermo Scientific

Serial Number : 1201778117

Standard Gas Concentration

Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM

Nitric Oxide (NO) 46.77 PPM

Methane (CH<sub>4</sub>) - PPM

Carbon Monoxide (CO) 965.9 PPM

Cylinder No. : EB01159156

Expiration Date : Nov 06, 2026

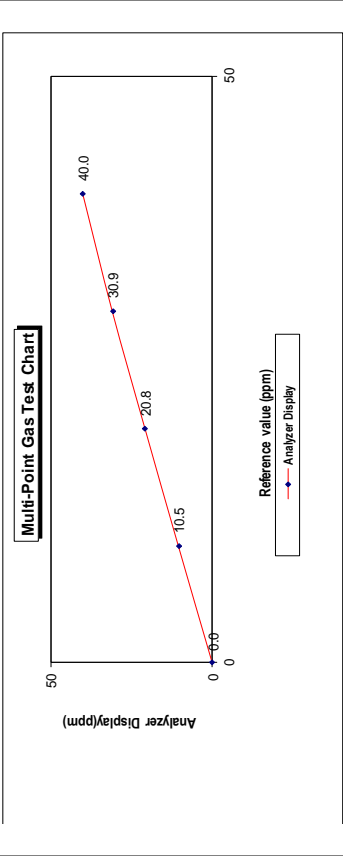
Dilutor Detail

Manufacturer : Thermo Scientific

Model : 146i

Serial Number : 1180540071

Multi-point gas test data					
Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error	[% Error ]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	0.5	4.8	4.8
Level 3	40.00%	20.0	0.8	3.8	3.8
Level 4	60.00%	30.0	0.9	2.9	2.9
Level 5	80.00%	40.0	0.0	0.0	0.0
Remark : Measuring Range		50.0 ppm	Average Difference (%)		2.30
:Acceptable Limit ± 5%					



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Chirchai Cj  
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Approve by  
K. Glem  
...../...../.....9 Sep 2024

## MULTI-POINT GAS TEST REPORT

Test Date : Dec 6, 2024

Equipment : Gas Analyzer (CO)  
Manufacturer : Thermo SCIENTIFIC

Model : 481  
Serial Number : 1201778119

### Standard Gas Concentration

Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM  
Nitric Oxide (NO) 46.77 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 965.9 PPM  
Cylinder No. : EB01.159156  
Expiration Date : Nov 06, 2026

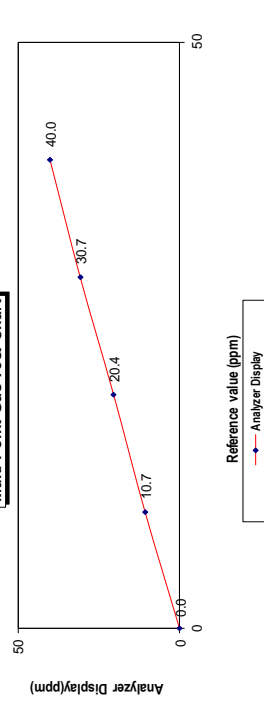
### Dilutor Detail

Manufacturer : Thermo Scientific  
Model : 1461  
Serial Number : 1180540071

### Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.0	0.0	0.0
Level 2 20.00%	10.0	10.7	6.5	6.5
Level 3 40.00%	20.0	20.4	2.0	2.0
Level 4 60.00%	30.0	30.7	2.3	2.3
Level 5 80.00%	40.0	40.0	0.0	0.0
Remark : Measuring Range 50.0 ppm :Acceptable Limit ± 5%		Average Difference (%)		2.16

### Multi-Point Gas Test Chart



Calculate by  
Chaiyaporn  
6 Dec 2567

Approve by  
Jiraporn  
6 Dec 2024

# Certificate of Calibration

## WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0072

Calibration Date: 2022/3/25

Calibration Expiry Date: 2023/3/24

### The Result of Calibration

Velocity	Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0		1.1	0.1	0.9 - 1.1	Pass
2.0		2.0	0.0	1.8 - 2.2	Pass
5.0		4.8	0.2	4.7 - 5.3	Pass
7.0		7.0	0.0	6.0 - 8.0	Pass
10.0		9.9	0.1	9.5 - 10.5	Pass
20.0		20.2	0.2	19.0 - 21.0	Pass

Wind Direction	Measured Value	Actual Value	Deviation	Tolerance	Result
45°		45	0	42 - 48	Pass
135°		135	0	132 - 138	Pass
225°		227	2	222 - 228	Pass
315°		314	1	312 - 318	Pass
0°		359	1	357 - 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
24.2°C	24.2	0.0	23.2-25.2	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1000	2	994-1002	Pass

Environment conditions :

Air temperature: 22 °C

Relative humidity: 62 %

Static pressure: 102.2 kPa

Performed by:

Jim Jim

Certified by

Head of Engineering department

This certificate may not be published or reproduced, except in full, unless obtaining permission in writing from Scarlet Tech Ltd.

4F-3, No. 347, 2nd Sec., Heping E. Rd., Daan Dist. Taipei City 106, Taiwan

เอกสารไม่ควบคุม



J  
NAC  
JIRANANEE ASSOCIATES CO., LTD.

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

Jirananee Associates Co., Ltd.  
63/14-15, 67/35-36,  
Perthkhaem 7/71, Rd. Wattanasara, Bangkokyok,  
Bangkok 10600 (Thailand)  
Tel: +66868080812  
Mobile: +66863999453  
E-mail: jnac-calibration@jiranatee.com  
Web site: www.jiranatee.com

## Certificate of Calibration

### WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (SI-WI-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.

Serial No.: 2205D70113

Calibration Date: 2022/9/14

Calibration Expiry Date: 2023/9/13

#### The Result of Calibration

Velocity			
Measured Value (m/s)	Actual Value (m/s)	Deviation	Result
1.0	1.0	0.0	Pass
2.1	2.0	0.1	Pass
5.1	5.0	0.1	Pass
7.0	7.0	0.0	Pass
10.2	10.0	0.2	Pass
19.8	20.0	0.2	Pass

Wind Direction			
Measured Value	Actual Value	Deviation	Result
45°	45°	0	Pass
135°	135°	1	Pass
227°	225°	2	Pass
316°	315°	1	Pass
358°	0°	2	Pass

Inspection			
Room Temp	Actual Value	Deviation	Result
22.5°C	22.5°C	0.0	Pass

Atmospheric Pressure Inspection			
Inspection	Actual Value	Deviation	Result
1005	1005	0	Pass

#### Environment conditions :

Air temperature: 22 °C  
Relative humidity: 55 %  
Static pressure: 102.2 kPa

Performed by:

Certified by Head of Engineering

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4F-3, No. 347, 2nd Sec., Heping E. Rd., Daan Dist. Taipei City 106, Taiwan

เอกสารไม่ควบคุม

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

#### MEASUREMENT ITEM

MANUFACTURER : LSI Lastem

MODEL/TYPE : Sensor: DNA202

SERIAL NUMBER : Data logger: E-LOG

ID NUMBER : Sensor: BQ1705627

CONDITION AS RECEIVED : Data logger: 17037708

CUSTOMER : Used Item

81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,

Prakhanong, Bangkok 10260

RECEIVED DATE : 02 Aug 2024

MEASUREMENT DATE : 07 Aug 2024

ISSUE DATE : 09 Aug 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C

Relative Humidity : 55.0 ± 15.0 %RH

Atmospheric Pressure : 1010± 10 hPa

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

CALIBRATION CONDITIONS

Wind tunnel cross-section area<sup>1</sup> : 900 cm<sup>2</sup>

Wind direction frontal area<sup>2</sup> : 195 cm<sup>2</sup>

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

Blockage ratio of test object<sup>4</sup> : 0.217 [-]

Preconditioning : 24 hours at ambient conditions.

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☒ Mr. Sorawit Thachalad

☐ Miss Jitraporn Lertomplad

Remarks:

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

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

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

<sup>4</sup> Ratio "b" to "D"



Approved signatory:

Mr. Parinya Booncharoen

Calibration Department Manager

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Certificate Number
CWD-027-67

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

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

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

**ENVIRONMENTAL CONDITIONS:**  
Ambient condition in the laboratory are as follow:  
Temperature : 23.0 ± 3.0 °C  
Relative Humidity : 55.0 ± 15.0 %RH  
Atmospheric Pressure : 1010 ± 10 hPa

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

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

**Preconditioning**  
Measurement Condition  
: 24 hours at ambient conditions.  
: The average values during measurement are (24.9)°C, (45.1) %RH and (1005.2) hPa.



Approved signatory:   
Mr. Parinya Booncharoen  
Calibration Department Manager

**TABULATION OF RESULTS:**  
The table on next page give the measured values.

Calibrated by:  
☒ Mr. Sravit Thadapal  
☐ Miss Jitraporn Lertboonphol

**Remark:**  
1. Nozzle cross-section area of the wind tunnel  
2. Projected cross-section area of the tested object include mounting pipe  
3. Diameter of mounting pipe  
4. Ratio 2° 1'

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Page 2 of 2 Pages

### MEASUREMENT RESULTS<sup>1</sup>

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

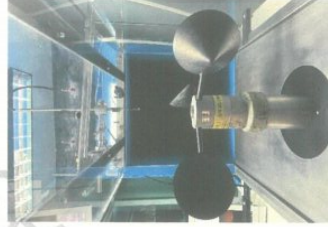
$V_{std}$ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$V_{std}$ (m/s)	Error (m/s)	$U$ (k=2) (m/s)
1.093	23.98	24.05	0.9	-0.2	0.31
2.051	24.24	24.05	1.8	-0.3	0.31
3.124	24.02	24.05	2.9	-0.2	0.31
4.086	24.04	24.05	3.8	-0.3	0.31
5.09	23.68	24.05	4.9	-0.2	0.31
6.08	23.84	24.05	5.9	-0.2	0.31
6.99	23.52	24.05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

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

<sup>2</sup> Velocity of standard

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

PHOTO OF CALIBRATION SET-UP



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



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Certificate Number
CWD-027-67

MEASUREMENT RESULTS <sup>5</sup>

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

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

Remark:

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

<sup>2</sup> Direction of standard

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

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



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Web site: www.jirarattee.com

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

Temperature measurement laboratory  
Calibration services department.

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-180-67

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

: Temperature sensor with data logger  
: LSI Lastem  
: E-LOG  
: 17037708  
: -  
: New item  
: United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260

RECEIVED DATE  
MEASUREMENT DATE  
ISSUE DATE

: 10 Oct 2024  
: 21 Oct 2024  
: 22 Oct 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature : 23.0 ± 3.0 °C  
Relative Humidity : 55.0 ± 15.0 %RH

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

TABULATION OF RESULTS:

The table on next page give the measured values.

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



Approved signatory: .....  
Mr. Parnya Boonchaoren  
Calibration Department Manager



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

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

Reference Used During Calibration:

- Standard Temperature Probe Model: STS-100 AS500, Serial No.: 667682 09
- Digital Temperature Indicator Model: DTI-1000-A MK II, Serial No.: 671407-00591

Uncertainty of Measurement:

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

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Result of Calibration: ☐ Without Adjustment ☒ With Adjustment

Calibration Range: 20 °C to 40 °C

Function:

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

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

UUC\*: Unit Under Calibration

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



Jiranatee Associates Co., Ltd

80/14-15, 87/15, 87/16  
Bangkok 10600 (Thailand)

Tel: +66(0)86080112

E-mail: jnac-calibration@jiranatee.com

Web site: www.jiranatee.com

Accredited calibration laboratory

ISO/IEC 17025:2017

NSC-TSI-TIS 17025

CALIBRATION 0367

Relative humidity and Air Temperature measurement laboratory

Calibration services department.

## CERTIFICATE OF CALIBRATION

Certificate No. : CRT-047-67

Page 1 of 2 Pages

MEASUREMENT ITEM  
MANUFACTURER  
MODEL/TYPE

: Relative humidity with data logger

: LSI Lastem

: Data Logger: E-LOG

: Sensor: DMA672.1

: Data Logger: 17037708

: Sensor: 24070579

: -

ID NUMBER

: New item

CONDITION AS-RECEIVED

: United Analyst and Engineering Consultant Co., Ltd.

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

Bangkok 10260

RECEIVED DATE

: 10 Oct 2024

MEASUREMENT DATE

: 21 Oct 2024

ISSUE DATE

: 22 Oct 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C

Relative Humidity : 55.0 ± 15.0 %RH

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

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

Uncertainty of Measurement:

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

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 Jitraporn Lertsomphol  
☐ Miss Ruangrumpai Phoommit

Approved signatory:

Mr. Parniya Booncharoen  
Calibration Department Manager



Measurement Results:

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

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

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

Calibration Range: 20%RH to 80%RH

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

UUC\*: Unit Under Calibration

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



## CERTIFICATE OF CALIBRATION

Certificate No. : CPR-010-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Digital barometer

MANUFACTURER : LSI Lastem

MODEL/TYPE : Sensor: DOA240.1

SERIAL NUMBER : Data logger: E-LOG

ID NUMBER : Sensor: R1605260

CONDITION AS-RECEIVED : Data logger: 17037708

CUSTOMER : -

RECEIVED DATE : Used item

MEASUREMENT DATE : United Analyst and Engineering Consultant Co., Ltd.

ISSUE DATE : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,

Phrakhanong, Bangkok 10260

: 02 Aug 2024

: 09 Aug 2024

: 09 Aug 2024

### Calibration procedure:

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

### Traceability:

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

### Uncertainty of Measurement:

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

### CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard Instrument:

Instrument: Absolute Pressure Transducer

Model: CPG2500

Serial No.: 4100126P

Certificate No.: MP-0009-24

Due Date: 27 Dec 2024

1. Calibration effort for calibration sequence 8

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

3. Calibration conditions:

4. Condition : ☒ Normal ☐ Abnormal

Pressure transmitting medium : Air

P<sub>h</sub> (20°C, 1 bar) : 1.19 kg/m<sup>3</sup>

H<sub>amb</sub> : (55±15) %

t<sub>amb</sub> : (23±3) °C

P<sub>amb</sub> : (1010±10) mbar

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

Calibrated by:

☐ Mr. Sorawit Thachalad

☒ Miss Jitraporn Lertsomphol

Approved signatory:

Mr. Parinya Booncharoen

Calibration Department Manager



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## CERTIFICATE OF CALIBRATION

Certificate No. : CPR-010-67

Page 2 of 2 Pages

MEASUREMENT RESULTS : ☒ Without adjustment ☐ With adjustment  
CALIBRATION IN THE RANGE OF : 800 mbar to 1100 mbar

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

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

Note: UUC\* Unit Under Calibration

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

\*End of certificate\*



## CERTIFICATE OF CALIBRATION

Certificate No. : CPR-010-67

Page 1 of 2 Pages

MEASUREMENT ITEM  
MANUFACTURER  
MODEL/TYPE

: Digital barometer  
: LSI Lastem  
: Sensor: DQA240.1  
: Data logger: E-LOG  
: Sensor: R1605260  
: Data logger: 17037708

ID NUMBER  
CONDITION AS-RECEIVED  
CUSTOMER

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

RECEIVED DATE  
MEASUREMENT DATE  
ISSUE DATE

: 02 Aug 2024  
: 09 Aug 2024  
: 09 Aug 2024

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

Traceability:

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

Uncertainty of Measurement:

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

CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date
Absolute Pressure Transducer	CPG2-500	4100126P	MP-0009-24	27 Dec 2024

1. Calibration effort for calibration sequence B  
2. The UUC\* was installed in vertical orientation above reference standard instrument and center of UUC\* was used as the reference level.

3. Calibration conditions:

4. Condition : ☒ Normal ☐ Abnormal  
Pressure transmitting medium : Air  
 $\rho_{air}$  (20°C, 1 bar) : 1.19 kg/m<sup>3</sup>  
 $H_{amb}$  : (55±15) %  
 $t_{amb}$  : (23±3) °C  
 $P_{amb}$  : (1010±10) mbar

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

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

Approved signatory:   
Mr. Parinya Booncharoen  
Calibration Department Manager



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IN WRITING FROM THE LABORATORY

## CERTIFICATE OF CALIBRATION

Certificate No. : CPR-010-67

MEASUREMENT RESULTS : ☒ Without adjustment ☐ With adjustment  
CALIBRATION IN THE RANGE OF : 600 mmHg to 825 mmHg

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

STD (mmHg)	UUC* (mmHg)	Error (mmHg)	Uncertainty (k=2) (mmHg)
600.18	600.1	0.0	0.21
627.65	627.5	-0.1	0.21
645.16	645.0	-0.2	0.21
667.66	667.6	-0.1	0.21
690.13	690.1	0.0	0.21
712.63	712.5	-0.1	0.21
735.13	735.0	-0.1	0.21
757.63	757.6	0.0	0.21
780.13	780.1	0.0	0.21
802.62	802.5	-0.1	0.21
825.14	825.1	-0.1	0.21

Note: UUC\* Unit Under Calibration

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

\*End of certificate\*



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## CALIBRATION REPORT

Calibration Number : RG-01082024  
Page 1 of 2 Pages

Measurement Item : Rain gauge with data logger  
Manufacturer : Data logger: LSI Lastem  
: Rain gauge: LSI Lastem  
Model/Type : Data logger: E-LOG  
: Rain gauge: DQA230.1#C  
Serial Number : Data logger: 17037708  
: Rain gauge: PC1705209  
ID NO : -

Customer : United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udomsuh 41, Sukhumvit Road, Bangkok, Phrahanong, Bangkok 10260

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

### Measurement Method:

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

#### 1. Obtain rain gauge inlet area:

Rain gauge precise diameter in cm = Diameter/2 = R (radius)  
Rain gauge area =  $\pi R^2$  3.14 (UUC diameter = 20.3 cm, UUC radius = 10.15 cm)  
Rain gauge area = 323.6 cm<sup>2</sup>

#### 2. Obtain theoretical correct rain gauge answer (number of tipplings) using 323.6 cm<sup>2</sup> inlet area and 0.6 L of rain.

a) 10,000 cm<sup>3</sup> / 323.6 cm<sup>2</sup> inlet area = 30.90 (rain gauge area = 1/30.90 of square meter)  
b) 30.90 \* 0.6 L volume = 18.45 mm (mm of rain over 1 m<sup>2</sup> surface) 500 ml of rain volume on the rain gauge area = 15.45 mm of rain.

c) Number of tipping = 18.45 / 0.2 mm = 77 tipplings.

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

Measurement Date : Aug 08, 2023  
Issued Date : Aug 09, 2023

Calibrated by:

☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol



Approved Signatory:

Mr. Parniya Booncharoen  
Calibration Department Manager

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

Quantity of H <sub>2</sub> O (ml)	Determined Tipping	Tipping count	Acceptable Tipping count
500	77	78	75 - 79
500	77	78	75 - 79
500	77	79	76 - 79
500	77	78	75 - 79
500	77	79	75 - 79

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

\*\*\*End of calibration report\*\*\*



Certificate Number
CWS-028-67

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM  
MANUFACTURER  
MODEL/TYPE

: Cup anemometer  
: LSI Lastem  
: Sensor: DNA202  
Data logger: E-LOG  
: Sensor: BQ1705626  
Data logger: 17037713

CONDITION AS-RECEIVED  
CUSTOMER

: Used Item  
: United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,  
Prakhanong, Bangkok 10260

RECEIVED DATE  
MEASUREMENT DATE  
ISSUE DATE

: 02 Aug 2024  
: 07 Aug 2024  
: 09 Aug 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature :  $23.0 \pm 3.0$  °C  
Relative Humidity :  $55.0 \pm 15.0$  %RH  
Atmospheric Pressure :  $1010 \pm 10$  hPa

PLACE OF CALIBRATION

: Eiffel-type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITIONS

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

Preconditioning  
Measurement Condition

: 24 hours at ambient conditions.  
: The average values during measurement are (24.5) °C, (43.0) %RH and (1009.1) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol

Approved signatory

Mr. Parinya Booncharoen  
Calibration Department Manager



Remark:

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

Certificate Number
CWD-028-67

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT ITEM**  
: Wind Direction Sensor  
**MANUFACTURER**  
: LSI Lastem  
**MODEL/TYPE**  
: Sensor: DNA212  
Data logger: E-LOG  
**SERIAL NUMBER**  
: Sensor: 19050292  
Data logger: 17037713  
**ID NUMBER**  
: --  
**CONDITION AS-RECEIVED**  
: Used Item  
**CUSTOMER**  
: United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udomsuk 41, Sudhumvit Road, Bangkok,  
Phrakhanong, Bangkok 10260

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

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature : 23.0 ± 3.0 °C  
Relative Humidity : 55.0 ± 15.0 %RH  
Atmospheric Pressure : 1010.1 ± 10 hPa

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

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

**Preconditioning**  
Measurement Condition : 24 hours at ambient conditions.  
The average values during measurement are (24.3°C, (45.1) %RH and (1005.1) hPa.

**TABULATION OF RESULTS:**  
The table on next page give the measured values.

**Calibrated by:**  
☒ Mr. Sorawat Thakhalad  
☐ Miss Jitraporn Lertsomphol



Approved signatory:

*Signature*  
Mr. Parinya Booncharoen  
Calibration Department Manager

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

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Page 2 of 2 Pages

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

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

V <sub>std</sub> <sup>6</sup> (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V <sub>unc</sub> <sup>7</sup> (m/s)	Error (m/s)	U (k=2) (m/s)
1.101	24.08	24.75	0.91	-0.19	0.31
2.056	25.40	24.75	1.84	-0.22	0.31
3.148	24.10	24.75	2.91	-0.23	0.31
4.060	24.10	24.75	3.76	-0.30	0.31
5.10	23.80	24.75	4.91	-0.19	0.31
6.05	25.50	24.75	5.91	-0.13	0.31
6.99	23.90	24.75	6.83	-0.16	0.31
8.11	25.08	24.75	7.99	-0.12	0.31
9.12	24.10	24.75	9.06	-0.06	0.31
9.96	24.70	24.75	9.90	-0.06	0.31
11.05	24.20	24.75	11.05	0.00	0.31
12.01	24.52	24.75	11.97	-0.04	0.35
13.03	24.30	24.75	12.96	-0.07	0.31
13.99	24.44	24.75	13.96	-0.03	0.38
15.00	24.30	24.75	14.96	-0.04	0.37
16.01	24.30	24.75	16.02	0.01	0.34

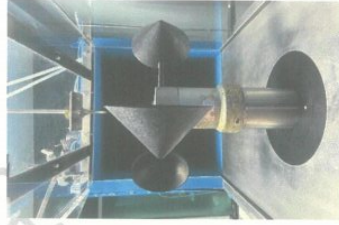
**Remark:**

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

<sup>6</sup> Velocity of standard

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

PHOTO OF CALIBRATION SET-UP



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



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Certificate Number
CWD-028-57

MEASUREMENT RESULTS<sup>5</sup>

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

Air speed m/s	D <sub>std</sub> Degree (°)	D <sub>acc</sub> Degree (°)	Error Degree (°)	U (k=2) Degree (°)
	0.000	0	0	0.80
	45.000	46	1	0.80
	90.000	91	1	0.80
	135.000	136	1	0.80
5.04	180.000	181	1	0.80
	225.000	226	1	0.80
	270.000	270	0	0.80
	315.000	315	0	0.80

Remark:

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

<sup>6</sup> Direction of standard

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

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



เอกสารไม่ควบคุม



Jirarathee Associates Co., Ltd.  
63/14-15, 67/10-16  
Petchburi 27/1, Rd. Wuthapha, Bangkokkai,  
Bangkok 10600 (Thailand)  
Tel: +66(0)6680832  
Mobile: +66863399453  
E-mail: jnac-calibration@jiranatee.com  
Web site: www.jiranatee.com

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

Temperature measurement laboratory  
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-181-67

Page 1 of 2 Pages

MEASUREMENT ITEM

: Temperature sensor with data logger

MANUFACTURER

: LSI Lastem

MODEL/TYPE

: E-LOG

SERIAL NUMBER

: 17037713

ID NUMBER

: -

CONDITION AS-RECEIVED

: New Item

CUSTOMER

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

RECEIVED DATE

: 10 Oct 2024

MEASUREMENT DATE

: 21 Oct 2024

ISSUE DATE

: 22 Oct 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

TABULATION OF RESULTS:

The table on next page give the measured values.

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

Traceability:

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

Reference Used During Calibration:

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

Uncertainty of Measurement:

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

Calibrated by:

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

Approved signatory:

Mr. Parnya Booncharoen  
Calibration Department Manager



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IN WRITING FROM THE LABORATORY

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Result of Calibration: ☐ Without Adjustment ☒ With Adjustment

Calibration Range: 20 °C to 40 °C

Function:

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

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (Before) (°C)	UUC Reading (After) (°C)	Error (°C)	Uncertainty (°C)
120	20.021	18.38	20.27	0.25	0.082
120	25.028	23.23	25.20	0.18	0.082
120	30.015	28.11	30.14	0.02	0.082
120	35.004	33.00	35.08	0.07	0.082
120	39.995	37.89	39.99	0.00	0.082

UUC\*: Unit Under Calibration

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



Jirantee Associates Co., Ltd.  
63/14-15, 67/15-16  
Petchburi 7/1, 84, Worthapha, Bangkokkai,  
Bangkok 10600 (Thailand)  
Tel: +66(0)860812  
Mobile: +66863595453  
E-mail: jnac-calibration@jiranatee.com  
Web site: www.jiranatee.com

Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TSI-TS 17025  
CALIBRATION 0367  
Relative humidity and Air Temperature measurement laboratory  
Calibration services department.

## CERTIFICATE OF CALIBRATION

Certificate No. : CRT-048-67

Page 1 of 2 Pages

MEASUREMENT ITEM  
MANUFACTURER  
MODEL/TYPE

: Relative humidity with data logger  
: LSI Lastem  
: Data Logger: E-LOG  
Sensor: DMA672.1

SERIAL NUMBER

: Data Logger: 17037713  
Sensor: 24070483

ID NUMBER

: -

CONDITION AS-RECEIVED

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

RECEIVED DATE

: 10 Oct 2024

MEASUREMENT DATE

: 21 Oct 2024

ISSUE DATE

: 22 Oct 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

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

Uncertainty of Measurement:

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

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 Jittaporn Lertsomphol  
☐ Miss Ruangrumpai Phoommit

Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager



Measurement Results:

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

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

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

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

UUC\*: Unit Under Calibration

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



## CERTIFICATE OF CALIBRATION

Certificate No. : CPR-011-67

Page 1 of 2 Pages

MEASUREMENT ITEM  
MANUFACTURER  
MODEL/TYPE

: Digital barometer  
: LSI Lastem  
: Sensor: DQA240.1  
Data logger: E-LOG  
: Sensor: R1605257  
Data logger: 17037713

Calibration procedure:

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

SERIAL NUMBER  
ID NUMBER  
CONDITION AS-RECEIVED  
CUSTOMER

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

Traceability:

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

RECEIVED DATE  
MEASUREMENT DATE  
ISSUE DATE

: 02 Aug 2024  
: 09 Aug 2024  
: 09 Aug 2024

Uncertainty of Measurement:

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

CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard Instrument:

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

1. Calibration effort for calibration sequence 8  
2. The UUC\* was installed in vertical orientation above reference standard instrument and center of UUC\* was used as the reference level.

3. Calibration conditions:

4. Condition  
Pressure transmitting medium : ☒ Normal ☐ Abnormal  
: Air  
P<sub>h</sub> (20°C, 1 bar) : 1.19 kg/m<sup>3</sup>  
H<sub>amb</sub> : (55±15) %  
t<sub>amb</sub> : (23±3) °C  
P<sub>amb</sub> : (1010±10) mbar

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

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

Approved signatory:   
Mr. Parinya Booncharoen  
Calibration Department Manager



เอกสารไม่ควบคุม

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## CERTIFICATE OF CALIBRATION

Certificate No. : CPR-011-67

Page 2 of 2 Pages

MEASUREMENT RESULTS : ☒ Without adjustment ☐ With adjustment

CALIBRATION IN THE RANGE OF : 800 mbar to 1100 mbar

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

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

Note: UUC\* Unit Under Calibration

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

\*End of certificate\*



## CERTIFICATE OF CALIBRATION

Certificate No. : CPR-011-67

Page 1 of 2 Pages

MEASUREMENT ITEM  
MANUFACTURER  
MODEL/TYPE

: Digital barometer  
: LSI Lastem  
: Sensor: DOA240.1  
Data logger: E-LOG

SERIAL NUMBER

: Sensor: R1605257  
Data logger: 17037713

ID NUMBER

: -

CONDITION AS-RECEIVED  
CUSTOMER

: Used item  
: United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,  
Prakhonong, Bangkok 10260

RECEIVED DATE

: 02 Aug 2024

MEASUREMENT DATE

: 09 Aug 2024

ISSUE DATE

: 09 Aug 2024

Calibration procedure:

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

Traceability:

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

Uncertainty of Measurement:

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

CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard Instrument:

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

1. Calibration effort for calibration sequence 8

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

3. Calibration conditions:

4. Condition	: <input checked="" type="checkbox"/> Normal <input type="checkbox"/> Abnormal
Pressure transmitting medium	: Air
$P_h$ (20°C, 1 bar)	: 1.19 kg/m <sup>3</sup>
$H_{amb}$	: (55±15) %
$t_{amb}$	: (23±3) °C
$P_{amb}$	: (1010±10) mbar

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

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



Approved signatory: .....  
Mr. Parinya Booncharoen  
Calibration Department Manager

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## CERTIFICATE OF CALIBRATION

Certificate No. : CPR-011-67

Page 2 of 2 Pages

MEASUREMENT RESULTS : ☒ Without adjustment ☐ With adjustment

CALIBRATION IN THE RANGE OF : 600 mmHg to 825 mmHg

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

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

Note: UUC\* Unit Under Calibration

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

\*End of certificate\*



## CALIBRATION REPORT

Calibration Number: : RG-01122024  
Page 1 of 2 Pages

Measurement Item : Rain gauge with data logger  
Manufacturer : Data logger: LSI Lastem  
Rain gauge: LSI Lastem  
Model/Type : Data logger: C-LOG  
Rain gauge: DQA230.1  
Serial Number : Data logger: 17037713  
Rain gauge: 19050180  
ID NO : -

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

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

Measurement Method:

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

1. Obtain rain gauge inlet area:

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

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

Rain gauge area = 323.6 cm<sup>2</sup>

2. Obtain theoretical correct rain gauge answer (number of tipplings) using 323.6 cm<sup>2</sup> inlet area and 0.5 L of rain.

a) 10,000 cm<sup>3</sup> / 323.6 cm<sup>2</sup> inlet area = 30.90 (rain gauge area = 1/30.90 of square meter)

b) 30.90 \* 0.5 L volume = 15.45 mm (mm of rain over 1 m<sup>2</sup> surface) 500 ml of rain volume on the rain gauge area = 15.45 mm of rain.

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

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

Measurement Date : Dec 12, 2024  
Issued Date : Dec 13, 2024

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



Approved Signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

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

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เอกสารไม่ควบคุม

Continuation of Calibration of Calibration Number

Calibration Number: RG-01122024  
Page 2 of 2 Pages

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

Quantity of H <sub>2</sub> O (ml)	Determined Tipping	Tipping count	Acceptable Tipping count
500	77	77	75 ± 79
500	77	76	75 ± 79
500	77	76	75 ± 79
500	77	76	75 ± 79
500	77	76	75 ± 79

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

\*\*\*End of calibration report\*\*\*



เอกสารไม่ควบคุม

Certificate of Calibration

Customer

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

Certificate No : 24-ACT-087  
Request No : Req-2024-1365

Unit Under Calibration Details

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

Calibration Environment and Details

Temperature : ( 23 ±2 °C )  
Humidity : ( 50 ± 20 %RH )  
Barometric Pressure : ( 1013 ± 10.0 hPa )  
Received Date : 20 June 2024  
Calibration Date : 25 June 2024  
Location of Calibration : LAB 1 Acoustic  
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEL	12 June 2025
THD Multimeter	2015	1047765	NIMT	16 January 2025

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

Note

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

Calibrated By :

Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By :

Mr. Pacit Mathavorn  
Calibration Engineer Supervisor

Issue Date : 25 June 2024

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ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT



NSC-TS-115.17025  
CALIBRATION 0115

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

Certificate No.: CP20240291EA  
Operation No.: CP2024070254

Certificate of Calibration

Equipment: Sound Level Meter  
Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)  
Model/Type: LX2 (Meter), 375A04B02 (Microphone), PRMLXT2C (Preamplifier)  
Serial No.: 0005396 (Meter), 329350 (Microphone), 073805 (Preamplifier)  
ID No.: UAE.EFM.033/2564  
Customer: United Analyst and Engineering Consultant Co.,Ltd.  
Address: 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak  
Phrakhanong, Bangkok 10260

Received Date: 25 July 2024  
Calibrated Date: 5 - 6 August 2024  
Issued Date: 7 August 2024  
Calibrated by: Ms. Juntaporn Kunhakom

Approved by:  ( Mr. Sittichai Swaksuriyawong )  
Group Manager

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

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Certificate No.: CP20240291EA

Calibration Report

Equipment: Sound Level Meter  
Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)  
Model/Type: LX2 (Meter), 375A04B02 (Microphone), PRMLXT2C (Preamplifier)  
Serial No.: 0005396 (Meter), 329350 (Microphone), 073805 (Preamplifier)  
ID No.: UAE.EFM.033/2564  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Pressure: (101.3 ± 1.5) kPa  
Method of Calibration :-  
IEC 61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5) Pressure humidity and Temperature Transmitter	PTU301	L3950483	CL1-P240023	24 March 2025
6) Pressure humidity and Temperature Transmitter	PTU301	L3950484	CL1-P240030	12 June 2025
7) Performance Audio Analyzer	U8903B	MY56510003	CB20240035EB	13 February 2025
			CK20230072EA	13 September 2024

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

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

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

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-

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Certificate No.: CP20240291EA

### Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
29.3

2.2 Microphone replaced by the electrical input signal device

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

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.3	0.1	0.3	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	0.2	0.2	0.2	±5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	-0.1	0.0	±5.0

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

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

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### Calibration Report

5.2 Time weighting at 1 kHz

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

Function : 6. Long-Term Stability

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

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.3

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
134.0	134.1	0.1	±1.1
139.0	139.1	0.1	±1.1
140.0	140.1	0.1	±1.1
141.0	141.1	0.1	±1.1

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### Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.1	0.1	±1.1
43.0	43.1	0.1	±1.1
42.0	42.2	0.2	±1.1
41.0	41.2	0.2	±1.1
40.0	40.3	0.3	±1.1

Function : 8. Tone burst response

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

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	135.4	134.8	-0.6	±3.0
Positive half cycle	134.4	134.0	-0.4	±2.0
Negative half cycle	134.4	134.0	-0.4	±2.0

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.5
143.4	143.4		

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### Calibration Report

Function : 11. High-Level Stability  
High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	139.0	139.0	0.0	±0.3

Uncertainty of measurement

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

Remarks: 1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.

2. The acceptance limit is for the deviated value.

3. Acceptance limits was IEC61672-3:2013 Class 2.

4. The coverage factor  $k = 2.00$

-- End of Report --

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Certificate of Calibration

**Customer**

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

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

Certificate No : 24-SLM-214

Request No : Req-2024-1379

**Unit Under Calibration Details**

Measurement item : Sound Level Meter

Manufacturer : Larson Davis

Model : LxT2

Serial Number : 0005398

ID : UAE.EFM.0352564

Resolution : 0.1 dB

Microphone Class : 2

Microphone Model : 375A04

Microphone S/N : 328675

Preamplifier Model : PRMLxT2C

Preamplifier S/N : 073793

Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C

Humidity : 50 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 24 June 2024

Calibrated Date : 2 July 2024

Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests

Location of Calibration : Lab Acoustic

Reference Standard

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

Note

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

Calibrated By :

Mr. Noppadon Luangrat  
Service Calibration Engineer

Approved By :

Mr. Pait Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 2 July 2024

1. Indication at the calibration check frequency

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

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

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting		
A	28.8	0.10

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

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

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

UUC Setting	Deviation from various Frequency Weighting Response curve				UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A (dB)	C (dB)	Z (dB)				
FAST / 37-139							
STD Setting							
125 Hz	-0.1	0.1	0.1		0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0		0.60	1.0	Pass
4000 Hz	0.6	0.6	0.6		0.60	3.0	Pass
8000 Hz	0.5	0.4	0.4		0.70	5.0	Pass

7. Long Term Stability

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

8. Level linearity on the reference level range

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

Certificate No : 24-SLM-214

Request No : Req-2024-1379

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

UUC Setting		Deviation from various Frequency				UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		Weighting Response curve						
FAST / 37-39		A (dB)	C (dB)	Z (dB)				
STD Setting								
63 Hz		-0.1	0.0	0.0	2.0			
125 Hz		-0.1	0.0	0.0	1.5			
250 Hz		-0.1	0.0	0.0	1.5			
500 Hz		0.0	0.0	0.0	1.5			
1000 Hz		0.0	0.0	0.0	1.0			
2000 Hz		0.1	0.1	0.0	2.0			
4000 Hz		0.0	0.0	0.1	3.0			
8000 Hz		0.0	0.0	0.1	5.0			
16000 Hz		0.0	0.0	-0.1	+5, -INF.			

6. Frequency and time weightings at 1kHz

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

9. Level linearity including the level range control

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

10. Tone burst response

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

11. Peak C Sound level

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

12. Overload indication

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

13. High Level Stability

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

Note :

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

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

Certificate No : 24-SI-M-214  
Request No : Req-2024-1379

#### Decision Rule for Statements of Conformity

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

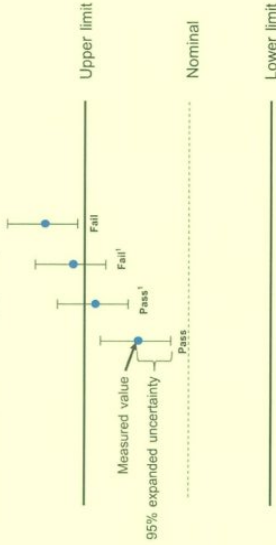
Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



End of Certificate

Certificate No.: CP20240293EA  
Operation No.: CP2024070256

## Certificate of Calibration

Equipment: Sound Level Meter  
Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)  
Model/Type: LxT2 (Meter), 375B02 (Microphone), PRMLxT2B (Preamplifier)  
Serial No.: 0005399 (Meter), 11789 (Microphone), 056125 (Preamplifier)  
ID No.: UAE.EFM.036/2564

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

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

Received Date: 25 July 2024

Calibrated Date: 6 - 7 August 2024

Issued Date: 7 August 2024

Calibrated by: Ms. Juntaporn Kunhakom

Approved by:   
( Mr. Sittichai Swaksuriyawong )  
Group Manager

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

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k )

providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.



Certificate No.: CP20240293EA

### Calibration Report

**Equipment:** Sound Level Meter  
**Manufacturer:** Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)  
**Model/Type:** LX72 (Meter), 375B02 (Microphone), PRLMT2B (Preamplifier)  
**Serial No.:** 0005399 (Meter), 11789 (Microphone), 056125 (Preamplifier)  
**ID No.:** UAE.EFM.036/2564  
**Ambient Temperature:** ( 23 ± 2 ) °C  
**Relative Humidity:** ( 50 ± 15 ) %  
**Pressure:** (101.3 ± 1.5) kPa  
**Method of Calibration :-**  
IEC 61672-3:2013.

#### Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5) Pressure humidity and Temperature Transmitter	PTU301	L3950483	CL1-P240023 CD20240142EA	24 March 2025 12 June 2025
6) Pressure humidity and Temperature Transmitter	PTU301	L3950484	CL1-P240030 CD20240143EA	11 April 2025 12 June 2025
7) Performance Audio Analyzer	U8903B	MY56510003	CB20240035EB CK20230072EA	13 February 2025 13 September 2024

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

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

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

#### Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-

Certificate No.: CP20240293EA

### Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
30.6

2.2 Microphone replaced by the electrical input signal device

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

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.1	0.0	0.1	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	1.9	1.9	1.9	±5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	-0.1	0.0	0.0	±2.0
125	0.0	0.0	0.1	±1.5
250	-0.1	0.0	0.0	±1.5
500	0.0	-0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	-0.1	0.0	0.0	±5.0

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

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

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Calibration Report

5.2 Time weighting at 1 kHz

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

Function : 6. Long-Term Stability

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

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.3

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
134.0	134.1	0.1	±1.1
139.0	139.1	0.1	±1.1
140.0	140.1	0.1	±1.1
141.0	141.1	0.1	±1.1

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7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.1	0.1	±1.1
43.0	43.2	0.2	±1.1
42.0	42.2	0.2	±1.1
41.0	41.3	0.3	±1.1
40.0	40.4	0.4	±1.1

Function : 8. Tone burst response

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

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	135.4	134.7	-0.7	±3.0
Positive half cycle	134.4	134.1	-0.3	±2.0
Negative half cycle	134.4	134.1	-0.3	±2.0

Function : 10. Overload Indication

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

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FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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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	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
- Free-field sound pressure response level	0.20	0.20
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.20	0.25
11) High-Level Stability	0.10	0.10

Remarks: 1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.  
2. The acceptance limit is for the deviated value.  
3. Acceptance limits was IEC61672-3:2013 Class 2.  
4. The coverage factor  $k = 2.00$

-- End of Report --

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Envi Equipment Service Co., Ltd.  
110/254 Moo 3, Tumbon Bang Rak Phathana, Amphur Bang Bua Thong, Nonthaburi 11110  
Tel. 098 362 9152, 089 478 7885  
E-mail: sales@envi-ees.com

Certificate No.: E24-060049  
Page.: 1 of 6

CERTIFICATE OF CALIBRATION

Customer : United Analyst and Engineering Consultant Co., Ltd.  
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangehak, Phrakhanong, Bangkok 10260  
Description of Equipment : Console meter  
Manufacturer : Apex Instrument  
Model Number : XC-572-V  
Serial Number : 0707048  
ID./Control No. : UAE.EFM.154/2550  
Environment Conditions : Temperature (25 ± 2) °C  
Humidity (50 ± 15) % RH  
Cal. Date : 25/06/2024  
Issue Date : 25/06/2024

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)  
This certificate is traceable to national standard, which realize the units of measurement according to the International System of Units (SI).

Result of Calibration

This certificate may not be reproduced other than in full except with prior Written approval of the Technical Manager, Envi Equipment Service Company Limited.  
These reported uncertainties of measurement are expanded by a coverage factor of  $k=2$ , providing a 95% confidence level

Calibrated by : Mr. Sanya Sangnil

Approved by :



(Mr. Mana Fuchas)  
Technical Manager

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METHOD 5 CONSOLE CALIBRATION  
 USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425  
 5-POINT METRIC UNIT

Meter Console Information				Calibration Conditions				Factors/Conversions			
Console Model Number	XC-572-V	Date	25/06/2024	Time	09:05 AM	Std Temp	293	K			
Console Serial Number	0707048	Calibration Reference No.	SER24-060019	Barometric Pressure	754.41	Std Press	760	mm Hg			
DGM Model Number	SK25EX	Calibration Meter Gamma	1.001			K <sub>i</sub>	0.386				
DGM Serial Number	00005715							Console Leak Check	PASS		

Calibration Data											
Metering Console				Calibration Meter							
Run Time	DGM Orifice	Volume Initial	Volume Final	Volume Initial	Volume Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Outlet Temp	
Elapsed (Q)	(P <sub>m</sub> )	(V <sub>m</sub> )	(V <sub>mf</sub> )	(V <sub>mi</sub> )	(V <sub>mf</sub> )	(V <sub>mi</sub> )	(V <sub>mf</sub> )	(t <sub>mi</sub> )	(t <sub>mf</sub> )	(t <sub>mf</sub> )	
min	mm H <sub>2</sub> O	m <sup>3</sup>	m <sup>3</sup>	m <sup>3</sup>	m <sup>3</sup>	m <sup>3</sup>	m <sup>3</sup>	°C	°C	°C	
12.25	13.0	1006.591	1006.731	30	30	224.31426	224.45480	28	28	28	
12.30	13.0	1006.731	1006.871	30	30	224.45480	224.59514	28	28	28	
8.57	26.0	1006.878	1007.018	29	29	224.60216	224.74278	28	28	28	
8.57	26.0	1007.018	1007.158	29	29	224.74278	224.88286	28	28	28	
13.85	40.0	1007.166	1007.446	29	29	224.89090	225.16890	27	27	27	
14.03	40.0	1007.446	1007.726	30	30	225.16890	225.44958	27	27	27	
10.45	70.0	1007.743	1008.023	30	30	225.46640	225.74430	26	26	26	
10.43	70.0	1008.023	1008.303	30	30	225.74430	226.02136	26	26	26	
9.15	90.0	1008.315	1008.595	30	30	226.03294	226.30764	26	26	26	
9.15	90.0	1008.595	1008.875	30	30	226.30764	226.58212	26	26	26	

METHOD 5 CONSOLE CALIBRATION  
 USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425  
 5-POINT METRIC UNIT

Meter Console Information				Calibration Conditions				Factors/Conversions			
Console Model Number	XC-572-V	Date	25/06/2024	Time	09:05 AM	Std Temp	293	K			
Console Serial Number	0707048	Calibration Reference No.	SER24-060019	Barometric Pressure	754.41	Std Press	760	mm Hg			
DGM Model Number	SK25EX	Calibration Meter Gamma	1.001			K <sub>i</sub>	0.386				
DGM Serial Number	00005715							Console Leak Check	PASS		

Calibration Data											
Standardized Data				Dry Gas Meter							
Dry Gas Meter (V <sub>mf</sub> )	(Q <sub>mf</sub> )	Calibration Meter (V <sub>w</sub> )	(Q <sub>w</sub> )	Calibration Factor Value (Y)	Variation (ΔY)	Flowrate Std & Corr (Q <sub>mf</sub> )	Std & Corr (Q <sub>mf</sub> )	Variation (ΔH <sub>g</sub> )			
m <sup>3</sup>	m <sup>3</sup> /min	m <sup>3</sup>	m <sup>3</sup> /min	(Y)	(ΔY)	m <sup>3</sup> /min	m <sup>3</sup> /min	mm H <sub>2</sub> O			
0.135	0.011	0.136	0.011	1.004	0.012	0.011	0.011	46.115	-0.256		
0.135	0.011	0.136	0.011	1.002	0.011	0.011	0.011	46.625	0.254		
0.136	0.016	0.136	0.016	1.003	0.011	0.016	0.016	45.168	-1.203		
0.136	0.016	0.135	0.016	0.999	0.008	0.016	0.016	45.517	-0.854		
0.273	0.020	0.270	0.019	0.990	-0.001	0.019	0.019	46.444	0.073		
0.273	0.019	0.272	0.019	1.000	0.008	0.019	0.019	46.776	0.405		
0.274	0.026	0.271	0.026	0.987	-0.005	0.026	0.026	46.419	0.048		
0.274	0.026	0.270	0.026	0.984	-0.008	0.026	0.026	46.552	0.181		
0.275	0.030	0.267	0.029	0.974	-0.018	0.029	0.029	47.010	0.639		
0.275	0.030	0.267	0.029	0.973	-0.019	0.029	0.029	47.085	0.714		
				0.991	Y Average			46.371	ΔH <sub>g</sub> Average		

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.  
 For ΔH<sub>g</sub>, orifice pressure differential that equates to 0.75 cfm (0.0212 m<sup>3</sup>/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1 mm) H<sub>2</sub>O.

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Meter Console Information		Calibration Conditions		Factors/Conversions	
Console Model Number	XC-572-V	Date	Time	Std Temp	K
Console Serial Number	0707048	Calibration Reference No.	25/06/2024	Std Press	760 mm Hg
DGM Model Number	SK25EX	Barometric Pressure	SER24-060019	K <sub>i</sub>	0.386
DGM Serial Number	00005715	Calibration Meter Gamma	754.41 mmHg	Console Leak Check	PASS



Console Model: XC-572-V

Console Serial: 0707048



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## THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information	
Console Model Number	XC-572-V
Console Serial Number	0707048
DGM Model Number	SK25EX
DGM Serial Number	00005715
Meter Box Model Number	JENCO 765 KF
Meter Box Serial Number	JC 15588

Calibration Conditions		
Date	Time	11:35 AM
Calibration Reference No.	SER24-060019	
Reference Thermometer	DIGICON	
Serial Number	183169105	

Results											
Console Thermocouple Simulator											
Meter Box Channel Temperature Reading ( °C )											
Channel and test point											
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	1038.0
Stack	-18.0	25.0	37.0	92.0	147.0	256.0	365.0	476.0	585.0	805.0	1024.0
Aux	-18.0	25.0	37.0	92.0	147.0						
Probe	-18.0	25.0	37.0	92.0	147.0						
Filter	-18.0	25.0	37.0	92.0	147.0						
Exit	-18.0	25.0	37.0								

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



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Instrument description : Flue Gas Analyzer  
Instrument model : Testo 350 New  
Control unit serial no. : 03099401/701  
Instrument serial no. : 60899615/701  
ID no. or control no. : UAE EFM. 006/2560  
Manufacturer : Testo SE & Co. KGaA  
Probe description : -  
Probe model : -  
Probe serial no. : -  
Customer name : United Analyst and Engineering Consultant Co., Ltd.  
Customer address : 81 Soi Udomsuk 41, Sukhumvit Rd., Bangchak, Phrakhanong, Bangkok 10260

Total pages of certificate : 2 Pages  
Receiving no. : L-242678  
Receiving date. : 15-Jul-24  
Parameter of calibration : Gas Calibration(Oxygen 2.50,10.04,21.02 %vol, Carbon Monoxide 80.18,302,1007 ppm, Nitrogen Dioxide 30.34,81.32, 201.9 ppm, Nitric Oxide 30.01, 151.5, 322.5 ppm, Sulphur Dioxide 50.36, 100.8, 600.8 ppm)

Condition of UUC. : Used  
Ambient condition : All of the Measurement were carried out the stabilized laboratory  
Temperature : 23 ± 5 °C  
Humidity : 55 ± 15 %RH

Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210

Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

*The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measured multiplied by coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. This certificate is applied only to item under test. Environmental condition.*

*This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid and The results relate only to the items tested/calibrated.*

*This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).*

Date of calibration : 17-Jul-24

Mr. Kwanchai Khamdoun  
Calibration Technician

Mrs. Nongluck Wongsettee  
Technical Manager



# Calibration Certificate

ENTECH  
Difference For Greater Value

Certificate No.: G 670490

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O <sub>2</sub> ) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen (O <sub>2</sub> ) 10.04 % Vol	CG-0153-21	Nint	18-Nov-26
Oxygen (O <sub>2</sub> ) 21.02 % Vol	CG-0041-22	Nint	10-Feb-27
Carbon monoxide (CO) 80.18 ppm	CG-0002-24	Nint	11-Jan-29
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1007 ppm	1870/24	Linde	17-Jun-26
Nitrogen Dioxide (NO <sub>2</sub> ) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide (NO <sub>2</sub> ) 81.32 ppm	3546/23	Linde	14-Jan-26
Nitrogen Dioxide (NO <sub>2</sub> ) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide (NO) 30.01 ppm	CG-0014-23	Nint	19-Feb-25
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (SO <sub>2</sub> ) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO <sub>2</sub> ) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO <sub>2</sub> ) 600.8 ppm	2003/23	Linde	17-Jul-25

## Measured room conditions

Temperature : 23.1 °C Humidity : 66.3 %RH Pressure : 1010.2 mbar

## Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1014.5 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O <sub>2</sub> (%Vol)	2.50	2.55	0.05	0.15
O <sub>2</sub> (%Vol)	10.04	10.12	0.08	0.20
O <sub>2</sub> (%Vol)	21.02	21.13	0.11	0.30
CO (ppm)	80.18	81	0.82	3.0
CO (ppm)	302	303	1	6.0
CO (ppm)	1007	1009	2	12
NO <sub>2</sub> (ppm)	30.34	32.5	2.16	8.0
NO <sub>2</sub> (ppm)	81.32	82.7	1.38	8.0
NO <sub>2</sub> (ppm)	201.9	202.8	0.9	12
NO (ppm)	30.01	31	0.99	8.0
NO (ppm)	151.5	153	1.5	8.0
NO (ppm)	322.5	324	1.5	12
SO <sub>2</sub> (ppm)	50.36	50	-0.36	6.0
SO <sub>2</sub> (ppm)	100.8	100	-0.8	6.0
SO <sub>2</sub> (ppm)	600.8	603	2.2	13

Remark : 1 cmol/mol = 1 %vol, 1 μmol/mol = 1 ppm.

End of Report

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Cert.No.: 24CH1153/1  
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#### Condition of this calibration result

1. Reference Standard Instrument

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

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.006	Hach Lenge GmbH	C03146	23 Feb 2026
pH 7.000	Hach Lenge GmbH	C03020	13 Dec 2024
pH 9.997	CPA chem	970853	25 Apr 2025

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

#### Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4.7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement ( $\pm$ mV )	Coverage factor $k$
			mV	pH		
pH Meter S/N.: HA1G0008	4.00	177.48	177.5	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	-177.5	10.01	0.058	2.00



Cert.No.: 24CH1153/1  
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#### Calibration Results

Function : pH Measurement

Calibration Date : 18 September 2024

Performing three buffers standard curve by using buffer nominal pH (4.7)(7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor $k$
pH Electrode S/N.: -	4.006	4.01	168.7	0.0077	2.00
	7.000	6.99	-3.2	0.0084	2.00
	7.000	7.00	-3.4	0.0092	2.05
	9.997	10.01	-174.4	0.011	2.05

Function : Temperature Measurement

Calibration Date : 25 October 2024

( \* ) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652  
- Serial No. : -  
Dimension of probe  
- Length : 103 mm.  
- Diameter : 16 mm.  
- Immersion Depth : 90 mm.

Calibration Point ( $^{\circ}$ C )	Standard Temperature ( $^{\circ}$ C )	UUC* Reading ( $^{\circ}$ C )	Error ( $^{\circ}$ C )	Uncertainty of measurement ( $\pm$ $^{\circ}$ C )	Coverage factor $k$
20.0	20.001	20.0	-0.001	0.13	2.00
25.0	25.005	25.0	-0.005	0.13	2.00
45.0	45.004	44.9	-0.104	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 %.

-000-



## Certificate of Testing

Cert.No.: 24TW200  
Page.: 1 of 2

**Equipment :** DO Meter  
**Manufacturer :** Horiba  
**Model :** LAQUA-DO210  
**Serial No. :** HE1D0010  
**ID No. :** UAE.EFM.208/2564(EFM.DO.10/64)  
**Received Date :** 17 September 2024  
**Test Date :** 18 September 2024  
**Reference :** 2409-0633WSC-1  
**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok,  
Pirakhanong, Bangkok 10260

**Laboratory Condition :** Temperature (  $25 \pm 5$  ) °C  
Humidity (  $50 \pm 20$  ) %  
**Test Procedure :** In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method

**Tested by :** Walalak Sirithean

**Approved by :**   
Approved Signatory

( ) Unnophol Harachai  
( ) Ponpan Paipim  
(✓) Sathip Meangmai

**Issue Date :** 18 September 2024

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### Condition of this result of calibration

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	24MM131	04 July 2025
2. Standard Material :-				
Sodium Thiosulfate 5-Hydrate AR				
<b>Material</b>	<b>Manufacturer</b>	<b>Lot No.</b>	<b>Assay</b>	
Sodium Thiosulfate 5-Hydrate AR	KEMAUS	2203162447	99.6%	

**Result :** Dissolved Oxygen Meter Adjustment With Air 100 %  
Dissolved Oxygen Probe No.: 9K1B0023

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.18	8.19	0.0055

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

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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.: 24LM150  
Page.: 1 of 2

Equipment : DO Meter with Sensor

Manufacturer : Horiba

Model : LAQUA-DO210

Serial No. : HE1D0010

ID No. : UAE.EFM.208/2564(EFM.DO.10/64)

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

Location : TPA On Site Calibration Laboratory

Received Order : 17 September 2024

Calibrated Date : 18 September 2024

Ambient Temperature : ( 26 ± 10 ) °C

Relative Humidity : ( 50 ± 30 ) %

AC Line Voltage : ( 220 ± 22 ) V

Calibrated by : Warakorn Lerngagtrakul

Approved by :

( ) Ponpan Paipim  
( ) Suwit Imjai  
(✓) Kunchit Promprat

Approved Signatory

Issue Date : 21 September 2024

The Uncertainties are for a confidence probability of approximately 95%

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

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Equipment : DO Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2409-0633WSC-2

Cert. No.: 24LM150  
Page.: 2 of 2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer ( IPT ) into Temperature Bath.

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) Digital Thermometer 2188080 231216 TPA 11 Oct 2024

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

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

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

Result of Calibration :- ( \* ) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 9K1B0023

Calibration Point ( °C )	Immersion Depth ( mm )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty ( ± °C )	Coverage Factor k
25.0	80	25.002	25.0	-0.002	0.16	2.00
30.0	80	30.003	30.0	-0.003	0.16	2.00
35.0	80	35.004	35.0	-0.004	0.16	2.00

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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เอกสารไม่ควบคุม



## Certificate of Calibration

Cert.No.: 24CH1158  
Page.: 1 of 3

**Equipment :** Conductivity Meter  
**Manufacturer :** YSI  
**Model :** Pro30  
**Serial No. :** 17A102821  
**ID No. :** UAE.EFM.123/2560(ENV.SCT.03/60)  
**Condition As-Received:** Used Item  
**Received Date :** 17 September 2024  
**Calibration Date :** 18 September 2024  
**Reference :** 2409-0635WSC-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 :** Warakorn Lemgagrakul

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

( ) Unnoppol Harachai  
( ) Ponpan Palpim  
(✓) Saithip Meangmai

**Issue Date :** 23 September 2024

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

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

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Cert.No.: 24CH1158  
Page.: 2 of 3

### Condition of this result of calibration

1. Reference Standard Instrument :-
- | Instrument               | Serial No. | ID No.   | Certificate No. | Due date    |
|--------------------------|------------|----------|-----------------|-------------|
| 1) Thermometer           | 9549224    | 130RC003 | 24/426          | 24 Apr 2025 |
| 2) Ref. Std. Thermometer | 2188080    | 130RC044 | 231216          | 10 Oct 2024 |
- This Certification 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
- | Conductivity Solution | Manufacturer | Lot No. | Exp. date    |
|-----------------------|--------------|---------|--------------|
| 1412.9 µS/cm          | CPA Chem     | 1005307 | 15 June 2025 |
| 12.880 mS/cm          | CPA Chem     | 940112  | 02 Nov 2024  |
- 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 1412.9 µS/cm

Conductivity Electrode Serial No.: 17A100315

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
1412.9 µS/cm	1317 µS/cm	1414 µS/cm	9.2 µS/cm	2.00
12.880 mS/cm	10.60 mS/cm	11.99 mS/cm	0.086 mS/cm	2.00

Remark : - UUC\* = Unit Under Calibration

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Cert.No.: 24CH1158  
Page.: 3 of 3

#### Calibration Results

##### Function : Temperature Measurement

This equipment was connected with Temperature Probe;

- Model : PRO 30 COND-T  
- Serial No. : 17A100315

Dimension of probe;

- Length : 95 mm  
- Diameter : 2.5 mm  
- Immersion Depth : 90 mm

##### Calibration Result : Without adjustment

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)	Coverage factor <i>k</i>
25.0	25.003	24.7	-0.303	0.13	2.00
30.0	30.002	29.7	-0.302	0.13	2.00
35.0	35.002	34.7	-0.302	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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เอกสารนี้ควบคุม

## ภาคผนวก ง-2

### เอกสารเครื่องมือวิเคราะห์

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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	Analytical Balance	PARTICULATE MATTER (PM10) TOTAL SUSPENDED PARTICULATE	Mettler Toledo	MS204TS/00 / C252436235	National Food Institute, Ministry of Industry, Thailand	2402420-003-01	19/4/2024	18/4/2025
2	Dionex Aquion RFIC Ion Chromatography	HYDROGEN CHLORIDE	Thermo Scientific	Dionex Aquion RFIC / 220380031	ARCHEMICA LAB CO., LTD	ID1047	23/4/2024	22/4/2025


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

## Calibration Certificate

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

Page 1 of 3

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

**Calibrated by** Mr. Pheraphat Tuanjit  
Scientist  
**Date of Issue:** 23 April 2024  
**Approved by**   
( Miss Preeyaporn Jaengkarnkit )  
Vice President, Department of Laboratory Services  
Responsible for the Technical Management Team

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

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

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

## Calibration Report

**Certificate No.:** 2402420-003-01  
**Equipment:** Electronic Balance  
**Model:** MS204TS/00  
**Serial No.:** C252436235  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g  
**ID No.:** UAE-AIR-023/2566

Page 2 of 3

**Date of Calibration:** 19 April 2024  
**Environment Condition:** Ambient Temperature: 21.7 ± 1.5 °C Relative Humidity: 65 ± 6.7 %  
**Place of Calibration:** Room 206 Balance Room 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Condition of Equipment:** Good Condition  
**Condition of This Results of Calibration:**

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M23111815	28 November 2024
Standard Weight Class E2	1-500g	15882	TCS	M23111825	28 November 2024
<b>Instrument</b>	<b>Model</b>	<b>Serial No.</b>	<b>Calibrated By</b>	<b>Certificate No.</b>	<b>Due Date</b>
Thermo-Hygro Meter	608-H1	NFI.BTH 019/23	Quality Reborn	QR24-0492	4 March 2025

3. This certification is traceable to SI UNIT

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

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

**Calibration Results:**

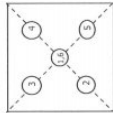
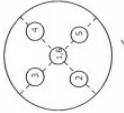
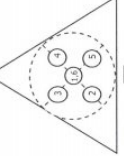
**1. Repeatability of Reading:**

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

**2. Off-Center Error:**

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

The balance reading obtained is given in the table.

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

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

## Calibration Report

**Certificate No.:** 2402420-003-01  
**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** MS204TS/00  
**Resolution:** 0.0001 g  
**Serial No.:** C352436235  
**ID No.:** UAE AIR 023/2566  
**Capacity:** 220 g

**Date of Calibration:** 19 April 2024 Page 3 of 3

**Calibration Results:** (Continued)

**Calibration Range:** 0-200 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:**

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

*P. Jangfaulit*  
23 April 2024

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

----- End -----

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



## Certificate of Calibration

### AquionRFIC : Anion (ID#1047)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co.,Ltd.

AquionRFIC S/N : 220380031  
AS-DV S/N : 220360045

for  
**United Analyst and Engineering Consultant Co.,Ltd.**  
บริษัท อูไนเต็ด แอนะลิซท์ แอนด์ อิงจิเนียริ่ง  
ARCHEMICA LAB CO.,LTD

Operator Signature : *K. Channarong* Date : Apr 23, 2024

(Mr.Channarong Khiao-Un)

Test Engineer

เอกสารไม่ควบคุม

# PM Anion ID#1047

## Preventive Maintenance Check List

เอกสารไม่ควบคุม

### Qualification Report

PM Check list, CM\_OQ and PQ

AquionRFIC : Anion (ID#1047)

Aquion : Cation (ID#1048)

For

United Analyst Engineering Consultand Co.,Ltd.

(Validate System 2024)

เอกสารไม่ควบคุม



Dionex Ion Chromatography  
Preventive Maintenance Report

Customer Organization	Name/ Department
United Analyst and Engineering Consultant Co.,Ltd.	Khun.Suwan Kongthong / Lab
Engineer	Date
Mr.Channarong Khiao-Un	23-24/Apr/2024

Instrument Detail

Instrument Model	Application
AquionRFC	Anion
Instrument components	Serial Number
AquionRFC	220380031
AS-DV	220360045

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
AS18	AG18	ADRS-600	-	EGC III KOH
				CR-ATC
Remark: ไม่พบปัญหา Column, Guard Column และ Suppressor เนื่องจาก peak shift ไม่พบ				

Perform By Archemica



K.Channarong

บริษัท อีเอ็มที แอนด์ จีทีอี  
ARCHEMICA LAB CO.,LTD

Archemica

23/Apr/2024

Date

Customer

23/Apr/2024

Date

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General ICS Maintenance Checklist

No.	Description	Checked	Cleaned	Replaced	Result
1	Power on & Connection	<input checked="" type="checkbox"/>	-	-	N.A
2	Instrument power on	<input checked="" type="checkbox"/>	-	-	-
3	Injection Valve Rebuild	<input checked="" type="checkbox"/>	Cleaned	Replaced	N.A
4	Rebuilt injection valve 6 port	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Rotor seal	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Stator face	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Optional Auxiliary Valve Rebuild	<input checked="" type="checkbox"/>	Cleaned	Replaced	N.A
8	Rebuilt auxiliary valve - port	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
9	Rotor seal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
10	Stator face	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
11	Check Valve Cartridge	<input checked="" type="checkbox"/>	Cleaned	Replaced	N.A
12	Inlet check valve assembly	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	Outlet check valve assembly	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	Verified correct flow orientation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	Pump Piston Rinse Seal, Piston Seal and Piston	<input checked="" type="checkbox"/>	Cleaned	Replaced	N.A
16	Piston rinse seal in primary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	Piston in primary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	Piston in secondary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	Piston seal in secondary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	Waste Valve and Priming Valve	<input checked="" type="checkbox"/>	Cleaned	Replaced	N.A
21	Waste valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22	Priming valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23	Cell Detector	<input checked="" type="checkbox"/>	Cleaned	Replaced	N.A
24	Check conductivity cell	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
25	Check electrochemical cell	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
26	Working electrode	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
27	Reference electrode	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
28	Gasket	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
29	Cell body	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
30	Other	<input checked="" type="checkbox"/>	Cleaned	Replaced	N.A
31	Sample Loop	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32	End-line filter	<input checked="" type="checkbox"/>	-	<input type="checkbox"/>	<input type="checkbox"/>
33	Leak sensor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34	Lubricate pump mechanic	<input type="checkbox"/>	Lubricated	-	<input type="checkbox"/>
35	Reconnected liquid lines to the valve	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
36	Reconnected liquid lines to pump heads	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
37	Primed pump	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
38	Checked pump for leaks	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
39	Checked gas for leaks	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>

เอกสารไม่ควบคุม



AS-DV Autosampler Preventive Maintenance Checklist

Model	Serial number	Firmware Version
<input checked="" type="checkbox"/> AS-DV	220360045	1.6.0

No.	Description	Result		
Power on & Connection		Checked	Cleaned	Replaced
1.	AS-DV power on	<input checked="" type="checkbox"/>	-	<input type="checkbox"/>
2.	AS-DV connection	<input checked="" type="checkbox"/>	-	<input type="checkbox"/>
Sampling Tip		Checked	Cleaned	Replaced
3.	Sampling needle	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4.	Sampling tubing (Transfer line)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5.	Reconnect sampling needle & tubing	<input checked="" type="checkbox"/>	-	<input type="checkbox"/>
Other		Checked	Cleaned	Replaced
6.	Check carousel movement	<input checked="" type="checkbox"/>	-	<input type="checkbox"/>
7.	Check needle movement	<input checked="" type="checkbox"/>	-	<input type="checkbox"/>
8.	Lubricate needle drive	<input type="checkbox"/>	<input checked="" type="checkbox"/> Lubricated	<input type="checkbox"/>
9.	AS-DV cover	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(Optional) High Pressure Valve		Checked	Cleaned	Replaced
10.	High pressure valve - Port	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
11.	- Rotor seal	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12.	- Stator face	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
13.	- Reconnected liquid line to the valve	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Others / comments

PM Cation ID#1048

Preventive Maintenance  
Check List



Dionex Ion Chromatography  
Preventive Maintenance Report

Customer Organization	Name/ Department
United Analyst and Engineering Consultant Co., Ltd.	Khun Suwan Kongthong / Lab
Engineer	Date
Mr.Channarong Khiao-Un	23-24/Apr/2024

Instrument Detail

Instrument Model	Application
Aquion	Cation
Instrument components	Serial Number
Aquion	220340349

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
CS12A	CG12A	CDER-600	-	-
Remark: แนะนำให้ปิดเครื่องใช้ก่อนถ่าย, System ยังไม่ได้ใช้				

Perform By Archemica



K. Channarong

บริษัท อารเคมีคา แล็บ จำกัด

ARCHEMICA LAB CO.,LTD

Archemica

23/Apr/2024

Date

Suwan

Customer

28/Apr/2024

Date



General ICS Maintenance Checklist

No.	Description	Checked	Cleaned	Replaced	Result
Power on & Connection					
1	Instrument power on	<input checked="" type="checkbox"/>	-	-	N.A.
2	Instrument connection	<input checked="" type="checkbox"/>	-	-	-
Injection Valve Rebuild					
3	Rebuilt injection valve & port	<input checked="" type="checkbox"/>	Cleaned	Replaced	N.A.
4	- Rotor seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	- Stator face	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(Optional) Auxiliary Valve Rebuild					
6	Rebuilt auxiliary valve - port	<input checked="" type="checkbox"/>	Cleaned	Replaced	N.A.
7	- Rotor seal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
8	- Stator face	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Check Valve Cartridge					
9	Inlet check valve assembly	<input checked="" type="checkbox"/>	Cleaned	Replaced	N.A.
10	Outlet check valve assembly	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	Verified correct flow orientation	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
Pump Piston Rinse Seal, Piston Seal and Piston					
12	Piston rinse seal in primary pump head	<input checked="" type="checkbox"/>	Cleaned	Replaced	N.A.
13	Piston seal in primary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	Piston in primary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	Piston rinse seal in secondary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	Piston seal in secondary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	Piston in secondary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Waste Valve and Priming Valve					
18	Waste valve	<input checked="" type="checkbox"/>	Cleaned	Replaced	N.A.
19	Priming valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cell Detector					
20	Check conductivity cell	<input checked="" type="checkbox"/>	Cleaned	Replaced	N.A.
21	Check electrochemical cell	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
22	- Working electrode	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
23	- Reference electrode	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
24	- Gasket	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
25	- Cell body	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other					
26	Sample Loop   Size 25 uL	<input checked="" type="checkbox"/>	Cleaned	Replaced	N.A.
27	End-line filter	<input type="checkbox"/>	-	<input type="checkbox"/>	<input type="checkbox"/>
28	Leak sensor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29	Lubricate pump mechanic	<input type="checkbox"/>	Lubricated	-	<input type="checkbox"/>
30	Reconnected liquid lines to the valve	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
31	Reconnected liquid lines to pump heads	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
32	Primed pump	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
33	Checked pump for leaks	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
34	Checked gas for leaks	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>

เอกสารไม่ควบคุม

# CM OQ

## Chromeleon Operation Qualification

เอกสารไม่ควบคุม

### ThermoFisher SCIENTIFIC Chromeleon Operational Qualification

#### General Information

Instrument Controller: DESKTOP-C4FS3L7  
Client: DESKTOP-C4FS3L7  
Operator: Mr.Channarong Khiao-Un  
Computer Name: DESKTOP-C4FS3L7  
Version Number: 7.3.1 Build 6535  
7.3.1.6535

Overall Test Result: Passed

#### Comparison Format:

All Parameters:	Significant Digits:	10
-----------------	---------------------	----



K.Channarong 23/Apr/2024

Reviewer's Signature // Date

Operator's Signature // Date

เอกสารไม่ควบคุม

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Chromeleon Operational Qualification, Part 1  
Verification of Selected Results

Detection Algorithm:		Cobra
Calibration Type:		Lin, WithOffset
Evaluation Type:		Area
Standard Method:		External
Calibration Mode:		Total
Report Variable	Peak Name	Status
Offset (c0)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Slope (c1)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Correlation Coeffi.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Variance	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Std. Deviation	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Rel. Std. Dev.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Variance Coeffi.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok

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เอกสารไม่ควบคุม

ThermoFisher  
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Chromeleon Operational Qualification, Part 1  
Verification of Selected Results

Report Variable	Peak Name	Status
Calibration Point X	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Calibration Point Y	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Amount [ng]	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Resolution (EP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Resolution (USP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Peak Asymmetry (EP/USP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Peak Asymmetry (AIA)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok

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Chromeleon Operational Qualification, Part 1  
Verification of Selected Results

Report Variable	Peak Name	Status
Theoretical Plates (EP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Theoretical Plates (USP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Theoretical Plates (JP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok

Test Result: Passed

เอกสารไม่ควบคุม

ThermoFisher  
S C I E N T I F I C

Chromeleon Operational Qualification, Part 2  
Most Frequently Used Parameters: Comparison with Expected Results

Detection Algorithm: Cobra  
Calibration Type: Lin, WithOffset  
Evaluation Type: Area  
Standard Method: External  
Calibration Mode: Total

Variable Category	Report Variable	Peak Name	Status
Injection	No.		ok
	Name		ok
	Type		ok
	Position		ok
	Status		ok
	Volume		ok
	Dilution Factor		ok
	Weight		ok
	IntStd		ok
	InstrumentMethod ProcessingMethod		ok
Chromatogram	Channel		ok
	No. of Peaks		ok
	Chromatogram Start Time		ok
	Signal Min.		ok
	Signal Max.		ok
	Unit		ok
	Noise		ok
Peak Results	No.	Acetanilide	ok
	No.	Acetophenone	ok
	No.	Propiophenone	ok
	Peak Name	Acetanilide	ok
	Peak Name	Acetophenone	ok
	Peak Name	Propiophenone	ok
	Ret.Time	Acetanilide	ok
	Ret.Time	Acetophenone	ok
	Ret.Time	Propiophenone	ok

เอกสารไม่ควบคุม

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Abs.Ret.Dev.	Acetanilide	ok
	Ret.Dev.(abs)	Acetophenone	ok
	Ret.Dev.(abs)	Propiophenone	ok
	Rel.Ret.Dev.	Acetanilide	ok
	Ret.Dev.(rel)	Acetophenone	ok
	Ret.Dev.(rel)	Propiophenone	ok
	Area	Acetanilide	ok
	Area	Acetophenone	ok
	Area	Propiophenone	ok
	Rel.Area	Acetanilide	ok
	Rel.Area (Total)	Acetophenone	ok
	Rel.Area (Total)	Propiophenone	ok
	Height	Acetanilide	ok
	Height	Acetophenone	ok
	Height	Propiophenone	ok
	Rel.Height (Total)	Acetanilide	ok
	Rel.Height (Total)	Acetophenone	ok
	Rel.Height (Total)	Propiophenone	ok
	Amount	Acetanilide	ok
	Amount	Acetophenone	ok
	Amount	Propiophenone	ok
	Concentration	Acetanilide	ok
	Concentration	Acetophenone	ok
	Concentration	Propiophenone	ok
	Rel.Amount	Acetanilide	ok
	Rel.Amount	Acetophenone	ok
	Rel.Amount	Propiophenone	ok
	Peak Width (0%)	Acetanilide	ok
	Peak Width (0%)	Acetophenone	ok
	Peak Width (5%)	Acetanilide	ok
	Peak Width (5%)	Acetophenone	ok
	Peak Width (10%)	Acetanilide	ok
	Peak Width (10%)	Acetophenone	ok
	Peak Width (10%)	Propiophenone	ok

เอกสารไม่ควบคุม

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Peak Width (50%)	Acetanilide	ok
	Peak Width (50%)	Acetophenone	ok
	Peak Width (50%)	Propiophenone	ok
	Left Width (0%)	Acetanilide	ok
	Left Width (0%)	Acetophenone	ok
	Left Width (0%)	Propiophenone	ok
	Right Width (0%)	Acetanilide	ok
	Right Width (0%)	Acetophenone	ok
	Right Width (0%)	Propiophenone	ok
	Peak Start	Acetanilide	ok
	Peak Start	Acetophenone	ok
	Peak Start	Propiophenone	ok
	Peak Stop	Acetanilide	ok
	Peak Stop	Acetophenone	ok
	Peak Stop	Propiophenone	ok
	Peak Start Value	Acetanilide	ok
	Peak Start Value	Acetophenone	ok
	Peak Start Value	Propiophenone	ok
	Peak Stop Value	Acetanilide	ok
	Peak Stop Value	Acetophenone	ok
	Peak Stop Value	Propiophenone	ok
	BL-Value Peak Start	Acetanilide	ok
	BL-Value Peak Start	Acetophenone	ok
	BL-Value Peak Start	Propiophenone	ok
	BL-Value Peak Stop	Acetanilide	ok
	BL-Value Peak Stop	Acetophenone	ok
	BL-Value Peak Stop	Propiophenone	ok
	Type	Acetanilide	ok
	Type	Acetophenone	ok
	Type	Propiophenone	ok
	Resolution (EP)	Acetanilide	ok
	Resolution(EP)	Acetophenone	ok
	Resolution(USP)	Acetanilide	ok
	Resolution(USP)	Acetophenone	ok
	Asymmetry(EP)	Acetanilide	ok
	Asymmetry(EP)	Acetophenone	ok
	Asymmetry(EP)	Propiophenone	ok

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Chromleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Asymmetry(A/A)	Acetanilide	ok
	Asymmetry(A/A)	Acetophenone	ok
	Asymmetry(A/A)	Propiophenone	ok
	Theor. Plates(EP)	Acetanilide	ok
	Theor. Plates(EP)	Acetophenone	ok
	Theor. Plates(EP)	Propiophenone	ok
	Theor. Plates(USP)	Acetanilide	ok
	Theor. Plates(USP)	Acetophenone	ok
	Theor. Plates(USP)	Propiophenone	ok
	Theor. Plates(JP)	Acetanilide	ok
	Theor. Plates(JP)	Acetophenone	ok
	Theor. Plates(JP)	Propiophenone	ok
Peak Calibration	Cal.Mode	Acetanilide	ok
	Cal.Mode	Acetophenone	ok
	Cal.Mode	Propiophenone	ok
	Cal.Type	Acetanilide	ok
	Cal.Type	Acetophenone	ok
	Cal.Type	Propiophenone	ok
	Weights	Acetanilide	ok
	Weights	Acetophenone	ok
	Weights	Propiophenone	ok
	Calibr. Coefficient C0	Acetanilide	ok
	Calibr. Coefficient C0	Acetophenone	ok
	Calibr. Coefficient C0	Propiophenone	ok
	Calibr. Coefficient C1	Acetanilide	ok
	Calibr. Coefficient C1	Acetophenone	ok
	Calibr. Coefficient C1	Propiophenone	ok
	RF-Value	Acetanilide	ok
	RF-Value	Acetophenone	ok
	RF-Value	Propiophenone	ok
	No. of Points	Acetanilide	ok
	No. of Points	Acetophenone	ok

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Chromleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	No. of Points	Propiophenone	ok
	No. of Points(disabled)	Acetanilide	ok
	No. of Points(disabled)	Acetophenone	ok
	No. of Points(disabled)	Propiophenone	ok
	Variance	Acetanilide	ok
	Variance	Acetophenone	ok
	Variance	Propiophenone	ok
	Var.Coeff	Acetanilide	ok
	Var.Coeff	Acetophenone	ok
	Var.Coeff	Propiophenone	ok
	Std.Dev.	Acetanilide	ok
	Std.Dev.	Acetophenone	ok
	Std.Dev.	Propiophenone	ok
	Rel.Std.Dev.	Acetanilide	ok
	Rel.Std.Dev.	Acetophenone	ok
	Rel.Std.Dev.	Propiophenone	ok
	Corr.Coeff.	Acetanilide	ok
	Corr.Coeff.	Acetophenone	ok
	Corr.Coeff.	Propiophenone	ok
	R-Square	Acetanilide	ok
	R-Square	Acetophenone	ok
	R-Square	Propiophenone	ok
	Adj. R-Square	Acetanilide	ok
	Adj. R-Square	Acetophenone	ok
	Adj. R-Square	Propiophenone	ok
	X	Acetanilide	ok
	X	Acetophenone	ok
	X	Propiophenone	ok
	Y	Acetanilide	ok
	Y	Acetophenone	ok
	Y	Propiophenone	ok
	W	Acetanilide	ok
	W	Acetophenone	ok
	W	Propiophenone	ok
	F(X)	Acetanilide	ok
	F(X)	Acetophenone	ok
	F(X)	Propiophenone	ok

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	Residual for Cal.Point X	Acetanilide	ok
	Residual for Cal.Point X	Acetophenone	ok
	Residual for Cal.Point X	Propiophenone	ok
	Calibration Point Status	Acetanilide	ok
	Calibration Point Status	Acetophenone	ok
	Calibration Point Status	Propiophenone	ok
	Amount	Acetanilide	ok
	Amount	Acetophenone	ok
	Amount	Propiophenone	ok
Component	Cal.Type	Acetanilide	ok
	Peak Type	Acetanilide	ok
	Left Limit	Acetophenone	ok
	Right Limit	Acetanilide	ok
	Group	Acetanilide	ok
	Factor	Acetophenone	ok
	Amount	Acetanilide	ok
	Conc.Unit	Acetophenone	ok
			ok

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Purity	PPI	Acetanilide	ok
	PPI	Acetophenone	ok
	PPI	Propiophenone	ok
	RSD PPI	Acetanilide	ok
	RSD PPI	Acetophenone	ok
	RSD PPI	Propiophenone	ok
	Match	Acetanilide	ok
	Match	Acetophenone	ok
	Match	Propiophenone	ok
	RSD Match	Acetanilide	ok
	RSD Match	Acetophenone	ok
	RSD Match	Propiophenone	ok
	Rel.Max at	Acetanilide	ok
	Rel.Max at	Acetophenone	ok
	Rel.Max at	Propiophenone	ok

Test Result: Passed

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Chromeleon Operational Qualification, Part 3  
System Suitability Test: Comparison with Expected Results

Variable Category	Report Variable	Status
System Suitability Test Case	Number	ok
	Name	ok
	Inj. Condition	ok
	Eval. Formula	ok
	Operator	ok
	Statistics	ok
	Rounding	ok
	MinimumNumberOfInjections	ok
	MaximumNumberOfInjections	ok
	Channel	ok
	Peak	ok
	Ref. Value Formula 1	ok
	Ref. Value Formula 2	ok
	N.A.	ok
System Suitability Test Case Result	Inj. Eval. Result	ok
	Eval. Result	ok
	Peak Result	ok
	Injection Condition Result	ok
	Ref. Value 1	ok
	Ref. Value 2	ok
	Result	ok
	Message	ok
	Average	ok
	Count	ok
	Maximum	ok
	Minimum	ok
	Range	ok
	Rel. Range	ok
	Rel. Std. Dev.	ok
	Std. Dev.	ok
	Sum	ok

Test Result: Passed

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SOFTWARE OQ

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Chromeleon

	Part 1 - Verification of Selected Results	PASS
	Part 2 - Most Frequently Used Parameters: Comparison with Expected Results	PASS
	Part 3 - System Suitability Test: comparison with Expected Results	PASS

OVERALL TEST RESULT: PASS



บริษัท อารีเคมีกา แล็บ จำกัด  
ARCHEMICA LAB CO., LTD.

Field Service Representative Signature:	Customer Signature:
<i>K. Tanwarat</i>	<i>Simon</i>
Date: 29 Apr 2024	Date: 29 Apr 2024

# PQ Anion ID#1047

## Performance Qualification

### Test Equipment

Equipment	Manufacturer	Model	Serial Number	Cal/Ver Date	Good Until
Multimeter	Fluke	289	27970244	N/A	N/A
Thermocouple	Fluke	K-Type	27970244	N/A	N/A
Balance	Mettler Toledo	AB204-S	1129361010	N/A	N/A
IC Qualification	Thermo Scientific	Test Box	21379153	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A

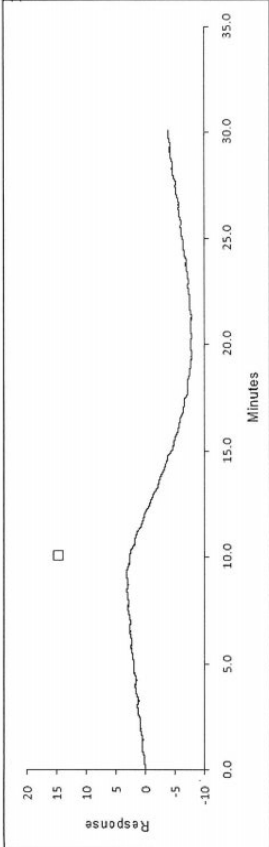
### Standards/Chemicals

Description	Manufacturer	Concentration	Part Number	Lot Number	Expiration Date
Nitrate	Thermo Scientific	5 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	10 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	25 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	50 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	100 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	1000 ppm	060254	231226	Dec-2024
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A



Field Service Representative Signature:	Customer Signature:
<i>K. Banthorak</i>	<i>Sunam</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

NOISE AND DRIFT (CD)



Information

System Name	Aqion RFIC	
Detector	SN	220360045
Data Path	chrom://desktop-c4fs37/ChromleonLocal/Archemical/Service Contract/Validate 2024/1PM1PQ 23-04-24/Anion/IC OQ.seq/278.smp/ECD_1_channel	

Noise and Drift

Test	Measured (nS)	OQ Limit (nS)	Result	Conversion Factor
Noise	1.1 nS	≤ 2.0 nS	PASS	1000
Drift	16.1 nS/hr	≤ 20.0 nS/hr	PASS	1000



OVERALL TEST RESULT: PASS

บริษัท อีอาร์เคมีคัล แล็บ จำกัด  
ARCHEMICA LAB CO., LTD.

Field Service Representative Signature:	Customer Signature:
<i>K. Attanaporn</i>	<i>Sinon</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

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REPEATABILITY (CD)

Information

System Name	Aqion RFIC	
Detector SN		220360045
Data Path	ChromleonLocal/Archemical/Service Contract/Validate 2024/1PM1PQ 23-04-24/Anion/IC OQ	

Peak Results

Sample Name	Injection Volume (µL)	Retention Time (min)	Area
Repeatability 01	25	0.265	2.825
Repeatability 02	25	0.265	2.822
Repeatability 03	25	0.265	2.831
Repeatability 04	25	0.265	2.835
Repeatability 05	25	0.265	2.834
Repeatability 06	25	0.265	2.836

Repeatability

Test	Measured (% RSD)	OQ Limit (% RSD)	Result
Retention Time	0.0	≤ 5.0	PASS
Area	0.2	≤ 1.0	PASS



OVERALL TEST RESULT: PASS

บริษัท อีอาร์เคมีคัล แล็บ จำกัด  
ARCHEMICA LAB CO., LTD.

Field Service Representative Signature:	Customer Signature:
<i>K. Attanaporn</i>	<i>Sinon</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

เอกสารไม่ควบคุม



ELUENT GENERATOR TEST

EG Current Test

Set Point (mM)	Expected (mA)	Reading (mA)	Deviation (mA)	OQ Limit (mA)	Result
1.00	1.6082	1.604	0.00	± 0.01	PASS
5.00	8.041	8.019	0.02	± 0.05	PASS
10.00	16.082	16.037	0.05	± 0.10	PASS
50.00	80.41	80.17	0.24	± 0.50	PASS
100.00	160.82	160.32	0.50	± 1.00	PASS



OVERALL TEST RESULT: PASS

Field Service Representative Signature:	Customer Signature:
<i>K. Arunwong</i>	<i>Arten</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

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IC PUMP FLOW RATE ACCURACY

IC Pump Flow Rate

Set Point (mL) (mL/min)	Reading (mL/min)	Deviation (%)	OQ Limit (%)	Result
0.5	0.4995	0.100	± 2.0	PASS
1.0	0.999	0.10	± 2.0	PASS



OVERALL TEST RESULT: PASS

Field Service Representative Signature:	Customer Signature:
<i>K. Arunwong</i>	<i>Arten</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

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TEMPERATURE ACCURACY

Column Compartment

Set Point (°C)	Reading (°C)	Deviation (°C)	OQ Limit (°C)	Result
30.0	30.5	0.5	± 2.0	PASS



OVERALL TEST RESULT: PASS

Field Service Representative Signature:	Customer Signature:
<i>K. Chuan-Rong</i>	<i>Simon</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

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OQ EXCEPTIONS AND COMMENTS

N/A

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Field Service Representative Signature:	Customer Signature:
<i>K. Chuan-Rong</i>	<i>Simon</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

เอกสารไม่ควบคุม

OO REVIEW AND COMPLETION

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These Operational Qualification Results should be reviewed by the Customer. If the qualification is accepted, both the Customer and the Service Representative should sign the Operational Qualification Results, below.

OPERATIONAL QUALIFICATION RESULTS

Based upon the actual results obtained, this Operational Qualification **PASSED** the acceptance criteria described in the Operational Qualification in the Installation Checklist procedure.

Service Representative

A Field Service Representative signature below confirms the completion of all aspects of the Operational Qualification and have concluded that the system has been successfully verified to be operating as required.

Customer

A Customer signature below confirms the completion of all aspects of the Operational Qualification have been completed and that the system has been successfully verified to be operating as required.



Field Service Representative Signature:	Customer Signature:
<i>K. Khamkhaeng</i>	<i>[Signature]</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

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	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	30/1/2025	29/1/2026
		CHROMIUM COPPER LEAD MERCURY NICKEL ZINC IRON						
2	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11/5/2024	10/5/2025
			Mettler Toledo	AB204-S/FACT / 1129361010	United Analyst and Engineering Consultant Co., Ltd.	250422 1 BL002 25	23/4/2025	22/4/2026
3	Analytical Balance	TOTAL DISSOLVED SOLIDS TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2402283-002-01	2/4/2024	1/4/2025
			Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2502226-002-01	20/3/2025	19/3/2026
4	Analytical Balance	TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2402283-001-01	2/4/2024	1/4/2025
			Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2502226-001-01	20/3/2025	19/3/2026
5	BOD Incubator	BIOCHEMICAL OXYGEN DEMAND	ARCO	UC4-1320 / 1021	Technology Promotion Association (Thailand-Japan)	24TM1113	11/7/2024	16/7/2025
6	BOD Incubator	BIOCHEMICAL OXYGEN DEMAND	ARCO	UC4-1320 / 1021	Technology Promotion Association (Thailand-Japan)	24TM1114	11/7/2024	10/7/2025

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*
7	BOD Incubator	BIOCHEMICAL OXYGEN DEMAND	ARCO	UR-1320 / -	Technology Promotion Association (Thailand-Japan)	24TM587	1/4/2024	31/3/2025
			ARCO	UR-1320 / -	Technology Promotion Association (Thailand-Japan)	25TM577	19/3/2025	19/3/2026
8	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21/2/2024	20/2/2025
			YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	25TW29	18/2/2025	16/2/2026
9	Digestion Units	TOTAL KJELDAHL NITROGEN	VELP/VELP Scientifica	DKL20 / 213517	National Food Institute Ministry of Industry, Thailand	2404228-001-01	26/8/2024	25/8/2025
10	SCT Meter	CONDUCTIVITY (umhos/cm)	Horiba	LAQUA-EC210 / HC9L0015	Technology Promotion Association (Thailand-Japan)	25CH245	26/2/2025	25/2/2026
11	Heating Block	CHEMICAL OXYGEN DEMAND	Hanna Instruments Italia Srl.	HI 839800-02 / H 018500 I	Hanna Instruments (Thailand) Ltd.	HIT-2412-0389	18/3/2024	17/3/2025
			Hanna Instruments Italia Srl.	HI 839800-02 / H 018500 I	Hanna Instruments (Thailand) Ltd.	HIT-2510-0375	7/3/2025	6/3/2026
12	Heating Block	CHEMICAL OXYGEN DEMAND	Hanna Instruments Inc.(Romania)	HI839800-02 / 4500052101	Hanna Instruments (Thailand) Ltd.	HIT-2427-0942	17/2024	30/6/2025
13	Mercury Analyzer	MERCURY	NIC. Japan	RA-4500 / 17780278	Coax Group Corporation Ltd.	Preventive Maintenance Report	9/7/2024	8/7/2025
14	Hot Air Oven	TOTAL DISSOLVED SOLIDS TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B216.1686	National Food Institute, Ministry of Industry, Thailand	2500116-001-01	8/10/2024	7/10/2025
15	Hot Air Oven	TOTAL DISSOLVED SOLIDS TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	24TM589	1/4/2024	31/3/2025

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*
16	Cooled Incubator	FECAL COLIFORM BACTERIA	Binder	KB400 / WTB20200000015535	Technology Promotion Association (Thailand-Japan)	24TM647	1/4/2024	31/3/2025
		TOTAL COLIFORM BACTERIA	Binder	KB400 / WTB20200000015535	National Food Institute, Ministry of Industry, Thailand	2502229-006-01	19/3/2025	18/3/2026
17	Incubator	FECAL COLIFORM BACTERIA TOTAL COLIFORM BACTERIA	Binder	KB400 / 20220000022479	Technology Promotion Association (THAILAND-JAPAN)	24TM938	9/7/2024	8/7/2025
18	Kjeltec Distillation Unit	TOTAL KJELDAHL NITROGEN	FOSS	KT9 / 91905393	FOSS South East Asia	12875	5/7/2024	4/7/2025
19	Kjeltec System Distilling Unit	TOTAL KJELDAHL NITROGEN	Foss Tecator (Labtec)	KT200 / 91790524	FOSS South East Asia	9810	8/2/2024	7/2/2025
			Foss Tecator (Labtec)	KT200 / 91790524	FOSS South East Asia	13319	27/1/2025	26/1/2026
20	Kjeltec Distillation Unit	TOTAL KJELDAHL NITROGEN	FOSS	Kjeltec 8100 / 91889052	FOSS South East Asia	9807	8/2/2024	7/2/2025
			FOSS	Kjeltec 8100 / 91889052	FOSS South East Asia	13854	24/2/2025	23/2/2026
21	pH Meter	pH	Horiba	LAQUA-PH210 / HA9M0048	technology promotion association (thailand-japan)	24CH723	19/6/2024	17/6/2025
22	pH Meter	pH	Horiba	LAQUA-PH210 / HA0A0005	technology promotion association (thailand-japan)	24CH1597	26/12/2024	24/12/2025
23	pH Meter	pH	Horiba	LAQUA-PH210 / HA1L0035	technology promotion association (thailand-japan)	25CH262	28/2/2025	27/2/2026
24	pH Meter	pH	Horiba	LAQUA-PH210 / HA1M0036	technology promotion association (thailand-japan)	25CH52	15/1/2025	14/1/2026
25	pH Meter	pH	Horiba	LAQUA-PH210 / HA0D0082	technology promotion association (thailand-japan)	25CH588	21/5/2025	20/5/2026

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*
26	pH Meter	pH	Horiba	LAQUA-PH210 / HA0C0025	technology promotion association (thailand-japan)	25CH261	26/2/2025	25/3/2026
27	pH Meter	pH	YSI Environmental	pH 100A / JC03335	Technology Promotion Association (Thailand-Japan)	25CH163	5/2/2025	3/2/2026
28	pH Meter	pH	YSI Environmental	pH 100A / JC03354	Technology Promotion Association (Thailand-Japan)	24CH1379	5/11/2024	6/11/2025
29	Spectrophotometer	CHROMIUM HEXAVALENT NITRATE	Agilent	Cary 60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP25-019	26/5/2025	25/5/2026
30	UV-VIS Spectrophotometer	COLOUR (pH 7.0) COLOUR (pH Sample) NITRATE NITROGEN TOTAL PHOSPHORUS	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP25-001	3/1/2025	2/1/2026
31	UV/VIS Spectrophotometer	AMMONIA-NITROGEN CHEMICAL OXYGEN DEMAND	Hitachi	U-5100 / 23A4-008	DQE Services Co.,Ltd.	SP24-028	11/9/2024	9/9/2025
32	Turbidity Meter (Portable)	TURBIDITY (NTU)	Oakton Instruments(China)	T-100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	24CH1115	6/9/2024	5/9/2025

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



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## Certificate of Calibration

Cert.No.: 24CH723  
Page.: 1 of 3

Equipment : pH Meter  
Manufacturer : Horiba  
Model : LAQUA-PH210  
Serial No. : HA9M0048  
ID No. : UAE.EFM.003/2563(EFM.pH.03/63)  
Condition As-Received: Used Item  
Received Date : 18 June 2024  
Calibration Date : 19 June 2024  
Reference : 2406-0570WSC-1  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phraekhanong, 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 : Warakorn Lengagatrakul

Approved by :   
Approved Signatory

( ) Unnophol Harachai  
( ) Ponpan Paipim  
(✓) Sathip Meangmai

Issue Date : 20 June 2024

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

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Cert.No.: 24CH723  
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	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

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

2. Certified Reference Materials : 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	970851	25 Apr 2026
pH 6.986	CPA chem	970852	25 Apr 2025
pH 9.997	CPA chem	970853	25 Apr 2025

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

### Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement ( ±mV )	Coverage factor k
			mV	pH		
pH Meter S/N.: HA9M0048	pH 4.00	177.48	177.6	4.01	0.058	2.00
	7.00	0.00	0.2	7.00	0.058	2.00
	10.00	0.00	0.2	7.00	0.058	2.00
		-177.48	-177.3	10.01	0.058	2.00



Cert.No.: 24CH723  
Page.: 3 of 3

#### Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor <i>k</i>
pH Electrode	4.008	4.01	176.1	0.0079	2.00
S/N: Q9AD0211	6.986	7.00	0.7	0.0093	2.00
	6.986	7.01	0.7	0.0093	2.00
	9.997	10.01	-172.2	0.0092	2.00

#### Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652-10D

- Serial No. : Q9AD0211

Dimension of probe

- Length : 103 mm.

- Diameter : 16 mm.

- Immersion Depth : 80 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor <i>k</i>
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.001	30.0	-0.001	0.13	2.00
35.0	35.004	35.0	-0.004	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.: 24CH1115  
Page.: 1 of 2

Equipment : Turbidity Meter  
Manufacturer : Oakton  
Model : T100IR  
Serial No. : 1120501017  
ID. No. : UAE.WAT.056/2563  
Condition As-Received: Used Item  
Received Date : 05 September 2024  
Calibration Date : 06 September 2024  
Reference : 2409-0177DSC-1  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 20) %  
Calibration Procedure : In - house method : CP-CH11  
Direct measurement by using Formazin standard solution

Calibrated by : Walalak Sirithean  
Approved by : *Sathip*  
Approved Signatory

( ) Unnophol Harachai  
( ) Porpan Paipim  
(✓) Sathip Meangmai

Issue Date : 9 September 2024

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No. : 24CH1115

Page. : 2 of 2

#### Condition of this calibration result

##### 1. Reference Standard Instruments :

Instruments	Serial No.	ID No.	Certificate No.	Due date
1) Thermo-Hygograph	1103328	130EC010	24H1372	12 July 2025
2) Electronic Balance	1126143764	140RC004	22MM22	20 Feb 2025

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

##### 2. Standard Material : The Formazin suspension has been prepared gravimetric from

Material	Manufacturer	Lot No.	Assay
1) Hexamethylenetetramine	HIMEDIA	0000493947	99.65%
2) Hydrazinium Sulfate	HIMEDIA	0000522014	99.40%

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

#### Calibration result

Performing five - Formazin suspension standard curve by using 0.20,100,400,800 NTU

Turbidity Meter Serial Number : 1120501017

Standard Formazine suspension ( NTU )	UUC* Reading ( NTU )	Uncertainty of Measurement ( ± NTU )	Coverage Factor k
0	0.00	0.0081	2.06
20	20.2	0.39	2.00
100	100	0.75	2.00
400	401	1.5	2.06
800	801	2.1	2.17

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

- NTU = Nephelometric Turbidity Units

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.: 24CH1379

Page.: 1 of 3

Equipment : pH Meter  
Manufacturer : EcoSense  
Model : pH100A  
Serial No. : JO03354  
ID No. : UAE EFM.063/2562(ENV pH03.62)  
Condition As-Received: Used Item  
Received Date : 05 November 2024  
Calibration Date : 06 November 2024  
Reference : 2411-0122WSC-1  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In - house method :  
- CP-CH5 by direct measurement with DC voltage  
standard and direct measurement with  
certified reference material (CRM)  
- CP-CH8 by comparison with temperature standard

Calibrated by : Warakorn Lengagatrakul

Approved by :  
Approved Signatory

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

Issue Date : 8 November 2024

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.: 24CH1379  
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	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025

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

2. Certified Reference Materials : The measurement results are traceable to SI through Hach Lenge GmbH Ltd.,  
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	1034203	27 Sep 2026
pH 6.999	Hach Lenge GmbH	C03145	28 Feb 2026
pH 10.010	CPA chem	1034205	27 Sep 2025

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

**Calibration Results**

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement ( $\pm$ mV)	Coverage factor $k$
			mV	pH		
pH Meter S/N.: JC03354	4.00	177.48	177	4.01	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-178	10.01	0.58	2.00



Cert.No.: 24CH1379  
Page.: 3 of 3

**Calibration Results**

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor $k$
pH Electrode S/N.:240710SIA605377	4.008	4.01	173	0.0079	2.00
	6.999	7.00	-2	0.0092	2.00
	6.999	7.00	-2	0.0095	2.00
Function : Temperature Measurement					
(*) Without adjustment					
This equipment was connected with Temperature Probe;					
- Model : -					
- Serial No. : 240710SIA605377					
Dimension of probe					
- Length : 110 mm.					
- Diameter : 12 mm.					
- Immersion Depth : 100 mm.					

Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -  
- Serial No. : 240710SIA605377  
Dimension of probe  
- Length : 110 mm.  
- Diameter : 12 mm.  
- Immersion Depth : 100 mm.

Calibration Point ( $^{\circ}$ C)	Standard Temperature ( $^{\circ}$ C)	UUC* Reading ( $^{\circ}$ C)	Error ( $^{\circ}$ C)	Uncertainty of measurement ( $\pm$ $^{\circ}$ C)	Coverage factor $k$
15.0	15.003	14.9	-0.103	0.13	2.00
30.0	30.001	29.9	-0.101	0.13	2.00
45.0	45.003	44.8	-0.203	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.: 24CH1597  
Page.: 1 of 3

Equipment : pH Meter  
Manufacturer : Horiba  
Model : LAQUA-PH210  
Serial No. : HA0A0005  
ID No. : UAE.EFM.004/2563(EFM.pH.04/63)  
Condition As-Received: Used Item  
Received Date : 24 December 2024  
Calibration Date : 26 December 2024  
Reference : 2412-0601WSC-2  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong, Bangkok 10260

Ambient Temperature :  $(25 \pm 2.5) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 15) \%$   
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 : Warakorn Lemgegrakul

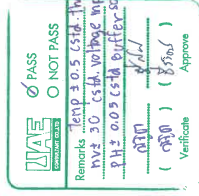
Approved by :   
Approved Signatory

( ) Pornthippa Tameyakul  
( ) Porpan Palpin  
(x) Sathip Meangmai

Issue Date : 27 December 2024

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

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Cert.No.: 24CH1597  
Page.: 2 of 3

#### Condition of this calibration result

- Reference Standard Instrument  

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025
- This Certification is traceable to SI Thought Technology Promotion Association (Thailand - Japan)
- Certified Reference Materials  
:The measurement results are traceable to SI through Hach Lange GmbH Ltd.,  
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00  
:The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	1034203	27 Sep 2026
pH 7.000	Hach Lange GmbH	C03185	09 July 2026
pH 10.010	CPA chem	1034205	27 Sep 2025

- 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
			mV	pH		
			pH			
pH Meter S/N.: HA0A0005	4.00	177.48	177.4	4.01	0.058	2.00
	7.00	0.00	0.1	7.00	0.058	2.00
	7.00	0.00	0.1	7.00	0.058	2.00
	10.00	-177.48	-177.2	10.01	0.058	2.00



Cert.No.: 24CH1597  
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	177.2	0.0079	2.00
	7.000	7.00	2.2	0.0092	2.00
	7.000	7.00	2.2	0.0085	2.00
	10.010	10.01	-170.9	0.0095	2.00

Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -
- Serial No. : -
- Dimension of probe
- Length : 112 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	15.003	15.0	-0.003	0.13	2.00
30.0	30.001	30.0	-0.001	0.13	2.00
45.0	45.002	45.0	-0.002	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.: 24MM292  
Page.: 1 of 3

Equipment : Electronic Balance  
Manufacturer : Mettler Toledo  
Model : AB204-S/FACT  
Serial No. : 1129361010  
ID No. : UAE.WAS.002/2552

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260

Location : Balance Room (108)

Received order : 11 May 2024

Calibration Date : 11 May 2024

Ambient Temperature : 15 °C to 40 °C

Relative Humidity : 30 % to 90 %

Calibrated by : Khit Rutnanaprapachai

*Kunchit*

Approved by : Approved Signatory

( ) Ponpan Paipim  
( ) Suwit Imjai  
(✓) Kunchit Promprat

Issue Date : 15 May 2024

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม



Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2405-0166OC-1  
Procedure used :-

Calibration were conducted using in-house calibration procedure CP-OB01 based on UKAS LAB 14 according to direct measurement method against standard weight.

### Condition of this result of calibration

1. Reference standard instruments:-

- 1) Standard Weight Set (E2) Model 15884 Serial No. 24053 ID No. 70RC007 Test report No. MM-0013-24 Due date 25 Jan 2026
- 2) This certificate is valid only to the item calibrated on date and place of calibration.
- 3) This result of calibration was made on requested at the point specified by customer.
- 4) This certificate is not certified for any commercial transaction.
- 5) This certification is traceable to the International System of Unit.

Result of calibration ( ) Without Adjustment ( \* ) After Adjustment by Internal Calibration

Range capacity : 0 g to 220 g Resolution 0.0001 g

Before Adjustment :

Applied Weight ( g )	Balance Reading ( g )	Correction ( g )	Measurement Uncertainty ( ± mg )	Coverage Factor ( k )
100	100.0000	0.0000	0.19	2.03
200	200.0006	-0.0006	0.30	2

After Adjustment :

1. Determination of the standard deviation of weighing machine ( n = 10 )

Applied Weight ( g )	Standard Deviation of Reading ( g )
100	0.00007
200	0.00005

เอกสารไม่ควบคุม



Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2405-0166OC-1

#### Result of calibration

#### 2. Effect of off center loading

A mass of 100 g was placed to various position on the pan.  
The weighing machine reading error obtained is given in the table

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)
-0.0004	-0.0004	-0.0003	-0.0003	-0.0004

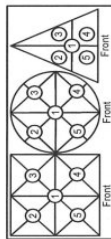
#### 3. Departure from nominal value

Applied Weight (g)	Balance		Measurement Uncertainty ( $\pm$ mg)	Correction (g)	Coverage Factor ( $k$ )
	Reading (g)	Factor ( $k$ )			
Unload	0.0000	0.15	0.15	0.0000	2.13
0.01	0.0100	0.15	0.15	0.0000	2.13
0.05	0.0500	0.15	0.15	0.0000	2.13
0.1	0.1000	0.15	0.15	0.0000	2.13
0.5	0.5000	0.15	0.15	0.0000	2.13
1	1.0000	0.15	0.15	0.0000	2.13
10	10.0000	0.15	0.15	0.0000	2.11
50	49.9999	0.17	0.17	+0.0001	2.06
100	99.9999	0.19	0.19	+0.0001	2.03
150	149.9998	0.29	0.29	+0.0002	2
200	199.9990	0.30	0.30	+0.0010	2

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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Cert.No.: 24MM292  
Page: 3 of 3



Maximum difference between  
off-center and central loading  
(g)

0.0001



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NSC-TS1-TS1725  
CALIBRATION 0008

Cert. No.: 24TM587  
Page: 1 of 3

## Certificate of Calibration

Equipment : BOD Incubator  
Manufacturer : ARCO  
Model : UR-1320  
Serial No. :  
ID No. : UAE.WAO.018/2551  
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 : 01 April 2024  
Calibration Date : 01 April 2024  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$   
Calibrated by : Krisda Malee

Approved by :  
( ) Ponpan Palpim  
( ) Suwit Imjai  
( ) Kunchit Promprat  
Approved Signatory

Issue Date : 5 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม

เอกสารไม่ควบคุม  
A 0065063



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2404-0004OC-1

Cert. No.: 24TM587  
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      MY57013711      23LM115      TPA      11 Jul 2024
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

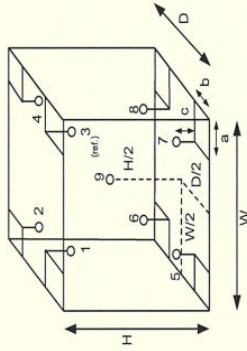
**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Not Available

Environment during calibration	
	Beginning
Temp. ( °C )	27
REL.Humid. ( % )	48
AC Supply ( Volt )	221



**Probe Installation Details :**

Dimension of Chamber :	
a = 10 cm	D = 0.62 m
b = 10 cm	W = 1.2 m
c = 10 cm	H = 1.2 m
	Capacity = 0.89 m <sup>3</sup>

Position :	Ref. Std. ID No.:
1	18-18RTD-01
2	18-18RTD-02
3	18-18RTD-03
4	18-18RTD-04
5	18-18RTD-05
6	23-18RTD-06
7	18-18RTD-07
8	22-18RTD-08
9 (ref.)	18-18RTD-09



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2404-0004OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 24TM587  
Page : 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor k
20.0	20.0	20.0	0.45	0.55	1.3	2

Calibration Point ( °C )	Measured Temperature ( °C )								Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	19.954	20.183	20.235	19.707	19.706	19.739	19.785	19.821	19.828

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

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

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

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

**UUC\* :** Unit Under Calibration

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

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

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เอกสารไม่ควบคุม  
a 1209743



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NSC-TB1-TIS7025  
CALIBRATION 0088

Cert. No.: 24TM589  
Page : 1 of 3

## Certificate of Calibration

Equipment : Hot Air Oven  
Manufacturer : Memmert  
Model : UF 55  
Serial No. : B212.0411  
ID No. : UAE.WAO.005/2556

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 : 01 April 2024  
Calibration Date : 01 - 02 April 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Krisda Malee  
Approved by :   
Approved Signatory

( ) Ponpan Paipim  
( ☒ ) Suwit Imjai  
( ) Kunchit Promprat

Issue Date : 5 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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A 0065065



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2404-0004OC-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 ) and Thermocouple Type T.

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 23LM115 TPA 11 Jul 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

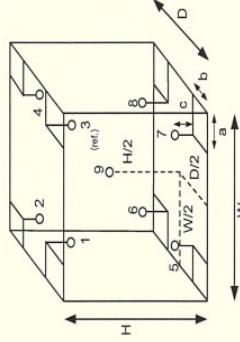
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration : ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	27	26
REL.Humid. ( % )	47	48
AC Supply ( Volt )	221	220



Probe Installation Details : Dimension of Chamber :  
a = 5.0 cm D = 0.50 m  
b = 5.0 cm W = 0.80 m  
c = 5.0 cm H = 0.75 m  
Capacity = 0.30 m<sup>3</sup>

Ref. Std. ID No.: @ Calibration Point		
Position :	( 120 to 180 ) °C	( 104 ) °C
1	21-18TC-01	22-18RTD-2/1
2	21-18TC-02	18RTD-2/2
3	21-18TC-03	18RTD-2/3
4	21-18TC-04	18RTD-2/4
5	21-18TC-05	18RTD-2/5
6	21-18TC-06	18RTD-2/6
7	21-18TC-07	18RTD-2/7
8	21-18TC-08	18RTD-2/8
9 (ref.)	21-18TC-09	18RTD-2/9

Cert. No.: 24TM589  
Page : 2 of 3

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A 1209739



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NSC-TS1-TS17025  
CALIBRATION 0008

## Certificate of Calibration

Cert. No.: 24TM647  
Page: 1 of 3

Equipment : Incubator  
Manufacturer : Binder  
Model : KB 400 E6  
Serial No. : 20200000015535  
ID No. : UAE.MIC.018/2564  
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 : 01 April 2024  
Calibration Date : 01 April 2024  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$   
Calibrated by : Man Pattanapongpaiboon

Approved by :  
( ) Ponpan Paipim  
(✓) Suwit Injai  
( ) Kunchit Promprat

Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2404-0004OC-3  
Result of Calibration :- (\*) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 24TM589  
Page : 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor k	Measured Temperature ( °C )									Uncertainty ( ± °C )
							Position									
							1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.0	104.0	0.032	0.47	0.84	2	104.464	103.847	104.226	104.232	104.106	103.691	104.275	104.127	104.013	0.42
120.0	120.0	120.0	0.12	0.72	1.3	2	120.486	120.089	120.635	120.596	119.531	119.644	120.364	120.144	120.158	1.1
180.0	180.0	180.0	0.13	1.2	1.5	2	180.574	179.769	180.285	180.870	179.594	179.790	180.287	179.961	179.802	1.1

**Average\*** : The average of 30 values in each position.  
**Temperature stability** : One-half of the greatest maximum difference of measured temperature at any one sensor.  
**Temperature uniformity** : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.  
**Overall Variation** : The Difference of the maximum and minimum measured temperatures throughout observation.  
**UUC\*** : Unit Under Calibration  
**Note** : The reported uncertainty of measurement was included stability and excluded uniformity .

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

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เอกสารไม่ควบคุม  
a 1209738



**Equipment :** Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2404-0003QC-6  
**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	MY49023932	23LM122	TPA	26 Jul 2024

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

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

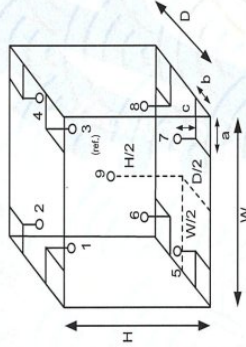
**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	24	24
REL.Humid. ( % )	54	57
AC Supply ( Volt )	221	223



**Probe Installation Details :**

Dimension of Chamber :	
a = 10 cm	D = 0.48 m
b = 10 cm	W = 0.65 m
c = 10 cm	H = 1.2 m
	Capacity = 0.37 m <sup>3</sup>



**Equipment :** Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2404-0003QC-6  
**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Close

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor <i>k</i>	Measured Temperature ( °C )									Uncertainty ( ± °C )
							Position									
							1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.0	35.0	0.035	0.19	0.22	2	35.000	35.022	34.841	34.851	35.027	35.011	35.023	35.028	35.007	0.30

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

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

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

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

**UUC\* :** Unit Under Calibration

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

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

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## Certificate of Calibration

Cert. No.: 24TM938  
Page : 1 of 3

Equipment : Incubator  
Manufacturer : Binder  
Model : KB 400 E6  
Serial No. : 2022000022479  
ID No. : UAE.MIC.028/2566

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory

Received Order : 09 July 2024  
Calibration Date : 09 July 2024  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$

Calibrated by : Khit Ruttanaprapachai

Approved by :   
Approved Signatory

( ) Ponpan Paipim  
(☒) Suwit Imjai  
( ) Kunchit Promprat

Issue Date : 19 July 2024

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2407-0153OC-4  
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 : MY49001451  
Serial No. : 24LM44  
Traceable : TPA  
Due Date : 17 Mar 2025

2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

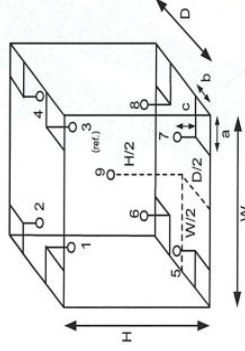
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	23	24
REL.Humid. ( % )	52	54
AC Supply ( Volt )	221	222



Probe Installation Details :  
a = 10 cm  
b = 10 cm  
c = 10 cm  
Dimension of Chamber :  
D = 0.47 m  
W = 0.65 m  
H = 1.2 m  
Capacity = 0.37 m<sup>3</sup>

Position :	Ref. Std. ID No.:
1	19RTD-2/1
2	19RTD-2/2
3	19RTD-2/3
4	19RTD-2/4
5	19RTD-2/5
6	24-19RTD-2/6
7	19RTD-2/7
8	19RTD-2/8
9 (ref.)	19RTD-2/9

เอกสารไม่ควบคุม



**Equipment :** Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2407-0153OC-4  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Not Available

**Cert. No.:** 24TM938  
**Page :** 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor k
35.0	35.0	35.0	0.030	0.31	0.33	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.093	35.011	35.081	35.118	34.840	35.054	34.924	34.978	34.824	0.30

**Average\* :** The average of 30 values in each position.  
**Temperature stability :** One-half of the greatest maximum difference of measured temperature at any one sensor.  
**Temperature uniformity :** The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.  
**Overall Variation :** The Difference of the maximum and minimum measured temperatures throughout observation.  
**UUC\* :** Unit Under Calibration  
**Note :** The reported uncertainty of measurement was included stability and excluded uniformity .  
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

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## Certificate of Calibration

**Cert. No.:** 24TM1113  
**Page :** 1 of 3

**Equipment :** BOD Incubator  
**Manufacturer :** ARCO  
**Model :** UC4-1320  
**Serial No. :** -  
**ID No. :** UAE.WAO.002/2550  
**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 :** 11 July 2024  
**Calibration Date :** 11 July 2024  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Tawatchal Pama

**Approved by :**   
Approved Signatory

( ) Ponpan Paipim  
( ☒ ) Suwit Injai  
( ) Kunchit Promprat

**Issue Date :** 14 July 2024

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

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Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2407-0243OC-1

Cert. No.: 24TM1113  
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. Due Date  
1 ) Data Acquisition MY49023932 23LM122 26 Jul 2024  
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

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

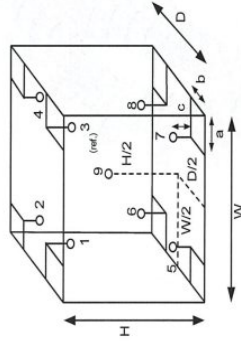
#### Result of Calibration :-

( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	29	32
REL.Humid. ( % )	78	85
AC Supply ( Volt )	233	234



#### Probe Installation Details :

a = 10 cm  
b = 10 cm  
c = 10 cm  
Dimension of Chamber :  
D = 0.62 m  
W = 1.2 m  
H = 1.2 m  
Capacity = 0.89 m<sup>3</sup>

Position :	Ref. Std. ID No.:
1	19-16RTD-01
2	19-16RTD-02
3	19-16RTD-03
4	19-16RTD-04
5	19-16RTD-05
6	19-16RTD-06
7	21-16RTD-07
8	19-16RTD-08
9 (ref.)	19-16RTD-09



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2407-0243OC-1  
Result of Calibration :-  
( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 24TM1113  
Page : 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor k
20.0	20.0	19.8	0.55	0.66	1.5	2

Calibration Point ( °C )	Measured Temperature ( °C )								Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.210	20.331	20.162	19.645	20.287	20.070	19.838	19.781	19.954

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 %.

-000-

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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534/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG BANGKOK 10250  
TEL.0-2717-3000-29 FAX.0-2719-9484



## Certificate of Calibration

Cert. No.: 24TM1114  
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 : 11 July 2024  
Calibration Date : 11 July 2024  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$

Calibrated by : Tawatchai Pana

Approved by :

( ) Ponpan Palim  
(✓) Suwit Injal  
( ) Kunchit Promprat

Issue Date : 14 July 2024

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2407-0243OC-2  
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	MY49023932	23LM122	TPA	26 Jul 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

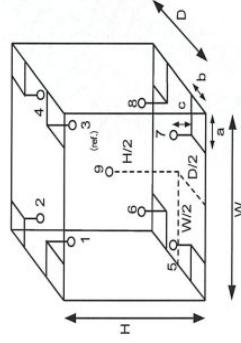
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	29	29
REL.Humid. ( % )	78	72
AC Supply ( Volt )	233	234



### Probe Installation Details :

a =	10 cm	D =	0.62 m
b =	10 cm	W =	1.2 m
c =	10 cm	H =	1.2 m
		Capacity =	0.89 m <sup>3</sup>

### Dimension of Chamber :

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

Position :	Ref. Std. ID No.:
1	20-16RTD-10
2	20-16RTD-02
3	20-16RTD-03
4	23-16RTD-04
5	22-16RTD-05
6	20-16RTD-06
7	20-16RTD-07
8	22-16RTD-08
9 (ref.)	22-16RTD-09

เอกสารไม่ควบคุม



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2407-0243OC-2  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 24TMI114  
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	19.9	0.29	0.81	1.2	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°C)
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.361	19.640	20.312	20.079	19.908	19.872	19.955	19.818	19.758	0.48

Average\* : The average of 30 values in each position.  
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.  
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.  
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.  
UUC\* : Unit Under Calibration  
Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

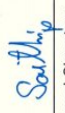
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TEL. 0-2717-3000 FAX. 0-2719-9484

Cert.No.: 24TW39  
Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5100  
Serial No. : 11B 101863  
ID No. : UAE.WAO.004/2554  
Received Date : 20 February 2024  
Test Date : 21 February 2024  
Reference : 2402-0629DSC-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 Sirthean  
Approved by :   
Approved Signatory

( ) Pornthippa Tameyakul  
( ) Unnophol Harachai  
(✓) Saithip Meangmai

Issue Date : 22 February 2024

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



Cert.No.: 24TW39  
Page.: 2 of 2

#### Condition of this result of calibration

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	23MM405	16 July 2024

#### 2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

**Result :** Dissolved Oxygen Meter Adjustment With Air 100 %  
Dissolved Oxygen Probe No.: 22B100125

Titration Method (Azide Modification Method)	DO Meter Reading	Standard Deviation
(mg/L) 8.20	(mg/L) 8.19	(mg/L) 0.0055

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

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MSC-J1837817023  
CALIBRATION 0068

## Certificate of Calibration

Cert.No.: 25CH52  
Page.: 1 of 3

Equipment : pH Meter  
Manufacturer : Horiba  
Model : LAQUA-PH210  
Serial No. : HA1M0036  
ID No. : UAE.EFM.012/2565(EFM.pH.02/65)  
Condition As-Received: Used Item  
Received Date : 14 January 2025  
Calibration Date : 15 January 2025  
Reference : 2501-0473WSC-2  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

Ambient Temperature :  
Relative Humidity :  
Calibration Procedure :

(25 ± 2.5) °C  
(50 ± 15) %  
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 :

Warakorn Lemgagtrakul

Approved by :

Saitip

Approved Signatory

( ) Ponthippa Tameyakul  
( ) Ponpan Paipim  
(✓) Saitip Meangmai

Issue Date :

17 January 2025

PASS

NOT PASS

Remarks  
pH 4.008 (CPA chem)  
pH 6.999 (Hach Lenge GmbH)  
pH 10.010 (CPA chem)

Verify  
( ) ( )  
Approve  
( ) ( )



Cert.No.: 25CH52  
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument

- 1) Document Process Calibrator  
2) Ref. Standard Thermometer

Serial No.	ID No.	Cert. No.	Due Date
54030049	130RC116	24E2759	25 Aug 2025
4982054	110RC044	24I757	14 July 2025

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

2. Certified Reference Materials

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

Buffer Solution

- pH 4.008  
pH 6.999  
pH 10.010

Manufacturer

- CPA chem  
Hach Lenge GmbH  
CPA chem

Lot No.

- 1034203  
C03220  
1034205

Exp. date

- 27 Sep 2026  
29 Oct 2026  
27 Sep 2025

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
			mV	pH		
pH Meter S/N.: HA1M0036	4.00	177.48	177.6	4.01	0.058	2.00
	7.00	0.00	0.1	7.00	0.058	2.00
	10.00	0.00	0.1	7.00	0.058	2.00



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## Certificate of Calibration

Cert.No.: 25CH163  
Page.: 1 of 3

Equipment : pH Meter  
Manufacturer : EcoSense  
Model : pH100A  
Serial No. : JC03335  
ID No. : UAE.EFM.062/2562(ENV.pH.02/62)  
Condition As-Received: Used Item  
Received Date : 04 February 2025  
Calibration Date : 05 February 2025  
Reference : 2502-0105WSC-1  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

Ambient Temperature :  $(25 \pm 2.5) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 15) \%$   
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 : Warakorn Lengagatrakul

Approved by : Approved Signatory  
( ) Chakrit Waewwanjua  
( ) Ponpan Paipim  
(✓) Saithip Meangmai

Issue Date : 06 February 2025

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 25CH52  
Page.: 3 of 3

### Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7(7.10))

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor $k$
pH Electrode S/N.: -	4.008	4.01	173.6	0.0071	2.00
	6.999	6.99	-0.9	0.0085	2.00
	6.999	7.01	-1.7	0.0092	2.00
	10.010	10.01	-173.4	0.0092	2.00

Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -  
- Serial No. : -  
Dimension of probe  
- Length : 110 mm.  
- Diameter : 16 mm.  
- Immersion Depth : 100 mm.

Calibration Point ( $^{\circ}\text{C}$ )	Standard Temperature ( $^{\circ}\text{C}$ )	UUC* Reading ( $^{\circ}\text{C}$ )	Error ( $^{\circ}\text{C}$ )	Uncertainty of measurement ( $\pm ^{\circ}\text{C}$ )	Coverage factor $k$
15.0	15.003	15.0	-0.003	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
45.0	45.002	45.1	0.098	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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Cert.No.: 25CH163  
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	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025
- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)				

2. Certified Reference Materials : The measurement results are traceable to SI through Hach Lange 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 4.007	CPA chem	1066665	18 Jan 2027
pH 6.999	Hach Lange GmbH	C03220	29 Oct 2026
pH 10.010	CPA chem	1066669	18 Jan 2026

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 ( $\pm$ mV )	Coverage factor $k$
			mV	pH		
pH Meter S/N.: JC03335	4.00	177.48	177	4.01	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-177	10.01	0.58	2.00



Cert.No.: 25CH163  
Page.: 3 of 3

#### Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor $k$
pH Electrode S/N.: 231018SIA605377	4.007	4.01	173	0.0079	2.00
	6.999	7.00	-2	0.0092	2.00
	6.999	7.00	-2	0.0085	2.00
	10.010	10.01	-177	0.0092	2.00

#### Function : Temperature Measurement

( \*) Without adjustment

This equipment was connected with Temperature Probe;

- Model :  
- Serial No. : 231018SIA605377  
Dimension of probe  
- Length : 110 mm.  
- Diameter : 12 mm.  
- Immersion Depth : 100 mm.

Calibration Point ( $^{\circ}$ C )	Standard Temperature ( $^{\circ}$ C )	UUC* Reading ( $^{\circ}$ C )	Error ( $^{\circ}$ C )	Uncertainty of measurement ( $\pm$ $^{\circ}$ C )	Coverage factor $k$
15.0	15.003	15.1	0.097	0.13	2.00
30.0	30.002	30.1	0.098	0.13	2.00
45.0	45.002	45.1	0.098	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.: 25CH245  
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 :** 25 February 2025  
**Calibration Date :** 26 February 2025  
**Reference :** 2502-0787WSC-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 :** Warakorn Lengagtrakul

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

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

**Issue Date :** 27 February 2025

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

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### Condition of this result of calibration

1. Reference Standard Instrument :-
- | Instrument               | Serial No. | ID No.   | Certificate No. | Due date     |
|--------------------------|------------|----------|-----------------|--------------|
| 1) Thermometer           | 1963878    | 130RC095 | 241995          | 09 Sep 2025  |
| 2) Ref. Std. Thermometer | 4982054    | 110RC044 | 241757          | 14 July 2025 |
- This Certification 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
- | Conductivity Solution | Manufacturer | Lot No. | Exp. date    |
|-----------------------|--------------|---------|--------------|
| 1412.9 µS/cm          | CPA Chem     | 1005307 | 15 June 2025 |
| 12.881 mS/cm          | CPA Chem     | 1005308 | 15 June 2025 |
- 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 1412.9 µS/cm

Conductivity Electrode Serial No.: 9B9F0277

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement ( ± )	Coverage factor k
1412.9 µS/cm	1409 µS/cm	1413 µS/cm	9.2 µS/cm	2.00
12.881 mS/cm	13.26 mS/cm	13.32 mS/cm	0.086 mS/cm	2.00

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



Cert.No.: 25CH245  
Page.: 3 of 3

#### Calibration Results

##### Function : Temperature Measurement

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 Result : Without adjustment

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)	Coverage factor <i>k</i>
15.0	15.004	15.0	-0.004	0.13	2.00
30.0	30.004	30.0	-0.004	0.13	2.00
45.0	45.001	45.0	-0.002	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.: 25CH261  
Page.: 1 of 3

Equipment :

pH Meter

Manufacturer :

Horiba

Model :

LAQUA-PH210

Serial No. :

HAOC0025

ID No. :

UAE.EFM.117/2563(EFM.pH.07/63)

Condition As-Received:

Used Item

Received Date :

25 February 2025

Calibration Date :

26 to 28 February 2025

Reference :

2502-0783WSC-1

Submitted by :

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

Ambient Temperature :

(25 ± 2.5) °C

Relative Humidity :

(50 ± 15) %

Calibration Procedure :

In - house method :

- CP-CH5 by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by :

Warakorn Lengagtrakul

Approved by :

Approved Signatory

( ) Chakrit Waewwanjua

( ) Ponpan Paipim

(✓) Saithip Meangmai

Issue Date :

28 February 2025

The Uncertainties are for a confidence probability of approximately 95%

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NAE

NOT PASS

PASS

Remarks: Temp = 0.5 (Std. Thermometer)  
mV = 50.4516 (Deluge Input)  
pH = 0.05 (Std. Buffer solution)

Verify

Approve



Cert.No.: 25CH261  
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument

Serial No.	ID No.	Cert. No.	Due Date
54030049	130RC116	24E2759	25 Aug 2025
4982054	110RC044	24I757	14 July 2025

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

2. Certified Reference Materials

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

Buffer Solution

Manufacturer

Lot No.

Exp. date

pH 4.007	CPA chem	1066665	18 Jan 2027
pH 6.999	Hach Lenge GmbH	C03220	29 Oct 2026
pH 10.010	CPA chem	1066669	18 Jan 2026

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
			mV	pH		
pH Meter S/N : HA0C0025	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.0	7.02	0.058	2.00
	10.00	0.00	0.0	7.02	0.058	2.00



Cert.No.: 25CH261  
Page.: 3 of 3

#### Calibration Results

##### Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7)(7.10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor $k$
pH Electrode S/N.: Q9AG0214	4.007	4.01	178.4	0.0071	2.00
	6.999	7.00	4.1	0.0092	2.00
	6.999	7.00	3.0	0.0095	2.00
	10.010	10.01	-169.8	0.0092	2.00

##### Function : Temperature Measurement

###### (\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652-10D  
- Serial No. : Q9AG0214

Dimension of probe

- Length : 110 mm.  
- Diameter : 16 mm.  
- Immersion Depth : 80 mm.

Calibration Point ( $^{\circ}\text{C}$ )	Standard Temperature ( $^{\circ}\text{C}$ )	UUC* Reading ( $^{\circ}\text{C}$ )	Error ( $^{\circ}\text{C}$ )	Uncertainty of measurement ( $\pm$ $^{\circ}\text{C}$ )	Coverage factor $k$
15.0	15.002	15.0	-0.002	0.13	2.00
30.0	30.003	30.0	-0.003	0.13	2.00
45.0	45.002	44.9	-0.102	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 %.

-oOo-

## Certificate of Calibration

Cert.No.: 25CH262  
Page.: 1 of 3

Equipment :

pH Meter

Manufacturer :

Horiba

Model :

LAQUA-PH210

Serial No. :

HA1L0035

ID No. :

UAE.EFM.011/2565(EFM.pH.01/65)

Condition As-Received:

Used Item

Received Date :

25 February 2025

Calibration Date :

26 to 28 February 2025

Reference :

2502-0783WSC-2

Submitted by :

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

Ambient Temperature :

(25  $\pm$  2.5)  $^{\circ}\text{C}$

Relative Humidity :

(50  $\pm$  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 :

Warakorn Lengagatrakul

Approved by :

Approved Signatory

( ) Chakrit Waewwanjua

( ) Ponpan Paipim

(✓) Saithip Meangmai

Issue Date :

28 February 2025

The Uncertainties are for a confidence probability of approximately 95%

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

NAE

NOT PASS

PASS

Remarks: Temp = 0.5 (5.0) Thermometer  
mV = 50.4516, Voltage Input  
pH = 0.05 (5.16) Buffer solution

Verify

Approve



Cert.No.: 25CH262  
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	130RC116	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	4982054	110RC044	24757

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

2. Certified Reference Materials

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

Buffer Solution

Manufacturer

Lot No.

Exp. date

pH 4.007	CPA chem	1066665	18 Jan 2027
pH 6.999	Hach Lenge GmbH	C03220	29 Oct 2026
pH 10.010	CPA chem	1066669	18 Jan 2026

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
			mV	pH		
pH Meter S/N : HA1L0035	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.1	7.02	0.058	2.00
	10.00	0.00	0.1	7.02	0.058	2.00
		-177.48	-177.4	10.01	0.329	4.53



Cert.No.: 25CH262  
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	4.007	4.01	178.3	0.0085	2.05
S/N.: -	6.999	7.00	2.3	0.0092	2.00
	6.999	7.00	2.4	0.0092	2.00
	10.010	10.01	-172.2	0.0092	2.00

##### Function : Temperature Measurement

###### (\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -

- Serial No. : -

Dimension of probe

- Length : 110 mm.

- Diameter : 16 mm.

- Immersion Depth : 80 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
15.0	15.003	15.0	-0.003	0.13	2.00
30.0	30.004	30.0	-0.004	0.13	2.00
45.0	45.002	45.0	-0.002	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 %.

-oOo-



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



NSC-TSI-TIS17025  
CALIBRATION 0008

## Certificate of Calibration

Cert.No.: 25CH588  
Page.: 1 of 3

Equipment : pH Meter  
Manufacturer : Horiba  
Model : LAQUA-PH210  
Serial No. : HA0D0082  
ID No. : UAE.EFM.072/2564(EFM.pH.05/64)  
Condition As-Received: Used Item  
Received Date : 20 May 2025  
Calibration Date : 21 May 2025  
Reference : 2505-0602WSC-3  
Submitted by : United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udornasuk 41, Sukhumvit Road, Bangkok,  
Phrakhanong, Bangkok 10260  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In - house method :  
- CP-CH5 by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM)  
- CP-CH8 by comparison with temperature standard

Calibrated by : Walalak Sirithean

Approved by :   
Approved Signatory

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

Issue Date : 23 May 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.



Cert.No.: 25CH588  
Page.: 2 of 3

### Condition of this calibration result

## 1. Reference Standard Instrument

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

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 Lange 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 4.007	CPA chem	1068665	18 Jan 2027
pH 7.000	Hach Lange GmbH	C03232	02 Dec 2026
pH 10.010	CPA chem	1068669	18 Jan 2026

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 ( $\pm$ mV)	Coverage factor <i>k</i>
			mV	pH		
pH Meter S/N.: HA0D0082	pH	mV				
	4.00	177.48	177.3	4.01	0.058	2.00
	7.00	0.00	0.0	7.00	0.058	2.00
	10.00	0.00	0.0	7.00	0.058	2.00
				-177.3	10.01	2.00



TECHNOLOGY PROMOTION ASSOCIATION (THAIAND-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



Cert.No.: 25CH588  
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.: Q9AA0036	4.007	4.01	160.4	0.0086	2.05
	7.000	7.00	-13.5	0.0085	2.00
	7.000	7.01	-12.6	0.0096	2.00
	10.010	10.00	-186.0	0.0092	2.00

##### Function : Temperature Measurement

##### (\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652-10D
- Serial No. : Q9AA0036
- Dimension of probe
- Length : 103 mm.
- Diameter : 16 mm.
- Immersion Depth : 80 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	29.999	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.: 25TM577  
Page : 1 of 3

Equipment : BOD Incubator

Manufacturer : ARCO

Model : UR-1320

Serial No. : -

ID No. : UAE.WAO.018/2551

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Lab Floor 2

Received Order : 19 March 2025  
Calibration Date : 19 March 2025  
Ambient Temperature : (26 ± 10) °C  
Relative Humidity : (50 ± 30) %  
AC Line Voltage : (220 ± 22) V

Calibrated by : Man Pattanapongpaiboon

Kunchit

Approved by : Approved Signatory

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

Issue Date : 27 March 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 :** 2503-0437OC-1

**Cert. No.:** 25TM577  
**Page :** 2 of 3

**Procedure Used :-**

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

**Condition of this result of calibration**

1. Reference standard instrument:-

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

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

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

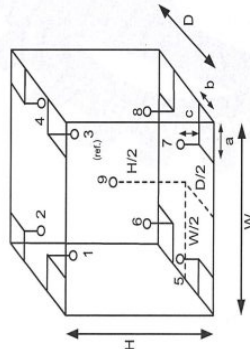
**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	28	28
REL Humid. ( % )	56	55
AC Supply ( Volt )	224	224



**Probe Installation Details :**

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

**Dimension of Chamber :**

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

เอกสารไม่ควบคุม



**Equipment :** BOD Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2503-0437OC-1  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Close

**Cert. No.:** 25TM577  
**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>	Measured Temperature (°C)									Uncertainty (±°C)
							Position									
							1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.0	20.0	0.24	0.54	0.99	2	20.215	20.192	19.652	19.710	19.710	20.006	19.720	19.810	19.733	0.41

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

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

**Overall Variation :** The Difference of the maximum and minimum measured temperatures throughout observation.  
**UUC\* :** Unit Under Calibration

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

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

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# TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

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

## Certificate of Testing

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

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5100  
Serial No. : 11B 101863  
ID No. : UAE.WAO.004/2554  
Received Date : 14 February 2025  
Test Date : 17 February 2025  
Reference : 2502-0473DSC-1  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok,  
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  
(✓) Saitip Meangmai

Issue Date : 18 February 2025

เอกสารไม่ควบคุม



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

### Condition of this result of calibration

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

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

2. Standard Material :-

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

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

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

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

-o0o-

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FOSS

FOSS South East Asia  
3388 Sirinrat Building, 25th - 26th Floor, Unit No. 3388/90,  
Rama IV Road, Klongton, Klongtoey, Bangkok, Thailand 10110

## Customer Service Report

Report No: 9807

Date: 8-Feb-2024

Customer: UAE

Instrument: KT8100

Address: BANGKOK

Serial: 9189052

Hours  
Start 08:00  
Finish 09:30  
Travel To Customer 15hrsLabour  
09:50 2.5hrs  
19:00 1hrTravel From Customer  
16:00  
19:00 2hr

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

PO/Quote Number: If applicable

PMA Type: Fosscore If applicable Contract No. If applicable

Details of Work / Test	Condition / Status
# PM KT8100	
- ตรวจเช็คเครื่องวัดค่า pH	
- ตรวจสอบ Accuracy = 50 - 50 HCl	
- ตรวจสอบ Accuracy 5 min - 180 min	
- ตรวจสอบค่า pH ที่	
- 10.10 pH ตาม pH Standard	
- ตรวจสอบ Accuracy ของค่า pH	
Result - 0.1 pH	
Accuracy = 100 %	
Instrument Ready for Use	OK
If not OK - Comment	

Part No:	Batch	Description	Qty
60031807	13-10-2023	FOSS pH kit 8100/8100 12 บอ	1

I confirm this report is accurate and complete	
Signed Foss	Signed Customer
Name	Name
Would you be willing to participate in a brief survey in order to tell us how we performed?	
Email	

เอกสารไม่ควบคุม

## บันทึกผลการทวนสอบใบรับรองการสอบเทียบ (Verification of Certificate)

Certificate No. : 25TW29					Equipment : Do Meter		
Brand : YSI					Model : 5100		
Serial No. : 11B 101863					ID No. : UAE.WAO.004/2554		
Calibration results							
Titration Method	Standart Deviation	Do meter Reading	Error%	Correction%	Error   Total Error	Judgement	(Total Error < Judgement )
( mg/L )	( mg/L )	( mg/L )	( mg/L )	( mg/L )	( mg/L )	( ± mg/L )	( mg/L )
8.22	0.0055	8.22	0.0000	0.0000	0.0	0.02	pass
ผู้บันทึก.....อิสรา.บุญประกอบ.....					ผู้ตรวจสอบ.....		
วันที่.....28/02/2025.....					วันที่.....28 ก.พ. ๒๕		
หมายเหตุ :							

เก็บใบนี้เพื่อ.....

...../.....

เอกสารไม่ควบคุม

FOSS

## Customer Service Report

Date: 9 Feb 2024

Customer: UAE

Instrument: KT200

Report No: 9810

FOSS South East Asia

3388 Sirinrat Building, 25th - 26th Floor, Unit No. 3388/90,  
Rama IV Road, Klongton, Klongtoey, Bangkok, Thailand 10110

Address: Bangkok

Serial: 91790524

Travel To Customer  
08:30 PMLabour  
09:30 2hrsTravel From Customer  
16:30 2hrs

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

PO/Quote Number:	Contract No.	If applicable
FOSSCAT c		If applicable

Details of Work / Test		Condition / Status
# PM KT200		
- ตรวจเช็คแบตเตอรี่ PM		
- ตรวจเช็คสาย 3 pin 100 ml		
- Alkali 30 ml - 20 ml		
- ตรวจเช็ค PM kit		
- ตรวจสอบถังยา		
# PM KIT 5000 725 SLOTH KIT COMPLETE 1 PC		

Part No:	Batch	Description	Qty
10009465	14.2.2020	Pass PM kit 1200 level of Analyser 2100	1

I confirm this report is accurate and complete			
Signed FOSS		Signed Customer	
Name		Name	
Would you be willing to participate in a brief survey in order to tell us how we performed?			
			Email

เอกสารไม่ควบคุม

FOSS

## Customer Service Report

Date: July 5, 2024

Job No.: 8339

Instrument: KTA Distillator

Report No.: 12875

FOSS South East Asia  
3388 Sirinrat Building, 25th - 26th Floor, Unit No. 3388/90,  
Rama IV Road, Klongton, Klongtoey, Bangkok, Thailand 10110

Customer: UAE

Address: Bangkok

Serial: 91905243

Travel To Customer (Hrs)  
08:30 1Labour (Hrs)  
09:30 5Travel From Customer (Hrs)  
14:30 1.5

Application		Special		Standard	
Distributor	x	Courtesy Visit	x	Installation	x
Digital Service	x	PMA Onboarding	x	Quote	x
Internal	x	Warranty	x	Repair	x
Digital Service	x	Sales Support	x	Remote	x
				Health Check Visit	x

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

Details of Work / Test		OK	Not OK*
- 8m - Visual Check -			
+ No leak			
+ No dening			
- Change PM kit x4 lit			
- Function Check -			
+ Dilution 80 ml ->			
+ Alkali 50 ml ->			
+ Reagent N/A ->			
+ Screen / Drain			
Blank = Follow up, Recovery 100%			
Instrument Ready for Use			

Part No:	Batch	Description	Qty
60100416	03-01-2024	PM kit Kjettec 1 distillator	1

I confirm this report is accurate and complete			
Signed FOSS		Signed Customer	
Name		Name	
Customer Contact:			
Email:			

เอกสารไม่ควบคุม

FOSS

## Customer Service Report

FOSS South East Asia  
3388 Sirinrat Building, 25th - 26th Floor, Unit No. 3388/90,  
Rama IV Road, Klongtoey, Klongtoey, Bangkok, Thailand 10110

Report No.: 13319

Date: Jan 27, 2025

Customer: UAE

Job No.: 11645

Address: Bangkok

Instrument: K1200

Serial: 91790524

Travel To Customer (Hrs)		Labour (Hrs)		Travel From Customer (Hrs)	
Start	09.00	1	10.00	3	
Finish	10.00		13.00		

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

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

Details of Work / Test					
- DH -					
+ Visual Check					
- No leak					
- have damage on heater & main switch					
- OK					
+ subsea heater 110v. main switch operation via					
- OK					
+ check per kit # 1301					
- OK					
+ Function Check					
- Power on ROFF					
- Alarm					
- Steam					
- Condenser					
- water pump - OK					

Part No:	Batch	Description	Qty
100159465	11-06-2024	FOSS per kit K1200 heater analyzer/2100	1
100035112	25.02.2024	Heating element 8 team	1
15630111	19.10.2022	Smart Kit K595Kont 2 Pk	1

I confirm this report is accurate and complete			
Signed FOSS		Signed Customer	
Name		Name	

Email:		Customer Contact:	
*Remark:	เอกสารแนบ		

FOSS

## Customer Service Report

FOSS South East Asia  
3388 Sirinrat Building, 25th - 26th Floor, Unit No. 3388/90,  
Rama IV Road, Klongtoey, Klongtoey, Bangkok, Thailand 10110

Report No.: 13854

Date: 24 February 2025

Customer: UAE

Job No.: 11735

Address: Bangkok

Instrument: K18100

Serial: 91887052

Travel To Customer (Hrs)		Labour (Hrs)		Travel From Customer (Hrs)	
Start	09.00	2 hrs	09.00-12.00	15.00	
Finish	09.00		13.00-14.00	12.00	

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

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

Details of Work / Test					
+ PM K18100 12mo					
- test before PM					
- Cleaning K18100, 36 mo replace					
- Fishing Alkali Pump					
- test operation					
- Distillation 80 - 80 ml					
- Distillation 6 min 150 - 170 ml					
- Alkali 50 - 50 ml					
- all pass					

Part No:	Batch	Description	Qty
60031810	08-01-2024	FOSS PM K18100 36mo	1

I confirm this report is accurate and complete			
Signed FOSS		Signed Customer	
Name		Name	

Email:		Customer Contact:	
*Remark:	เอกสารแนบ		

Please scan QR code

## Certificate of Calibration

Certificate No.: 250422-1-BL002-25

Code No.: BL002-25

Page: 1 of 3

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

**Equipment:** Electronic Balance  
**Manufacturer:** Mettler Toledo  
**Model:** AB204-S/FACT  
**Serial No.:** 1129361010  
**Asset No.:** UAE.WAS.002/2552  
**Building:** N/A  
**Floor:** 1  
**Room:** 107

**Received Date:** April 22, 2025  
**Date of Calibration:** April 23, 2025  
**Calibration Conditions:**  
Temperature 22.8 °C to 23.4 °C  
Humidity 54.8 % to 68.9 %  
Pressure 756.6 mmHg to 758.2 mmHg

**Calibrated by:** Sakkarin Sriahang  
**Approved by:** Suwit Chotnok  
**Signature:**   
**Issued Date:** April 25, 2025

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

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

3) This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the United Analyst and Engineering Consultant Co., Ltd. (UAE)

**เอกสารไม่ควบคุม**

Certificate No.: 250422-1-BL002-25

Code No.: BL002-25

Page: 2 of 3

**Equipment:** Electronic Balance  
**Model:** AB204-S/FACT  
**Serial No.:** 1129361010  
**Max. Capacity:** 220 g  
**Calibration Date:** April 23, 2025  
**Condition As-Received:** In Condition  
**Manufacturer:** Mettler Toledo  
**Readability:** 0.0001 g  
**ID No.:** UAE.WAS.002/2552

### Condition of Equipment:

#### Condition of This Result of Calibration:

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

#### 2. Reference Standards:

Reference Standard:	Model	Serial No.	Calibrated By	Certificate No.	Traceability	Due Date
Standard Weight Class E2 (OIML)	1 mg to 1 kg	B749109122	AMARC	25-009359	Mettler-Toledo	21-Jan-27
Standard Weight Class F1 (OIML)	1 mg to 200 g	11119512	AMARC	24-013840	Mettler-Toledo	04-Feb-26
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Traceability	Due Date
Thermo-Hygro-Baro Meter	MHB-382SD	AK 46457	SUCCESS	SG-H-00997167	Success Gateway	21-Nov-25
Thermo-Hygro-Baro Meter	MHB-382SD	AK 46457	TPA	25F795	TPA	25-Feb-26

3. This certification is traceable to SI Unit

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

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

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

#### Calibration Result:

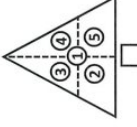
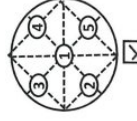
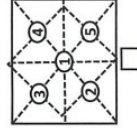
1. Repeatability of Reading:

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

2. Eccentric or off-center loading

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

The Balance reading obtained is given in the table.



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

**เอกสารไม่ควบคุม**



มูลนิธิพัฒนาอุตสาหกรรมอาหาร  
Foundation for Industrial Development National Food Institute  
national food institute  
ministry of industry



NSG-TIS-TIS 17025  
CALIBRATION 0061

**UAE** United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakhonong, Bangkok 10260  
Tel: 0 2763 2828 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

Certificate No.: 250422-1-BL002-25

Code No.: BL002-25

Page: 3 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 23, 2025

Calibration Result: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

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

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

4. Effect of Tare test:

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

Remark:

The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor  $k$ , providing

O---o-End-o---



มูลนิธิพัฒนาอุตสาหกรรมอาหาร  
Foundation for Industrial Development National Food Institute  
national food institute  
ministry of industry



## Calibration Certificate

Certificate No.: 2402283-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
Address: 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance  
Manufacturer: METTLER TOLEDO  
Model: XSR205DU  
Serial No.: C009071872  
ID No.: UAE.WAO.012/2563  
Order No.: 2402283  
Operation No.: 2402283-001  
Date of Receipt: 2 April 2024  
Date of Calibration: 2 April 2024

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

Date of Issue: 9 April 2024

The uncertainties are for a confidence probability of approximately 95%

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

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

2008 ๒๕๕๒ ๒๕๕๓ ๒๕๕๔ ๒๕๕๕ ๒๕๕๖ ๒๕๕๗ ๒๕๕๘ ๒๕๕๙ ๒๕๖๐ 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 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## Calibration Report

Certificate No.: 2402283-001-01

Equipment:

Manufacturer: METTLER TOLEDO

Resolution: 0.00001 g / 0.0001 g

ID No.: UAE.WAO.012/2563

Capacity: 220 g

Date of Calibration: 2 April 2024

Environment Condition: Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 47.5 ± 2.5 %

Place of Calibration: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard Model Serial No. Calibrated By Certificate No. Due Date

Standard Weight Class E2 1mg to 200g B505567572 TCS M23040535 8 April 2024

Instrument Model Serial No. Calibrated By Certificate No. Due Date

Thermo-Hygro Meter 608-H1 NFI.BTH 016/23 Quality Reborn QR24-0343 9 February 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
40	0.0000052
80	0.0000063
100	0.000048
200	0.000053

2. Off-Center Error:

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

The balance reading obtained is given in the table.

1	2	3	4	5	6	(Maximum Difference)
( g )	( g )	( g )	( g )	( g )	( g )	( g )
100.0002	100.0001	100.0002	99.9999	100.0001	100.0001	0.0003

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

## Calibration Report

Certificate No.: 2402283-001-01

Equipment:

Manufacturer: METTLER TOLEDO

Resolution: 0.00001 g / 0.0001 g

ID No.: UAE.WAO.012/2563

Capacity: 220 g

Date of Calibration: 2 April 2024

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 80 g ; Resolution: 0.00001 g )

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
Unload	0.000000	0.00000	0.00000	0.0000088	2.00
0.001	0.001003	0.00101	-0.00001	0.0000091	2.00
0.005	0.005003	0.00499	0.00001	0.0000094	2.00
0.01	0.010003	0.01000	0.00000	0.0000091	2.00
0.05	0.049996	0.05000	0.00000	0.0000098	2.00
0.1	0.100011	0.10000	0.00001	0.000011	2.00
0.5	0.500016	0.50001	0.00001	0.000014	2.00
1	1.000003	1.00002	-0.00002	0.000016	2.00
2	2.000023	2.00001	0.00001	0.000017	2.00
5	5.000017	5.00002	0.00000	0.000020	2.00
10	10.000009	10.00000	0.00001	0.000026	2.00
20	20.000031	20.00002	0.00001	0.000037	2.00
30	30.000040	30.00003	0.00001	0.000052	2.00
50	50.000028	50.00004	-0.00001	0.000068	2.00
80	80.000068	80.00005	0.00002	0.00011	2.00

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



## Calibration Report

Certificate No.: 2402283-002-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Resolution: 0.00001 g / 0.0001 g

Serial No.: C210685394

Capacity: 220 g

Date of Calibration: 2 April 2024

Environment Condition: Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 47.5 ± 2.5 %

Place of Calibration: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard Model Serial No. Calibrated By Certificate No. Due Date  
Standard Weight Class E2 1mg to 200g B505567572 TCS M2304053S 8 April 2024

Instrument Model Serial No. Calibrated By Certificate No. Due Date  
Thermo-Hygro Meter 608-H1 NFI.BTH 016/23 Quality Reborn QR24-0343 9 February 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
40	0.0000042
80	0.0000052
100	0.000048
200	0.000048

2. Off-Center Error:

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

The balance reading obtained is given in the table.


## Calibration Report

**Certificate No.:** 2402283-002-01  
**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** XSR205DU  
**Resolution:** 0.0001 g / 0.0001 g  
**Serial No.:** C210685394  
**ID No.:** UAE.WAO.010/2565  
**Capacity:** 220 g

**Date of Calibration:** 2 April 2024

**Calibration Results:** (Continued)

**Calibration Range:** 81 - 200 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:** (Range: 81 - 200 g ; Resolution: 0.0001 g )

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
90	90.00010	90.0001	0.0000	0.00015	2.00
100	100.00006	100.0001	0.0000	0.00015	2.00
110	110.00007	110.0001	0.0000	0.00016	2.00
120	120.00009	120.0000	0.0001	0.00017	2.00
130	130.00010	130.0000	0.0001	0.00019	2.00
140	140.00014	140.0000	0.0001	0.00020	2.00
150	150.00009	150.0001	0.0000	0.00020	2.00
160	160.00010	160.0001	0.0000	0.00022	2.00
170	170.00012	170.0001	0.0000	0.00023	2.00
200	200.00016	200.0002	0.0000	0.00028	2.00

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

----- End -----

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

## Verification Certificate

**Certificate No.:** 2404228-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 4

**Equipment:** Digestion Unit (Heating Block)

**Manufacturer:** VELP SCIENTIFICA

**Model:** DKL20

**Serial No.:** 213517

**ID No.:** UAE.WAS.005/2555

**Order No.:** 2404228

**Operation No.:** 2404228-001

**Date of Receipt:** 26 August 2024

**Date of Calibration:** 26-27 August 2024

**Calibrated by** Mr.Worapob Sookthong  
Scientist

**Approved by** ( Mr.Pheraphat Tuanjit )  
Manager, Division of Calibration Laboratory

**Date of Issue:** 30 August 2024

Responsible for the Technical Management Team

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

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

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

# Verification Report

**Certificate No.:** 2404228-001-01  
**Equipment:** Digestion Unit (Heating Block)  
 Model: DKL20      Serial No.: 213517  
 Resolution: 1      °C      ID No : UAE.WAS.005/2555  
 Manufacturer: VELP SCIENTIFICA  
**Date of Calibration:** 26-27 August 2024

Page 2 of 4

**Location:**  
**Environment Condition:**

Dry Laboratory (312), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Ambient Temperature ( 29 ± 1 ) °C  
Relative Humidity ( 60 ± 2 ) %  
Line Voltage ( 224 ± 1 ) Volt

**Condition of this results of Calibration:**

1. This instrument was calibrated by insert standard thermocouples type R into its Digestion blocks and Calibration according to NFI Method W-TE-026 based on BS 4309 : 1968
  - The temperature scale used was based on ITS - 90 .
  - All data show below were final values and the initial data may be obtained upon request.

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with Thermocouple	34970A	MY40405576/MY41194453	TC24/0063	5-Jun-2025	N.M. Technical Center Laboratory
	Type R	R/CH1 to R/CH3			

3. This certificate is traceable to International System of Units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of Calibrated item : Good

UUC\* Description

Time of Record	1 Hour	6 Minute	At	380 °C
Time of Record	1 Hour	6 Minute	At	380 °C

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

☒ Without adjustment

After adjustment

Note:                      = Unit Under Calibration  
                                 - UUC\*

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

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

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

**เอเคอาร์ไบโอสาย**

2008 baesagruaung 36 nuasagruaung ungnunwals ngaynummurs 10700  
2008 50 35 Anur Annam Road Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand  
Tel +66(0) 2422 8699 Fax +66(0) 2422 8945

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

**เอกสารแนบ**

2008 ๒๕๔9๙๘๖๓๗๑๓ ๓6 นิสิตจุฬาลงกรณ์มหาวิทยาลัย กรุงเทพมหานคร 10700  
2008 Soi 36, Alun Annam Road, Bang Yi Khan Subdistr., Bang Phay District, Bangkok 10700, Thailand  
Tel +66(0) 2422 8588 Fax +66(0) 2422 8545

 nforth

## Verification Report

**Certificate No.:** 2404228-001-01  
**Equipment:** Digestion Unit (Heating Block)  
 Model: DKL20      Serial No.: 213517  
 Resolution: 1      °C      ID No : UAE.WAS.005/2555  
 Manufacturer: VELD SCIENTIFICA  
**Date of Calibration:** 26-27 August 2024

Page 3 of 4

380 °C

**Calibration point:**

Calibration result:

Table1 : Reporting of Temperature

Block No.	UUC* Setting (°C)	UUC* Reading (°C)	Stability (±°C)	Standard Thermometer (°C)	Uncertainty (±°C)
1	380	380	0.21	380.14	2.0
2	380	380	0.21	380.70	2.0
3	380	380	0.12	381.17	2.0
4	380	380	0.12	379.82	2.0
5	380	380	0.20	381.01	2.0
6	380	380	0.16	380.48	2.0
7	380	380	0.19	379.35	2.0
8	380	380	0.25	380.27	2.0
9	380	380	0.17	382.28	2.0
10	380	380	0.35	380.98	2.0
11	380	380	0.30	380.35	2.0
12	380	380	0.23	382.38	2.0
13	380	380	0.17	378.95	2.0
14	380	380	0.18	379.69	2.0
15	380	380	0.16	382.06	2.0
16	380	380	0.14	380.14	2.0
17	380	380	0.16	381.09	2.0
18	380	380	0.15	382.71	2.0
19	380	380	0.25	381.32	2.0
20	380	380	0.25	381.21	2.0

**Note:**

- UUC\* = Unit Under Calibration

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

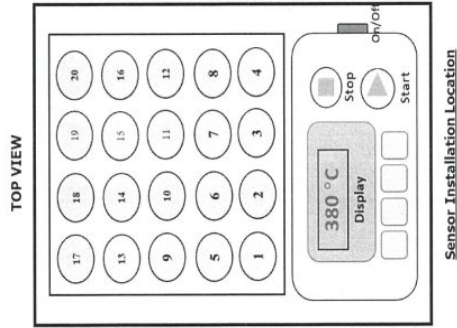
The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor  $k = 2$ , providing a level of confidence of approximately 95 %.

## Verification Report

**Certificate No.:** 2404228-001-01  
**Equipment:** Digestion Unit (Heating Block)  
Model: DKL20 Serial No.: 213517  
Resolution: 1 °C ID No.: UAE.WAS.005/2555  
Manufacturer: Velp Scientifica  
**Date of Calibration:** 26-27 August 2024  
**Calibration point:** 380 °C  
**Calibration result:** Continued

Page 4 of 4

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



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

## Calibration Certificate

**Certificate No.:** 2500116-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

**Equipment:** CHAMBER (Hot Air Oven)  
**Manufacturer:** MEMMERT  
**Model:** UF55  
**Serial No.:** B216.1666  
**ID No.:** UAE.WAO.027/2559  
**Order No.:** 2500116  
**Operation No.:** 2500116-001  
**Date of Receipt:** 8 October 2024  
**Date of Calibration:** 8 October 2024

**Calibrated by** Mr.Yothin Charoensuk  
Scientist  
**Approved by** ( Mr.Pheraphat Tuanjit )  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team  
**Date of Issue:** 15 October 2024

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

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

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

# Calibration Report

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

Page 2 of 3

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

Ambient Temperature	( 30.3 ± 1 ) °C
Relative Humidity	( 55 ± 1 ) %
Line Voltage	( 230 ± 3 ) Volt

**Condition of this results of Calibration:**

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

2. Reference Standard Instrument :

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

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

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

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

6. Condition of Calibrated item : Good

UC Description :	1	Hour	9	Minute	At	104.0, 140.0 and 180.0	°C
Time of Record							

Open	-
Close	X

-	Not Available
---	---------------

	Without adjustment	After adjustment
1. $\beta_1$	X	
2. $\beta_2$		
3. $\beta_3$		
4. $\beta_4$		
5. $\beta_5$		
6. $\beta_6$		
7. $\beta_7$		
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100. $\beta_{100}$		

7

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

**เอกสารไม่ควมคุม**

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๒๐๐8 Sol 36, Ayut Mahan Road, Bang Yi Khan Subdistrict, Bangkok District 10700, Thailand.  
Tel +66(0) 2422 8988 Fax +66(0) 2422 8945

# Calibration Report

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

Page 3 of 3

Calibration point:	104.0, 140.0 and 180.0 °C
--------------------	---------------------------

**Calibration point:**

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

Table1 : Reporting of Temperature

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

Table 2 : Reporting of Characterization Result

Table 2: Reporting of Characterization Result	UUC* Setting		UUC* Reading (°C)		Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	(°C)	MIN	MAX	Average			
	104.0	104.0	104.0	104.0	0.15	0.49	0.88
	140.0	140.0	140.0	140.0	0.13	0.71	1.2
	180.0	180.0	180.0	180.0	0.13	1.2	1.9

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

UUC\* = Unit Under Calibration

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

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

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

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

-----End-----

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

[illegible]

# Calibration Certificate

**Certificate No.:** 2502226-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
 Bangchack, Prakanong, Bangkok 10260

Page 1 of 4

Equipment:	Electronic Balance
Manufacturer:	METTLER TOLEDO
Model:	XSR205DU
Serial No.:	C009071872
ID No.:	UAE.WAO.012/2563
Order No.:	2502226
Operation No.:	2502226-001
Date of Receipt:	19 March 2025
Date of Calibration:	20 March 2025

Calibrated by	Mr. Yothin Charoensuk	Approved by	for N. mygrate
	Scientist		( Mr.Pheraphat Tuanjit )
			Manager, Division of Calibration Laboratory
			Responsible for the Technical Management Team
Date of Issue:	25 March 2025		

The uncertainties are for a confidence probability of approximately 95%

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

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

[illegible]

nfi.org

# Calibration Report

<b>Certificate No.:</b>	<b>2502226-001-01</b>
<b>Equipment:</b>	Electronic Balance
	<b>Model:</b> XSR205DU
	<b>Manufacturer:</b> METTLER TOLEDO
	<b>Resolution:</b> 0.00001 g / 0.0001 g
	<b>ID No.:</b> UAE.WAQ.012/2563
	<b>Serial No.:</b> C090071872
	<b>Capacity:</b> 820 g / 220 g

Date of Calibration: 20 March 2025

Environment Condition:	Ambient Temperature: $21.2 \pm 0.6$ °C	Relative Humidity: $48 \pm 3.5$ %
------------------------	--	-----------------------------------

**Place of Calibration:** 208 Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

## 2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	B505567572	TCS	M24041005	19 April 2025
Thermo-Hvao Meter	608-H1	NFLBTH 01723	Quality Reborn	OR25-0542	10 February 2025

3. This certification is traceable to SI UNIT

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

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

### Calibration Results:

### Calibration Results:

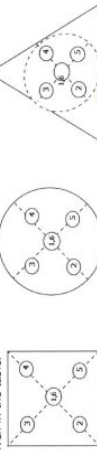
### 1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
40	0.000052
80	0.000042
100	0.000000
200	0.000000

## 2. Off-Center Error:

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

The balance reading obtained is given in the table.

[illegible]

for N. nigensdorf

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

**เอกสารนิพนธ์**

2009 เศรษฐกิจสร้างสรรค์ 36 นวัตกรรมสร้างสรรค์ กิจกรรมพัฒนาธุรกิจและสังคม  
F-USTJY Revision on Date: 2010-05-05

2008 โซล 36, Anun Amarin Building, Bang Yi Khan Subdistrict, Bangkok 10700, Thailand  
Tel.: +66(0) 2422 8688 Fax: +66(0) 2422 8545



nfi.or.th

## Calibration Report

**Certificate No.:** 2502226-001-01

**Equipment:**

Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Resolution:** 0.0001 g / 0.0001 g

**Model:** XSR205DU

**ID No.:** UAE.WAO.012/2563

**Serial No.:** C09071872

**Capacity:** 82 g / 220 g

**Date of Calibration:** 20 March 2025

Page 3 of 4

**Calibration Results:** (Continued)

**Calibration Range:** 0-80 g

**Calibration Adjustment:** Internal Calibration

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

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
Unloaded	0.00000	0.00000	0.00000	0.0000089	2.00
0.001	0.001003	0.00100	0.00000	0.0000092	2.00
0.005	0.005002	0.00500	0.00000	0.0000094	2.00
0.01	0.010003	0.01000	0.00000	0.0000091	2.00
0.05	0.049996	0.05000	0.00000	0.0000098	2.00
0.1	0.100011	0.10000	0.00001	0.000011	2.00
0.5	0.500016	0.50000	0.00002	0.000014	2.00
1	1.000003	1.00001	-0.00001	0.000016	2.00
2	2.000023	2.00005	-0.00003	0.000017	2.00
5	5.000015	5.00005	-0.00003	0.000021	2.00
10	10.000009	10.00005	-0.00004	0.000026	2.00
20	20.000030	20.00012	-0.00009	0.000037	2.00
30	30.000039	30.00012	-0.00008	0.000050	2.00
50	50.000028	50.00014	-0.00011	0.000068	2.00
80	80.000067	80.00020	-0.00013	0.00011	2.00

FCS-012 Revision: 01 Date: 20-04-65

2008 ๒๕๕๑-๒๕๖๓ 36 ถนนสุขุมวิท แขวงคลองตัน เขตคลองเตย กรุงเทพมหานคร 110  
2008 Soi 36, Aun Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand  
Tel: +66(0) 2422 8668 Fax: +66(0) 2422 8545

for N. mupabot



nfi.co.th

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2502226-001-01

**Equipment:**

Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Resolution:** 0.00001 g / 0.0001 g

**Model:** XSR205DU

**ID No.:** UAE.WAO.012/2563

**Serial No.:** C09071872

**Capacity:** 82 g / 220 g

**Date of Calibration:** 20 March 2025

Page 4 of 4

**Calibration Results:** (Continued)

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

**Calibration Adjustment:** Internal Calibration

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

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
90	90.00010	90.0002	-0.0001	0.00015	2.00
100	100.00006	100.0001	0.0000	0.00016	2.00
110	110.00007	110.0001	0.0000	0.00017	2.00
120	120.00009	120.0002	-0.0001	0.00018	2.00
130	130.00010	130.0002	-0.0001	0.00019	2.00
140	140.00013	140.0002	-0.0001	0.00019	2.00
150	150.00009	150.0002	-0.0001	0.00021	2.00
160	160.00010	160.0002	-0.0001	0.00022	2.00
170	170.00012	170.0002	-0.0001	0.00023	2.00
200	200.00013	200.0002	-0.0001	0.00028	2.00

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

----- End -----

FCS-012 Revision: 01 Date: 20-04-65

2008 ๒๕๕๑-๒๕๖๓ 36 ถนนสุขุมวิท แขวงคลองตัน เขตคลองเตย กรุงเทพมหานคร 110  
2008 Soi 36, Aun Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand  
Tel: +66(0) 2422 8668 Fax: +66(0) 2422 8545

for N. mupabot



nfi.co.th

เอกสารไม่ควบคุม

## Calibration Certificate

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

Page 1 of 4

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

**Calibrated by** Mr.Yothin Charoensuk  
Scientist  
**Date of Issue:** 25 March 2025  
**Approved by**  (Mr.Phraphat Tuanjit)  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team

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

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

FCS-003 Revision: 01 Date: 20-04-65

## Calibration Report

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

Page 2 of 4

**Date of Calibration:** 20 March 2025  
**Environment Condition:** Ambient Temperature: 21.2 ± 0.6 °C Relative Humidity: 48 ± 3.5 %  
**Place of Calibration:** 208 Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Condition of Equipment:** Good Condition

### Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019
2. Reference Standards:
- | Reference Standard       | Model       | Serial No.    | Calibrated By  | Certificate No. | Due Date         |
|--------------------------|-------------|---------------|----------------|-----------------|------------------|
| Standard Weight Class E2 | 1mg to 200g | B50567572     | TCS            | M24041005       | 19 April 2025    |
| Thermo-Hygro Meter       | 608-H1      | NFLBTH 017/23 | Quality Reborn | QR25-0542       | 10 February 2026 |
3. This certification is traceable to SI UNIT
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.

### Calibration Results:




#### 1. Repeatability of Reading:

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

#### 2. Off-Center Error:

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

The balance reading obtained is given in the table.

					
1 ( g )	2 ( g )	3 ( g )	4 ( g )	5 ( g )	6 ( g )
100.0001	100.0001	100.0001	100.0001	100.0001	100.0001
					(Maximum Difference) ( g )
					0.0000

for N.ingrat

FCS-012 Revision: 01 Date: 20-04-65

## Calibration Report

**Certificate No.:** 2502226-002-01  
**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.00001 g / 0.0001 g  
**ID No.:** UAE.WAO.01072565  
**Serial No.:** C210685394  
**Capacity:** 82 g / 220 g

**Date of Calibration:** 20 March 2025 Page 3 of 4

**Calibration Results:** (Continued)

**Calibration Range:** 0-80 g

**Calibration Adjustment:** Internal Calibration

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

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

FCS-012 Revision: 01 Date: 20-04-65

2008 ตราสัญลักษณ์ 35 มูลนิธิศูนย์ฯ มุ่งมั่นพัฒนาผลิตภัณฑ์อาหารไทยสู่สากล

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Tel: +66(0) 21422 8688 Fax: +66(0) 21422 8545

for N. Ningsont



nfi.or.th

## Calibration Report

**Certificate No.:** 2502226-002-01  
**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.00001 g / 0.0001 g  
**ID No.:** UAE.WAO.01072565  
**Serial No.:** C210685394  
**Capacity:** 82 g / 220 g

**Date of Calibration:** 20 March 2025 Page 4 of 4

**Calibration Results:** (Continued)

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

**Calibration Adjustment:** Internal Calibration

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

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

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

----- End -----

for N. Ningsont



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**Condition of this calibration result:**

Reference Standard Instruments : This certification is traceable to the international unit of unit maintained through:

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MY44065265	WK2307-164-1	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HT-771SD	AL07155	24H41	Technology Promotion Association (Thailand-Japan).

**Calibration Result:**

Measurement Temperature Source Accuracy for COD Reactor.

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	Uncertainty of Measurement ( $\pm$ °C)
25 Vial	150.0	150.0	0.50

Unit : °C

(1A)	(2A)	(3A)	(4A)	(5A)
150.308	150.221	150.101	150.121	149.738
(1B)	(2B)	(3B)	(4B)	(5B)
150.011	149.395	150.792	149.934	150.178
(1C)	(2C)	(3C)	(4C)	(5C)
150.071	150.052	150.477	150.400	150.451
(1D)	(2D)	(3D)	(4D)	(5D)
149.235	149.601	149.411	150.014	149.708
(1E)	(2E)	(3E)	(4E)	(5E)
150.096	149.107	150.024	150.002	149.342

Figure: Shows the location of the temperature source.

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

\*\* End of certificate \*\*

**เอกสารไม่ควบคุม**

**CERTIFICATE OF CALIBRATION**

Equipment : COD Test Tube Heater  
 Meter Model : HI839800-02 Serial No. : 04500052101  
 Tube Heater : 25 Vial Capacity Resolution : 0.1 °C  
 Temperature Range : (-10 to 160) °C Temperature of Reaction : 150 °C  
 Manufacturer : Hanna Instruments Made in : Romania  
 Condition As-Received : Used Product Reference : RE241152  
 Ambient Temperature : (25  $\pm$  2) °C Relative Humidity : (50  $\pm$  15)%RH  
 Customer name : United Analyst and Engineering Consultant Co., Ltd.

3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,

Phrakhanong, Bangkok 10260

Received date : 26 June 2024

Calibrate date : 1 July 2024

Issue date : 3 July 2024

Calibrated Location : Hanna Instruments (Thailand) Ltd.

Calibration Procedure : This calibrator was conducted by using in-house: calibration procedure

CP-04 by using certified reference standard instruments.

Calibrated by :

☒ Mr. Pichit Pethong

Approved by :

*[Signature]*

☐ Mr. Channarong Soinak

Mr. Anan Suwanchaisakul

Authorized Signatory



This certificate was certified only for the instrument we calibrated.

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

\*\* This certificate may not be reproduced other than in full, except with the prior written \*\*

approval of the head of Hanna Instrument (Thailand).

**เอกสารไม่ควบคุม**

### Condition of this calibration result:

Reference Standard Instruments : This certification is traceable to the international unit of unit maintained through:

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MY44065265	WK2307-164-1	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HT-771SD	AL07155	24H41	Technology Promotion Association (Thailand-Japan).

### Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor.

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	Uncertainty of Measurement (± °C)
25 Vial	150.0	149.8	0.48

Unit : °C

(1A)	(2A)	(3A)	(4A)	(5A)
149.574	149.873	149.861	149.748	149.878
(1B)	(2B)	(3B)	(4B)	(5B)
149.490	149.940	149.954	150.103	150.048
(1C)	(2C)	(3C)	(4C)	(5C)
149.625	150.036	150.080	150.015	149.580
(1D)	(2D)	(3D)	(4D)	(5D)
149.801	149.541	149.662	150.010	149.499
(1E)	(2E)	(3E)	(4E)	(5E)
149.563	149.611	149.569	149.831	149.762

Figure: Shows the location of the temperature source.

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

\*\* End of certificate \*\*

เอกสารไม่ควบคุม

Certificate No. : HIT-2510-0375

Page : 1 of 2

### CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater

Meter Model : HI839800-02 Serial No. : H0185001

Tube Heater : 25 Vial Capacity Resolution : 0.1 °C

Temperature Range : (-10 to 160) °C Temperature of Reaction : 150 °C

Manufacturer : Hanna Instruments Made in : Romania

Condition As-Received : Used Product Reference : RE250401

Ambient Temperature : (25 ± 2) °C Relative Humidity : (50 ± 15) % RH

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

3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,

Phrakhanong, Bangkok 10260

Received date : 5 March 2025

Calibrate date : 7 March 2025

Issue date : 7 March 2025

Calibrated Location : Hanna Instruments (Thailand) Ltd.

Calibration Procedure : This calibrator was conducted by using in-house: calibration procedure CP-04 by using certified reference standard instruments.

Calibrated by :

☒ Mr. Pichit Pethong

Approved by :

☐ Mr. Chanmarong Soinak

Mr. Anan Suwanchaisakul

Authorized Signatory



This certificate was certified only for the instrument we calibrated.

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

\*\* This certificate may not be reproduced other than in full, except with the prior written \*\*

approval of the head of Hanna Instrument (Thailand) เอกสารไม่ควบคุม

#### Condition of this calibration result:

Reference Standard Instruments : This certification is traceable to the international unit of unit maintained through:

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MY44065265	WK2407-141-1	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HT-771SD	AL07155	25H171	Technology Promotion Association (Thailand-Japan).

#### Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor.

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	Uncertainty of Measurement (±°C)
25 Vial	150.0	150.4	0.47

Unit : °C

(1A)	(2A)	(3A)	(4A)	(5A)
150.407	150.377	150.269	150.402	150.422
(1B)	(2B)	(3B)	(4B)	(5B)
150.426	150.394	150.644	150.690	150.542
(1C)	(2C)	(3C)	(4C)	(5C)
150.477	150.303	150.627	150.257	150.176
(1D)	(2D)	(3D)	(4D)	(5D)
150.462	150.456	150.199	150.406	150.102
(1E)	(2E)	(3E)	(4E)	(5E)
150.185	150.513	150.235	150.460	150.442

Figure: Shows the location of the temperature source.

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

\*\* End of certificate \*\*

เอกสารไม่ควบคุม

## Agilent 55 240 280 Series Atomic Absorption Spectroscopy Systems

### Preventive Maintenance Checklist

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>

### Introduction

#### Customer Information

- 1 Customers should provide all necessary operating supplies upon request of the engineer.
- 2 A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- 3 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.
- 4 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.

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## Important Customer Web Links

- For more information about *Agilent Technologies services*, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- To access *Agilent University*, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery.
- A training specialist can work directly with you to help determine your best options.
- A useful *Agilent Resource Center* web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>
- Need technical support, FAQs, supplies? – visit our *Support Home page* at <http://www.agilent.com/search/support>
- Get answers, Share insights. Build connections: Join the *Agilent Community* at <https://community.agilent.com/welcome>

## 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.

## Instrument Maintenance

### System Information

- ☐ Check this box if an instrument configuration report is attached instead of completing the 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	M1 13160001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

## 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 issues with the customer before starting.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. **น.ร.**
- ☒ 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.

## Preventive Maintenance Procedures

### FLAME SYSTEM section

- ☐ 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
  - ☐ ABA

#### 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.
- ☒ Clean the nebulizer, spray chamber and liquid trap.
- ☒ Change all O-rings and seals in the nebulizer, nebulizer block and spray chamber.
- ☒ Check that the pressure relief bung releases readily.
- ☒ Change O-rings on the fuel and oxidant delivery barbs
- ☒ Leave the liquid trap EMPTY and verify the flame will not ignite in this state.
- ☒ Refill liquid trap and check that overflow 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 and connections
- ☒ 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.

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### FURNACE SYSTEM section

☒ *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 workload component checks

- ☐ Inspect the GTA workload 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 workload water hoses and connections for leaks.
- ☐ Check all graphite components and replace if necessary.

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- ☐ 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.

### **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.

### **Sample preparation system (SPS 3) accessory**

#### **☒ Section NOT Applicable**

- ☐ Check the x-axis and z-axis timing belts – Replace if there is are any cracks, splits or color deterioration and belt tension.
- ☐ Check belt tensions - adjust if required
- ☐ Check the lubrication pad for single x-axis shaft. If pad is dry or customer has observed any vibration or erratic movements of the x-axis carriage, add 1 mL of Dow Corning 200 @ Fluid, 200 CS into the well.
- ☐ Check the auto-sampler ability to find tube positions - Calibrate 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.

### 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 office 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
<b>Flame optics PMT Gain test</b>		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	49 %
<b>Flame performance test with 5 ppm copper sample</b>		
Air /acetylene, mixing paddle removed	Abs value > 0.5	0.5598
Air /acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	0.2 %
<b>Deuterium furnace optics PMT Gain test</b>		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	—
<b>Deuterium furnace performance test with 25 ppb copper sample (324.8 nm)</b>		
Precision %RSD	≤ 4.0%	—
Abs value	≥ 0.15	—
<b>Zeeman furnace analytical performance: 25 ppb copper sample (327.4 nm)</b>		
Precision %RSD	≤ 4.0%	—
Abs value	≥ 0.10	—
MSR%	≥ 70 %	—

### AA consumable and parts list table

Part Description	Part Number	Product/Model # where used	PM supplied or Consumable	Instrument-Type
Test Solution – Cu 5ppm solution	6610030100	50 55 140 240 280	PM supplied	Common
Test Solution - Blank solution	5190-7001	50 55 140 240 280	PM supplied	Common
Copper, 1000 ug/ml, 100ml	5190-8279	50 55 140 240 280	*	Common
Kit, Mk. 7 O-rings, aqueous, complete set	9910093400	50 55 140 240 280	PM supplied	Flame
Organic Kit	9910093500	50 55 140 240 280	PM supplied	Flame
Wire Nebulizer Cleaning	9910024700	50 55 140 240 280	consumable	Flame
Tubing-Capillary Std Nebis	9910024800	50 55 140 240 280	consumable	Flame
Capillary Tube Hivac Neb (3) (organics only)	9910044000	50 55 140 240 280	consumable	Flame
Glass impact beads (5/pk)	9910025700	50 55 140 240 280	consumable	Flame
Teflon impact beads (5/pk): (organics only)	9910053300	50 55 140 240 280	consumable	Flame
Burner cleaning strip (100/pk)	9910053900	50 55 140 240 280	consumable	Flame
Window UV silica – round (right side)	2010082600	50 55 140 240 280	PM supplied	Common
Window UV silica – rectangular (left side)	2010082500	50 55 140 240 280	PM supplied	Common
Pad adhesive window (round)	4910012700	50 55 140 240 280	PM supplied	Common
Pad adhesive window (rectangular)	4910012800	50 55 140 240 280	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 in this box.

### Service Completion

Service request number 6007549143 Date service completed 30 Jan 2025  
 Agilent signature Kangkiet S. Customer signature Amida Y.  
 Total number of pages in this document 13

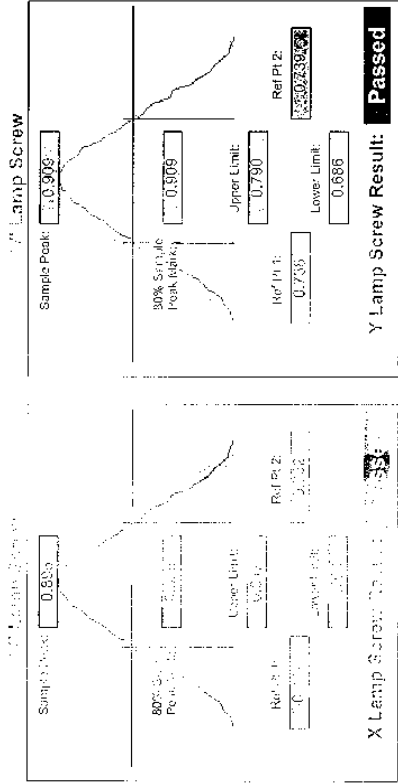




Beam Balance:

Lamp Type: Copper  
Lamp Socket Used: 3

Peak Selected: 324.80  
Lamp Alignment: **Not Aligned**



Calibration:

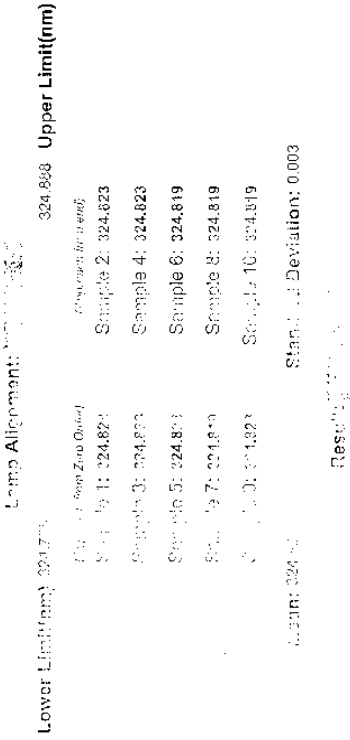
Lamp Element(s): Copper  
Lamp Element(s): 3  
Lamp Current (mA): 4.20  
Silt Width (mm): 0.5  
Lamp Wavelength (nm): 324.80  
Lamp Alignment: Not Aligned

	Lower Limit (nm)	Upper Limit (nm)	Result:
75.0 C	324.80	0.10	<b>Passed</b>
First Order	324.80	325.15	<b>Passed</b>
Second Order	324.80	649.97	<b>Passed</b>

เอกสารไม่ควบคุม

Wavelength (nm): 324.80

Lamp Used: Copper  
Peak Height (mm): 0.150  
Connection: Socket 3  
Silt Height: Normal



Standard Deviation: 0.003

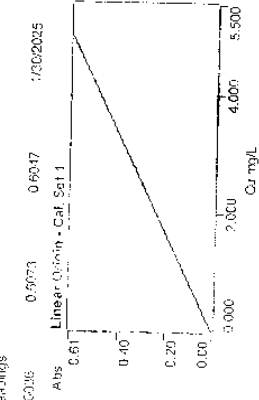
Result: Passed

เอกสารไม่ควบคุม



Analyst  
Date Started1/30/2025 10:33 AM GMT: 1/30/2025 3:33 AM  
WorksheetPrecision Test  
Comment  
MethodsCu  
Computer nameDESKTOP-R3UIFRS  
Serial Number:MY13160001

Method: Cu (Flame)				
Sample ID	Conc. mg/L	%RSD	Mean Abs	
CAL Z180	0.000	51.1	-0.0002	
Readings				
	-0.0003	-0.0003	-0.0001	1/30/2025 10:46:52 AM
STANDARD 1	0.000	0.2	0.0052	
Readings				
	0.0006	0.9073	0.0047	1/30/2025 10:47:24 AM



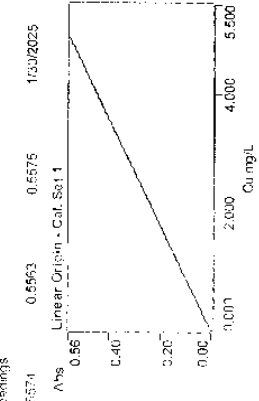
Curve Fit  
= Linear Origin  
Characteristic Conc  
= 0.000 mg/L  
r  
= 1.0000  
Calculated Conc  
= -0.000 0.000  
Residuals  
= 0.002 0.000

Abs = 0.121C5 x C				
5 ppm Cu	5.500	0.2	0.0051	
Readings				
	0.5073	0.6052	0.5047	0.6042
	0.6055	1.0076	0.6064	1/30/2025 10:48:32 AM

เอกสารไม่ควบคุม

Analyst  
Date Started1/30/2025 10:33 AM GMT: 1/30/2025 3:33 AM  
WorksheetSensitivity Test 01  
Comment  
MethodsCu  
Computer nameDESKTOP-R3UIFRS  
Serial Number:MY13160001

Method: Cu (Flame)				
Sample ID	Conc. mg/L	%RSD	Mean Abs	
CAL Z180	0.000	38.8	0.0002	
Readings				
	0.0002	0.0003	0.0001	1/30/2025 10:51:45 AM
STANDARD 1	0.000	0.2	0.5571	
Readings				
	0.5574	0.5563	0.5575	1/30/2025 10:52:22 AM



Curve Fit  
= Linear Origin  
Characteristic Conc  
= 0.000 mg/L  
r  
= 1.0000  
Calculated Conc  
= 0.002 0.000  
Residuals  
= -0.002 0.000

Abs = 0.1114 x C				
5 ppm Cu	5.500	0.2	0.5568	
Readings				
	0.5562	0.5506	0.5515	1/30/2025 10:52:54 AM

เอกสารไม่ควบคุม



Inspection result

ITEM	STANDARD	RESULT	JUDGE
1. Self Check			
1.1 Heating		PASS	OK
1.2 Cooling		PASS	OK
1.3 Leak		PASS	OK
1.4 Optical system		PASS	OK
1.5 Drift		PASS	OK
2. Analytical curve inspection(AREA)			
2.1 No Pretreatment (Low Conc.)	Correlation coefficient ( r ) ≥ 0.9990	0.9999	OK
3. Repeatability(AREA)			
3.1 No Pretreatment 100ppb, n=3		1. 99.60 ppb 2. 101.84 ppb 3. 101.22 ppb  C.V. ≤ 5%	OK
4. Blank	Below 1.0 (AREA)	0.1002	OK

เอกสารไม่ควบคุม

Counter

Maintenance

MAIN

SC

Counter

Parameter

Measurement Count

205772.2-06-08

Clear

0h30m(24-07-08)

Clear

Mercury Exhaust Filter Amount(mg)1500mg

102.2-06-08

Clear

0h01mg(24-07-08)

Clear

Lamp Active time(5000h)

1h13m(24-07-08)

Clear

0h00m(24-07-08)

Clear

Membrane Filter Usage Time(2000h)

0h58m(24-07-08)

Clear

0h00m(24-07-08)

Clear

Main Pump tube(750h)

0h58m(24-07-08)

Clear

0h00m(24-07-08)

Clear

Heating Lamp Time

58h23m(22-06-08)

Clear

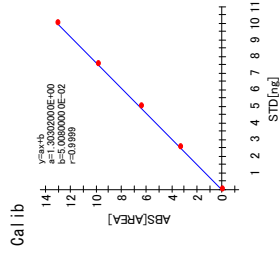
0h02m(24-07-08)

Clear

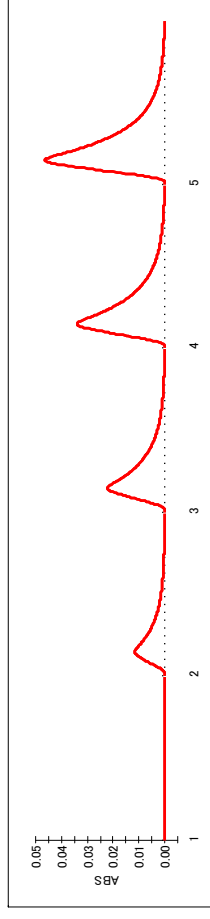
Exit

เอกสารไม่ควบคุม

Title	: Preventive Maintenance RA-4500 sn:17780278
Date	: 2024-07-09
Name	: Coax Group
Memo	: Calibration Curve 0-10ng

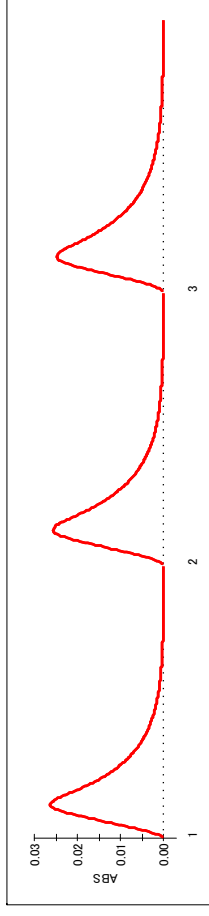


STD									
No.	STD [ppb]	SVOL [mL]	CVOL [mL]	DVOL [mL]	STD [ng]	AREA [ON]	MEAS [ng]	Dev [%]	Note
1	100.000	0.000	5.000	5.000	0.000	0.0846	0.0265	-	
2	100.000	0.025	5.000	5.000	2.500	3.3464	2.5298	1.2	
3	100.000	0.050	5.000	5.000	5.000	6.4170	4.8863	2.3	
4	100.000	0.075	5.000	5.000	7.500	9.8647	7.5322	0.4	
5	100.000	0.100	5.000	5.000	10.000	13.1132	10.0253	0.3	



SMP								
No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	AREA [ON]	MEAS [ng]	CONC [ug/L]	Note
1	100ppb	0.050	5.000	5.000	6.5389	4.9798	99.60	
2	100ppb	0.050	5.000	5.000	6.6848	5.0918	101.84	
3	100ppb	0.050	5.000	5.000	6.6446	5.0610	101.22	

Statistics					
No.	NAME	TRY	AV [ug/L]	SD [ug/L]	Cv [%]
1	100ppb	3	100.887	1.15660	1.15



## Self Check

```
Heat check:PASS!! ( 26.3degC[05:00] -> 30.3degC[02:29])
Sensor check:PASS!! ( 53-10= 43)
Leak check:PASS!! (0.19L/min)
Sig/Ref check:PASS!! (Sig:4.00V, Ref:4.02V)
Drift check:PASS!! ( 0.0000061 - -0.0000179 = 0.0000240)
```

CERTIFICATE OF CALIBRATION

Certificate No. : SP24-028

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

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

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : HITACHI

Model : U-5100

Serial No. : 23A4-008

ID No. : UAE.WAS.010/2567

Received Date : 10 September 2024

Calibration Date : 10 September 2024

Issue Date : 13 September 2024

Condition Instrument : Good

Calibrated by : 

ปณิฏ

Approved by : 

ชลธิชา

( Mr.Tanawut Rittidach )

( Ms. Chonthicha Sangngern )

Technical Manager

Quality Manager

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

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

เอกสารไม่ควบคุม

FM-708-02 R01 1/1/2021

Title : Preventive Maintenance RA-4500 sn:17780278

Date : 2024-07-09

Name : Coax Group

Memo : Blank

SNIP

No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	AREA [ON]	MEAS [ng]	CONC [ug/L]	Note
1	Blank DI				0.1002	0.0385		

-3-

เอกสารไม่ควบคุม

NIC

NIPPON INSTRUMENTS CORPORATION

## REPORT OF CALIBRATION

Certificate No. : SP24-028

Page 2 of 5

**Environment Condition :** Ambient Temperature  $25 \pm 5$  °C

Relative humidity  $55 \pm 20$  %RH

**Calibration method :** In-house method CP-01 Based on ASTM E275-08

### Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	115663	25 October 2025
Absorbance Standard set	25757	115638	25 October 2025
Wavelength Standard set	25806	115657	25 October 2025
Wavelength Standard set	25758	115665	25 October 2025

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

Institute of Standards and Technology (NIST) through Sarna Scientific Limited

**Spectral Band Width of UUC :** 5.0 nm.

**Scan Speed of UUC :** 40

**Scan Interval of UUC :** 0.1 nm.

**Resolution of UUC :** Photometric 0.001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

FM-708-02 R01 1/1/2021

## REPORT OF CALIBRATION

Certificate No. : SP24-028

Page 3 of 5

**Calibration Results :** Without adjustment

### Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.044	0.0044	0.0029	2.00
	2.1876	2.190	-0.0024	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.557	0.0025	0.0034	2.00
	1.0239	1.021	0.0029	0.0035	2.00
	2.1230	2.121	0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.519	0.0040	0.0029	2.00
	0.9633	0.961	0.0023	0.0028	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.515	0.0031	0.0031	2.00
	1.0002	0.997	0.0032	0.0033	2.00
	1.9973	1.996	0.0013	0.0085	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.549	0.0027	0.0030	2.00
	1.0803	1.078	0.0023	0.0029	2.00
	2.0373	2.031	0.0063	0.0081	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.557	0.0021	0.0031	2.00
	1.0518	1.049	0.0028	0.0029	2.00
	1.9274	1.923	0.0044	0.0080	2.00

เอกสารไม่ควบคุม

FM-708-02 R01 1/1/2021

REPORT OF CALIBRATION

Certificate No. : SP24-028

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
235	0.0000 0.7469	0.000 0.743	0.0000 0.0039	0.0050 0.0056	2.00 2.00
257	0.0000 0.8674	0.000 0.862	0.0000 0.0054	0.0050 0.0059	2.00 2.00
313	0.0000 0.2919	0.000 0.291	0.0000 0.0009	0.0050 0.0051	2.00 2.00
350	0.0000 0.6430	0.000 0.639	0.0000 0.0040	0.0050 0.0055	2.00 2.00

REPORT OF CALIBRATION

Certificate No. : SP24-028

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor <i>k</i>
241.00 279.30 288.90 334.50 361.40 418.40 447.20 459.30 537.00 638.00	240.4 278.7 288.5 334.2 361.1 418.0 446.7 459.6 536.6 637.4	0.60 0.60 0.40 0.30 0.30 0.40 0.50 -0.30 0.40 0.60	0.18 0.18 0.18 0.18 0.18 0.18 0.18 0.18 0.18 0.18	2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00
441.29 479.88 513.75 528.59 575.10 585.56 684.70 740.51 747.61 807.04 879.68	440.8 479.6 513.5 528.6 574.9 585.3 684.1 740.0 747.2 806.3 878.9	0.49 0.28 0.25 -0.01 0.20 0.26 0.60 0.51 0.41 0.74 0.78	0.18 0.18 0.18 0.18 0.18 0.20 0.18 0.20 0.18 0.18 0.18	2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor *k*.

which for a normal distribution corresponds to a coverage probability of approximately 95%

- End of Certificate -

## CERTIFICATE OF CALIBRATION

Certificate No. : SP25-001 Page 1 of 5

Customer : United Analyst and Engineering Consultant Co., Ltd. (Head Office)

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

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564

Received Date : 3 January 2025

Calibration Date : 3 January 2025

Issue Date : 8 January 2025

Condition Instrument : Good

Calibrated by : ปัทม์ Approved by : ชลธิชา  
(Mr. Tanawat Ritidach) (Ms. Chonthicha Sangngern)  
Technical Manager Quality Manager

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

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of DQE Services Co., Ltd.

**เอกสารไม่ควบคุม**

FM-708-02 R01 1/11/2021

## REPORT OF CALIBRATION

Certificate No. : SP25-001 Page 2 of 5

Environment Condition : Ambient Temperature  $25 \pm 5$  °C

Relative humidity  $55 \pm 20$  %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

### Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	115663	25 October 2025
Absorbance Standard set	25757	115638	25 October 2025
Wavelength Standard set	25806	115657	25 October 2025
Wavelength Standard set	25758	115665	25 October 2025

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

Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

**เอกสารไม่ควบคุม**

FM-708-02 R01 1/11/2021

## REPORT OF CALIBRATION

Certificate No. : SP25-001

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.578	0.0000	0.0031	2.00
	1.0484	1.045	0.0034	0.0029	2.00
	2.1876	2.192	-0.0044	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.560	-0.0005	0.0034	2.00
	1.0239	1.023	0.0009	0.0035	2.00
	2.1230	2.125	-0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.521	0.0020	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.977	-0.0017	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.518	0.0001	0.0031	2.00
	1.0002	0.998	0.0022	0.0033	2.00
	1.9973	1.993	0.0043	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.552	-0.0003	0.0030	2.00
	1.0803	1.079	0.0013	0.0030	2.00
	2.0373	2.032	0.0053	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.559	0.0001	0.0031	2.00
	1.0518	1.050	0.0018	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

เอกสารไม่ควบคุม

## REPORT OF CALIBRATION

Certificate No. : SP25-001

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.744	0.0029	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.863	0.0044	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.290	0.0019	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.640	0.0030	0.0055	2.00

เอกสารไม่ควบคุม

## REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 5 of 5

### Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor $k$
241.72	241.1	0.62	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.3	0.51	0.18	2.00
334.06	333.8	0.26	0.18	2.00
360.93	360.6	0.33	0.18	2.00
418.59	418.2	0.39	0.18	2.00
445.94	445.5	0.44	0.18	2.00
453.66	453.4	0.26	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.6	-0.01	0.18	2.00
637.98	637.7	0.28	0.18	2.00
431.38	431.1	0.28	0.18	2.00
472.50	472.3	0.20	0.18	2.00
513.47	513.4	0.07	0.18	2.00
528.88	528.9	-0.02	0.18	2.00
573.17	573.3	-0.13	0.18	2.00
585.35	585.1	0.25	0.20	2.00
684.40	684.5	-0.10	0.18	2.00
740.72	741.0	-0.28	0.20	2.00
748.55	748.8	-0.25	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.6	-0.32	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement  $U$  is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k$ .

which for a normal distribution corresponds to a coverage probability of approximately 95%

- End of Certificate -

**เอกสารไม่ควบคุม**

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## CERTIFICATE OF CALIBRATION

Certificate No. : SP25-019

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Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

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

Location of calibration : Instrument room (207)

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009

ID No. : UAE.WAT.020/2558

Received Date : 26 May 2025

Calibration Date : 26 May 2025

Issue Date : 29 May 2025

Condition Instrument : Good

Calibrated by : 

Approved by : 

( Mr.Tanawut Ritidach )

( Ms.Chonticha Sangnern )

Technical Manager

Quality Manager

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

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

**เอกสารไม่ควบคุม**

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## REPORT OF CALIBRATION

Certificate No. : SP25-019

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Environment Condition : Ambient Temperature  $25 \pm 5$  °C

Relative humidity  $55 \pm 20$  %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

### Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	115663	25 October 2025
Absorbance Standard set	25757	115638	25 October 2025
Wavelength Standard set	25806	115657	25 October 2025
Wavelength Standard set	25758	115665	25 October 2025

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

Institute of Standards and Technology (NIST) through Siama Scientific Limited

**Spectral Band Width of UUC** : 1.5 nm.

**Scan Speed of UUC** : 60 nm/min

**Scan Interval of UUC** : 0.15 nm.

**Resolution of UUC** : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

**เอกสารไม่ควบคุม**

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## REPORT OF CALIBRATION

Certificate No. : SP25-019

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Calibration Results : Without adjustment

### Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor $k$
420	0.0000	0.0000	0.0000	0.0028	2.00
	0.5780	0.5739	0.0041	0.0031	2.00
	1.0484	1.0430	0.0054	0.0029	2.00
	2.1876	2.1876	0.0000	0.0084	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5595	0.5581	0.0014	0.0034	2.00
	1.0239	1.0219	0.0020	0.0035	2.00
	2.1230	2.1207	0.0023	0.0085	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5230	0.5190	0.0040	0.0029	2.00
	0.9633	0.9609	0.0024	0.0029	2.00
	1.9753	1.9719	0.0034	0.0079	2.00
546.1	0.0000	0.0000	0.0000	0.0028	2.00
	0.5181	0.5161	0.0020	0.0031	2.00
	1.0002	0.9979	0.0023	0.0033	2.00
	1.9973	2.0021	-0.0048	0.0102	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5517	0.5503	0.0014	0.0030	2.00
	1.0803	1.0808	-0.0005	0.0031	2.00
	2.0373	2.0324	0.0049	0.0105	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5591	0.5583	0.0008	0.0031	2.00
	1.0518	1.0513	0.0005	0.0030	2.00
	1.9274	1.9281	-0.0007	0.0102	2.00

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## REPORT OF CALIBRATION

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Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor <i>k</i>
241.72	242.0	-0.28	0.18	2.00
279.45	279.5	-0.05	0.18	2.00
287.81	287.6	0.21	0.18	2.00
334.06	333.8	0.26	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	417.9	0.69	0.18	2.00
445.94	445.4	0.54	0.18	2.00
453.66	453.2	0.46	0.18	2.00
460.02	459.6	0.42	0.18	2.00
536.59	536.5	0.09	0.18	2.00
637.98	638.5	-0.52	0.18	2.00
431.38	430.7	0.68	0.18	2.00
472.50	472.3	0.20	0.18	2.00
513.47	513.5	-0.03	0.18	2.00
528.88	528.9	-0.02	0.18	2.00
573.17	573.8	-0.63	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	685.1	-0.70	0.18	2.00
740.72	741.1	-0.38	0.20	2.00
748.55	748.9	-0.35	0.18	2.00
807.03	807.1	-0.07	0.18	2.00
879.28	879.1	0.18	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor *k*.

which for a normal distribution corresponds to a coverage probability of approximately 95%

- End of Certificate -

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Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
235	0.0000	0.0000	0.0000	0.0050	2.00
	0.7469	0.7488	-0.0019	0.0063	2.00
257	0.0000	0.0000	0.0000	0.0050	2.00
	0.8674	0.8663	0.0011	0.0067	2.00
313	0.0000	0.0000	0.0000	0.0050	2.00
	0.2919	0.2902	0.0017	0.0052	2.00
350	0.0000	0.0000	0.0000	0.0050	2.00
	0.6430	0.6428	0.0002	0.0063	2.00

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