

# ภาคผนวก ค

เอกสารสอบเทียบเครื่องมือ



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

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
<b>Ambient</b>									
1	Office Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Thermo Scientific	G25A 158M	Tisch Environmental, Inc.	05072022	14 Jul 23	13 Jul 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	23P1396	9 May 23	8 May 24	-
3	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1860	2 Jun 23	1 Jun 24	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1201	5 Jun 23	5 Jun 24	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CW08130002	UAE Consultant Co., Ltd.	11012023	11 Jan 23	10 Jan 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920009	UAE Consultant Co., Ltd.	15022023	15 Feb 23	14 Feb 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CW19050148	UAE Consultant Co., Ltd.	15022023	15 Feb 23	14 Feb 24	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-58929-320	UAE Consultant Co., Ltd.	16032023	16 Mar 23	15 Mar 24	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201497726	UAE Consultant Co., Ltd.	07042023	7 Apr 23	6 Apr 24	-
10	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 201SP5IG	Airgas an Air Liquide company	EO4N99E15A0103	21 Jun 21	21 Jun 24	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1180540065	UAE Consultant Co., Ltd.	10012023	10 Jan 23	9 Jan 24	-
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i JC1606001758	UAE Consultant Co., Ltd.	09022023	9 Feb 23	8 Feb 24	-
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920016	UAE Consultant Co., Ltd.	10012023	10 Jan 23	9 Jan 24	-

**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>									
14	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778115	UAE Consultant Co.,Ltd.	09022023	9 Feb 23	8 Feb 24	-
15	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387063	UAE Consultant Co.,Ltd.	07042023	7 Apr 23	6 Apr 24	-
16	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2019PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
17	Wind Speed/Wind Direction	WSWD	Scarlet Tech Ltd.	WL-21 2205DT0113	Thai Meteorological Department	390/23	1 Nov 23	31 Oct 24	-
18	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	SvanteK	SV35 44792	Innovative Instrument Co.,Ltd.	23-ACT-021	14 Feb 23	13 Feb 24	-
19	Sound Level Meter	$L_{Aeq,24\text{ hrs}}$ $L_{A\text{dri}}$ $L_{A90}$ $L_{Amax}$ เสียงรบกวน	Larson Davis	LxT2 5394	Innovative Instrument Co.,Ltd.	22-ACT-034	21 Jan 22	20 Jan 24	-
20	Sound Level Meter	$L_{Aeq,24\text{ hrs}}$ $L_{A\text{dri}}$ $L_{A90}$ $L_{Amax}$ เสียงรบกวน	Larson Davis	LxT2 5405	Innovative Instrument Co.,Ltd.	22-ACT-101	11 Feb 22	10 Feb 24	-
21	Sound Level Meter	$L_{Aeq,24\text{ hrs}}$ $L_{A\text{dri}}$ $L_{A90}$ $L_{Amax}$ เสียงรบกวน	Larson Davis	LxT2 0006617	Innovative Instrument Co.,Ltd.	23-SLM-027	30 Jan 23	29 Jan 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>Workplace</b>									
22	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35A 73246	Innovative Instrument Co.,Ltd.	23-ACT-110	27 Jun 23	26 Jun 24	-
23	Sound Level Meter	$L_{Aeq} 8 \text{ hrs}$ $L_{Amax}$	Rion, Japan	NL-42 00709656	Sithiporn Associates Co., Ltd.	ACL23132	26 Apr 23	25 Apr 24	-
24	Sound Level Meter	$L_{Aeq} 12 \text{ hrs}$ $L_{Amax}$	Rion, Japan	NL-42 01010780	Sithiporn Associates Co., Ltd.	ACL23119	11 Apr 23	10 Apr 24	-
25	Sound Level Meter	$L_{Aeq} 5 \text{ min}$ $L_{Amax}$	Rion, Japan	NL-42 01010783	Sithiporn Associates Co., Ltd.	ACL23149	9 May 23	8 May 24	-
26	Sound Level Meter	$L_{Aeq} 5 \text{ min}$ $L_{Amax}$	Rion, Japan	NL-42 01010786	Sithiporn Associates Co., Ltd.	ACL23121	11 Apr 23	10 Apr 24	-
27	Primary Flow Calibrator	Calibrate personal pump	TSI Inc	4146 41461708009	Innovative Instrument Co.,Ltd.	23-AFM-080	23 Mar 23	22 Mar 24	-
28	Aneroid Barometer	Sodium Hypochloride Sulphuric Acid Hydrogen Chloride	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1855	2 Jun 23	1 Jun 24	-
29	Digital Thermo - Hygrometer	Sodium Hypochloride Sulphuric Acid Hydrogen Chloride	Digicon	TH-02 395034176	Technology Promotion Association (Thailand-Japan)	23H1100	22 May 23	21 May 24	-
30	Digital Lux Meter	Lux	Extech Instrument, Taiwan	407026 A 056653	Innovative Instrument Co.,Ltd.	23-LXM-138	20 Apr 23	19 Apr 24	-
31	Digital Lux Meter	Lux	Extech Instrument, Taiwan	407026 A 052262	Innovative Instrument Co.,Ltd.	23-LXM-169	19 May 23	18 May 24	-



## CERTIFICATE OF CALIBRATION

Certificate No. : COF-001-66

Page 1 of 2 Pages

### MEASUREMENT ITEM

: Top Load Orifice  
: Graebig GWW  
: G25A  
: 158M  
: UAE/MA2.033/2554  
: Used item  
: United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udonnuk 41, Sukhumvit Road, Bangkok, Phrakhanong,  
Bangkok 10260

### CONDITION AS-RECEIVED CUSTOMER

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

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature :  $23.0 \pm 3.0$  °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  $23.7$  °C and  $52.9\%$  RH.

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

### TABULATION OF RESULTS:

The table on next page give the measured values.



Calibrated by:

☒ Mr. Sorawit Thichakulad  
☐ Miss Jitraporn Lertsimphol

Approved signatory

*[Signature]*

Mr. Parinya Booncharoen  
Calibration Department Manager

### MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The Humid air was used as a medium in the system. The standard conditions are  $25$  °C ( $288.15$  K) and  $760$  mmHg for standard temperature and standard pressure respectively.

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

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

Slope (m): 1.95114

Intercept (b): -0.02950

Correlation coefficient (r): 0.99975

Uncertainty (k=2): 0.015  $m^3/min$

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

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

Slope (m): 1.22204

Intercept (b): -0.01853

Correlation coefficient (r): 0.99975

Uncertainty (k=2): 0.015  $m^3/min$

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





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

## Certificate of Calibration

Certificate No.: 22P800  
Page: 1 of 2

Equipment: U-Tube Manometer  
Manufacturer: Dwyer  
Model: 1221-36-W/M  
Serial No.: -  
ID No.: UAE.EFM.022/2560  
Condition As-Received: Used Item  
Received Date: 03 March 2022  
Calibration Date: 12 March 2022

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

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

81 Soi Udomsak 41, Sukhumvit Road, Bangkok,  
Phraekhanong, Bangkok 10260

Reference: 2203-0131WSC  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1010 mbar

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

### Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-0110-21	09 Aug 2022

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

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

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Aussanee  
Issue Date : 14 March 2022

Approved Signatory : Atapol P.  
[ ] Phalinee Prabpaipal  
[ ] Sura Suwanasri  
✓ Atapol Panurach

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Cert.No.: 22P800  
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 )

Applied Pressure (inH <sub>2</sub> O)	UUC Indication		Error (inH <sub>2</sub> O)
	High-port side (inH <sub>2</sub> O)	Low-port side (inH <sub>2</sub> O)	
0.00	0.00	0.00	0.00
2.00	1.00	-1.00	0.00
4.00	2.00	-2.00	0.00
6.00	3.00	-3.00	0.00
8.00	4.00	-4.00	0.00
10.00	5.00	-5.02	0.02
12.00	6.00	-6.02	0.02
14.00	7.00	-7.04	0.04
16.00	8.00	-8.04	0.04
18.00	9.00	-9.04	0.04
20.00	10.00	-10.04	0.04
22.00	11.00	-11.02	0.02
24.00	12.00	-12.02	0.02
26.00	13.00	-13.02	0.02
28.00	14.00	-14.04	0.04
30.00	15.00	-15.04	0.04
32.00	16.00	-16.04	0.04
34.00	16.98	-17.06	0.04
35.80	17.98	-18.00	0.18

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

\* UUC = Unit Under Calibration

\* AP = 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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## Certificate of Calibration

Certificate No. : 23P1860  
Page : 1 of 2

Equipment : Aneroid Barometer  
Manufacturer : Barigo  
Model :  
Serial No. :  
ID No. : UAE-ANV-153/2550  
Condition As-Received: Used Item  
Received Date: 28 May 2023  
Calibration Date: 02 June 2023

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.

Reference: 2305-0919WSC  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1006 mbar  
Submitted by: United Analyst and Engineering Consultant Co.,Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments  
Standard according to in-house calibration procedure CP-P10, using "DKO-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-0094-23	03 May 2024
2.This instrument was installed in vertical orientation and center of the dial was used as the reference level.				
3.This result of calibration was made on requested at the point specified by customer.				

- This result of calibration instrument was in absolute pressure.
- This instrument was used clean air as pressure media.
- The certificate is valid only to the item calibrated on date and place of calibration.
- This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew  
Issue Date : 08 June 2023

Approved Signatory : Attapol P.  
[ ] Phalinee Prabpaipal  
[ ] Sura Suwanmasri  
[x] Attapol Panurach



Result of calibration:- Without adjustment  
Function:- Absolute Pressure Measurement  
Scale Interval: 1 hPa ( The Fifth Estimate )  
Range: 960 hPa to 1030 hPa

Increasing Pressure

Applied Pressure (hPa)	963.65	975.02	984.39	993.76	1002.68	1011.75	1020.25	1030.28
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	-3.65	-5.02	-4.39	-3.78	-2.66	-1.75	-0.25	-0.28

Decreasing Pressure

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

The uncertainty of measurement was ± 0.30 hPa

\* UUC = Unit Under Calibration

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-34 FAX. 0-2719-9484



## Certificate of Calibration

Certificate No.: 23H1201  
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer  
Manufacturer: Barigo  
Model: -  
Serial No.: -  
ID No.: UAE-EMA2.014/2555  
Condition As-Received: Used Item  
Received Date: 26 May 2023  
Calibration Date: 30 May 2023  
Reference: 2305-0919WSC  
Ambient Temperature: ( 25 ± 3 ) °C  
Relative Humidity: ( 50 ± 20 ) %

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

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

81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong, Bangkok 10260

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

### Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Hygro-M2 Dew Point Monitor	5112	2360195	20703	02 Aug 2023
2) Handheld Thermometer With Sensor	1523	3240076	23105	15 Mar 2024

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

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

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

Calibrated by: Sonchai Dumwor  
Issue Date: 07 June 2023

Approved Signatory:

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

*Chakrit*



Cert. No.: 23H1201  
Page: 2 of 2

Result of Calibration:-  
Function: Humidity Measurement

Before Adjustment

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

Result of Calibration:-  
Function: Humidity Measurement

After Adjustment

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

Result of Calibration:-  
Function: Temperature Measurement

Without Adjustment

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

UUC\*: Unit Under Calibration

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

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*Chakrit*

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# MULTI-POINT GAS TEST REPORT

Test Date : Jan 11, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 421  
Manufacturer : Thermo Scientific Serial Number : CM08130002

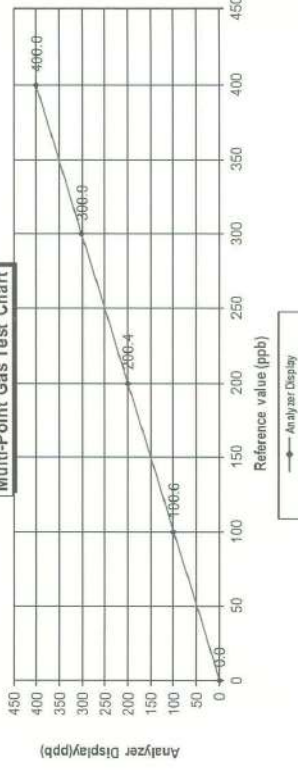
## Standard Gas Concentration

Sulphur Dioxide (SO <sub>2</sub> )	44.68	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	Model :	146i
Methane (CH <sub>4</sub> )	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8	PPM		
Cylinder No. :	EB0143262			
Expiration Date :	Jun 21, 2024			

## 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	100.6	0.60	0.60
Level 3 40.00%	200.0	200.4	0.40	0.20
Level 4 60.00%	300.0	300.9	0.90	0.30
Level 5 80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range	500.0 ppb			
Acceptable Limit $\pm 5\%$				0.22

## Multi-Point Gas Test Chart



Calculate by  
Sirichai Sangsri  
11/1/2023

Approve by  
Sirichai Sangsri  
11/1/2023

# MULTI-POINT GAS TEST REPORT

Test Date : Feb 15, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 421  
Manufacturer : Thermo Scientific Serial Number : 1182920009

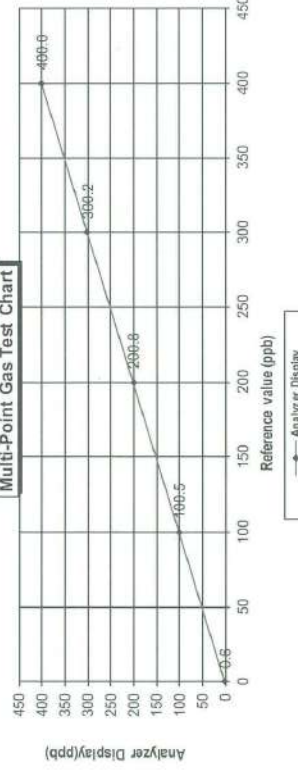
## Standard Gas Concentration

Sulphur Dioxide (SO <sub>2</sub> )	44.68	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	Model :	146i
Methane (CH <sub>4</sub> )	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8	PPM		
Cylinder No. :	EB0143262			
Expiration Date :	Jun 21, 2024			

## Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1 Zero	0.0	0.60	0.60	0.60
Level 2 20.00%	100.0	100.5	0.50	0.50
Level 3 40.00%	200.0	200.8	0.80	0.40
Level 4 60.00%	300.0	300.2	0.20	0.07
Level 5 80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range	500.0 ppb			
Acceptable Limit $\pm 5\%$				0.31

## Multi-Point Gas Test Chart



Calculate by  
Apichwat K.  
15/02/2023

Approve by  
Apichwat K.  
15 Feb 2023

**MULTI-POINT GAS TEST REPORT**

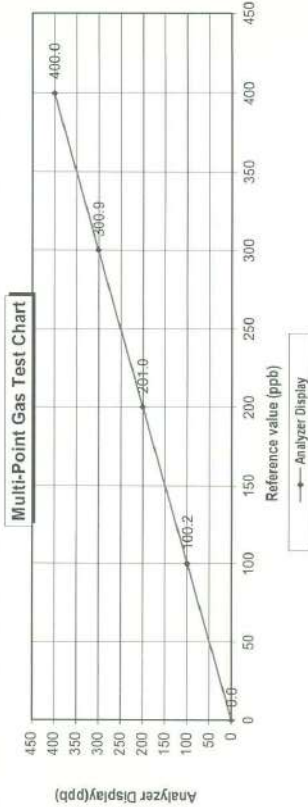
Test Date : Feb 15, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 421  
Manufacturer : Thermo Scientific Serial Number : CM19050148

Standard Gas Concentration				Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	44.68	PPM	Manufacturer :	Thermo Scientific	
Nitric Oxide (NO)	45.94	PPM	Model :	146i	
Methane (CH <sub>4</sub> )	-	PPM	Serial Number :	1180540071	
Carbon Monoxide (CO)	984.8				
Cylinder No. :	EB0143262				
Expiration Date :	Jun 21, 2024				

**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	0.20	0.20	0.20
Level 3 40.00%	201.0	1.00	0.50	0.50
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				0.20
:Acceptable Limit $\pm$ 5%				
Average Difference (%)				0.20



Calculate by  
Sirichai Gammga  
15 Feb 2023

Approve by  
Sirichai Gammga  
15 Feb 2023

**MULTI-POINT GAS TEST REPORT**

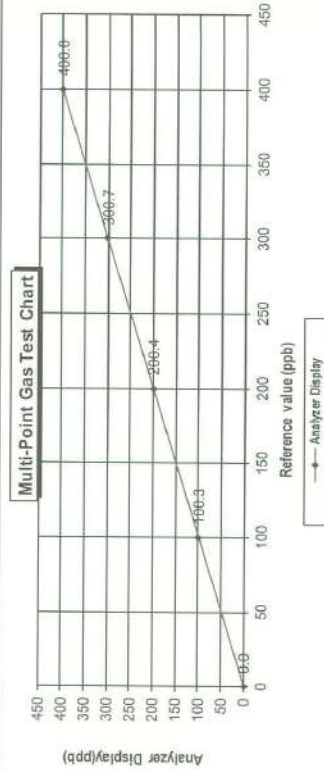
Test Date : Mar 16, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42C  
Manufacturer : Thermo Environmental Instruments Serial Number : 42C-58929-320

Standard Gas Concentration				Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	44.68	PPM	Manufacturer :	Thermo Scientific	
Nitric Oxide (NO)	45.94	PPM	Model :	146i	
Methane (CH <sub>4</sub> )	-	PPM	Serial Number :	1180540071	
Carbon Monoxide (CO)	984.8				
Cylinder No. :	EB0143262				
Expiration Date :	Jun 21, 2024				

**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	0.30	0.30	0.30
Level 3 40.00%	200.4	0.40	0.20	0.20
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				0.15
:Acceptable Limit $\pm$ 5%				
Average Difference (%)				0.15



Calculate by  
Aphivat K.  
16 Mar 2023

Approve by  
Aphivat K.  
16 Mar 2023



**MULTI-POINT GAS TEST REPORT**

Test Date : Apr 7, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>)  
Manufacturer : Thermo Scientific

Model : 42i  
Serial Number : 1201497726

**Standard Gas Concentration**

Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM  
Nitric Oxide (NO) 45.94 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : EB0143262  
Expiration Date : Jun 21, 2024

**Dilutor Detail**

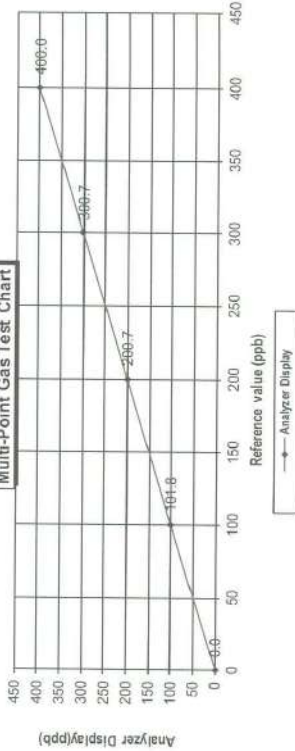
Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071

**Multi-point gas test data**

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	101.8	1.80	1.77	1.77
Level 3	40.00%	200.7	0.70	0.35	0.35
Level 4	60.00%	300.7	0.70	0.23	0.23
Level 5	80.00%	400.0	0.00	0.00	0.00
Average Difference (%)					0.47

Remark : Measuring Range 500.0 ppb  
: Acceptable Limit  $\pm 5\%$

**Multi-Point Gas Test Chart**



Calculate by  
Aphiwat K.  
21/4/11

Approve by  
Pattana U.  
21/4/11

**CERTIFICATE OF ANALYSIS**  
**Grade of Product: EPA Protocol**

Part Number: E04NI99E15A01D3  
Cylinder Number: EB0143262  
Laboratory: 124 - Durham (SAP) - NC  
PGVP Number: B22021  
Gas Code: CO, NO, NO<sub>2</sub>, SO<sub>2</sub>, BALN  
Reference Number: 122-402135167-1  
Cylinder Volume: 144.4 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 680  
Certification Date: Jun 21, 2024  
Expiration Date: Jun 21, 2024

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2017), document EPA 800/R-12/031. Using the assay procedures listed, Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a reference basis unless otherwise noted.  
Do Not Use This Cylinder Below 100 psig, to 0.7 megapascals.

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
NOX	45.00 PPM	45.96 PPM	G1	$\pm 1.4\%$ NIST Traceable
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	$\pm 1.4\%$ NIST Traceable
SULFUR DIOXIDE	45.00 PPM	44.68 PPM	G1	$\pm 1.0\%$ NIST Traceable
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	$\pm 0.7\%$ NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS		
Type	Lot ID	Cylinder No
NITRA	20061120	CC700066
PRM	12396	D859025
GMS	401423838102	CC505581
NITRA	16011043	CC473277
NITRA	14060119	CC434277

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

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801333 CO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO <sub>2</sub>	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 SO <sub>2</sub>	FTIR	Jun 03, 2021

**Triad Data Available Upon Request**

NOTES: PO #5221002807  
GROSS WT: 28.40kg  
NET WT: 4.73kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

APD

Approved for Release

เอกสารไม่ควบคุม

**MULTI-POINT GAS TEST REPORT**

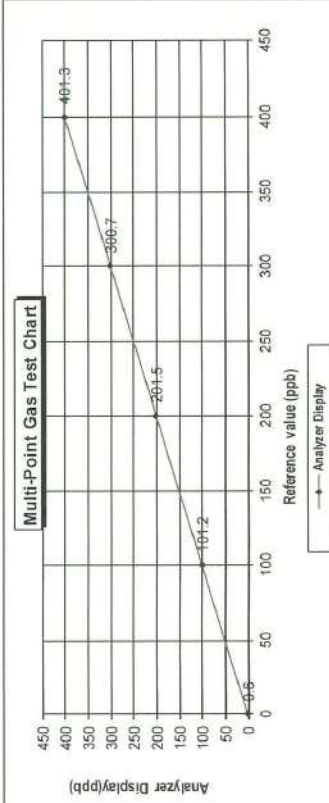
Test Date : May 3, 2022

Equipment :	Gas Analyzer (SO <sub>2</sub> )	Model :	43i
Manufacturer :	Thermo SCIENTIFIC	Serial Number :	1180540065

<b>Standard Gas Concentration</b>		<b>Dilutor Detail</b>	
Sulphur Dioxide (SO <sub>2</sub> )	44.75	PPM	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.35	PPM	146i
Methane (CH <sub>4</sub> )	-	PPM	1180540071
Carbon Monoxide (CO)	1007		
Cylinder No. :	CC159599		
Expiration Date :	Jul 30, 2022		

**Multi-point gas test data**

Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1	Zero	0.0			
Level 2	20.00%	100.0	0.60	0.60	0.60
Level 3	40.00%	200.0	1.20	1.19	1.19
Level 4	60.00%	300.0	1.50	0.74	0.74
Level 5	80.00%	400.0	0.70	0.23	0.23
Level 5		80.00%	401.3	0.32	0.32
Remark : Measuring Range		500.0 ppb	Average Difference (%)		0.62



Calculate by  
Sutheas Y.  
.....15.....

Approve by  
Feb 10 2022  
.....4 May 2022.....

**MULTI-POINT GAS TEST REPORT**

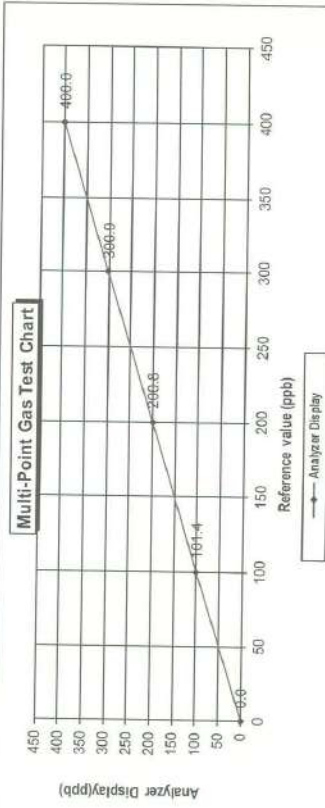
Test Date : Feb 9, 2023

Equipment :	Gas Analyzer (SO <sub>2</sub> )	Model :	43i
Manufacturer :	Thermo SCIENTIFIC	Serial Number :	JC1606001758

<b>Standard Gas Concentration</b>		<b>Dilutor Detail</b>	
Sulphur Dioxide (SO <sub>2</sub> )	44.68	PPM	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.94	PPM	146i
Methane (CH <sub>4</sub> )	-	PPM	1180540071
Carbon Monoxide (CO)	984.8		
Cylinder No. :	EB0143262		
Expiration Date :	Jun 24, 2024		

**Multi-point gas test data**

Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1	Zero	0.0			
Level 2	20.00%	100.0	0.00	0.00	0.00
Level 3	40.00%	200.0	1.40	1.38	1.38
Level 4	60.00%	300.0	0.80	0.40	0.40
Level 5	80.00%	400.0	0.90	0.30	0.30
Remark : Measuring Range		500.0 ppb	0.00	0.00	0.00
			Average Difference (%)		0.42



Calculate by  
Sirich Sampras  
.....9 Feb 2023.....

Approve by  
Feb 10 2023  
.....9 Feb 2023.....



## MULTI-POINT GAS TEST REPORT

Test Date : Jan 10, 2023

Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920016

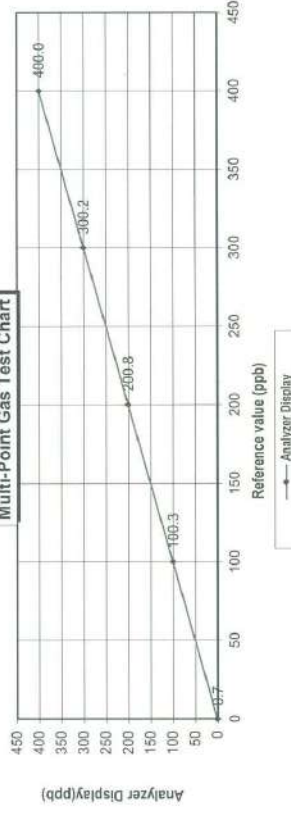
**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM  
Nitric Oxide (NO) 45.94 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : EB0143262  
Expiration Date : Jun 24, 2024

**Dilutor Detail**  
Manufacturer : Thermo SCIENTIFIC  
Model : 146i  
Serial Number : 1180540071

### Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1 Zero 0.0	0.7	0.70	0.70	0.70
Level 2 20.00%	100.3	0.30	0.30	0.30
Level 3 40.00%	200.8	0.80	0.40	0.40
Level 4 60.00%	300.2	0.20	0.07	0.07
Level 5 80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb				
:Acceptable Limit ± 5%				0.29

### Multi-Point Gas Test Chart



Calculate by  
Apichat k  
10.1.01.1.66

Approve by  
Patana k  
10.1.01.1.66

## MULTI-POINT GAS TEST REPORT

Test Date : Feb 9, 2023

Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778115

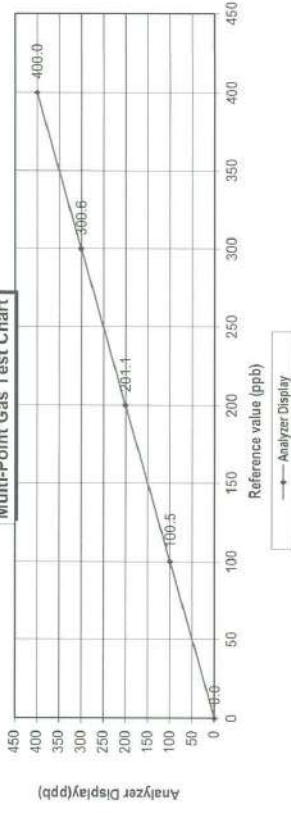
**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM  
Nitric Oxide (NO) 45.94 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : EB0143262  
Expiration Date : Jun 24, 2024

**Dilutor Detail**  
Manufacturer : Thermo SCIENTIFIC  
Model : 146i  
Serial Number : 1180540071

### Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1 Zero 0.0	0.0	0.00	0.00	0.00
Level 2 20.00%	100.5	0.50	0.50	0.50
Level 3 40.00%	201.1	1.10	0.55	0.55
Level 4 60.00%	300.6	0.60	0.20	0.20
Level 5 80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb				
:Acceptable Limit ± 5%				0.25

### Multi-Point Gas Test Chart



Calculate by  
Sichan Samson  
9.9.06

Approve by  
Patana k  
9.9.06

**MULTI-POINT GAS TEST REPORT**

Test Date : Apr 7, 2023

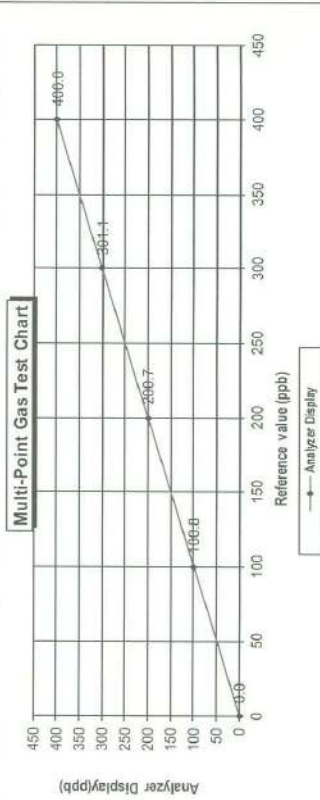
<b>Equipment :</b>	Gas Analyzer (SO <sub>2</sub> )	<b>Model :</b>	431
<b>Manufacturer :</b>	Thermo SCIENTIFIC	<b>Serial Number :</b>	CM22387063

<b>Standard Gas Concentration</b>		<b>Dilutor Detail</b>	
Sulphur Dioxide (SO <sub>2</sub> )	44.68 PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.94 PPM	Model :	146i
Methane (CH <sub>4</sub> )	- PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8 PPM		
Cylinder No. :	EB0143262		
Expiration Date :	Jun 24, 2024		

**Multi-point gas test data**

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	100.0	100.8	0.80	0.79	0.79
Level 3	200.0	200.7	0.70	0.35	0.35
Level 4	300.0	301.1	1.10	0.37	0.37
Level 5	400.0	400.0	0.00	0.00	0.00
Average Difference (%)					0.30

Remark : Measuring Range 500.0 ppb  
: Acceptable Limit  $\pm 5\%$



Calculate by  
Abhisat K.  
7 April 2023

Approve by  
Pattana  
7 April 2023



**THAI METEOROLOGICAL DEPARTMENT**

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

**Calibration Certificate**

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 1 November, 2023 Certification No. 390/23

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2205DR0113

Wind Sensor 2205DT0113

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1013.5 hPa

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

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

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

: testo, testo 645 Serial No. 02848057 : Thermoschneider No. 918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB550 No. K420001

Calibrated by : Pattana Signed : Mr. Pissod Promsat

Mechanical Engineer







## The Result of Calibration

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



## The Result of Calibration

Certification No. 390/23

1 November, 2023

Page : 2 of 5

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425		TESTED ANEMOMETER	
	Pressure inches H <sub>2</sub> O	Vacuum inches H <sub>2</sub> O	Velocity m/sec	Correction m/sec
1.00	-	-	1.0	0.0
3.02	-	-	3.0	0.02
5.00	-	-	5.0	0.0
7.04	-	-	7.0	0.04
9.02	-	-	8.9	0.12
11.02	-	-	9.0	2.02
13.01	-	-	13.0	0.01
15.01	-	-	14.9	0.11
17.02	-	-	17.0	0.02
20.02	-	-	19.9	0.12

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

Calibrated by : *Watchapol*

Mr. Watchapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม

Certification No. 390/23

Page : 3 of 5

1 November, 2023

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

Average

Calibrated by :

*Watchapol*

Mr. Watchapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



## The Result of Calibration

Certification No. 390/23

1 November, 2023

Page : 4 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction
757.32	757	0.32
755.68	756	-0.31
755.41	755	0.41
755.24	756	0.24
755.10	755	0.10
755.00	755	0.00
754.77	755	-0.23
754.60	754	0.60
754.44	754	0.44
754.17	754	0.17
757.27	757	0.27
757.38	757	0.38
757.33	757	0.33
757.15	757	0.15
756.99	757	-0.01
756.73	757	-0.27
755.81	756	-0.19
755.30	755	0.30
754.78	755	-0.22
753.48	753	0.48
Average		0.15

Calibrated by : *Watchapol*  
Mr. Watchapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



## The Result of Calibration

Certification No. 390/23

1 November, 2023

Page : 5 of 5

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

Calibrated by : *Watchapol*  
Mr. Watchapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม

## Certificate of Calibration

**Customer**  
Name : UNITED ANALYST AND ENGINEERING CONSULTANT  
CO.,LTD.  
Address : 81 Soi Udonsuk 41, Sukhumvit Road, Bungehak,  
Prakanong, Bangkok 10260

Certificate No : 23-ACT-021  
Request No : Req-2022-2269

### Unit Under Calibration Details

Measurement item : Acoustic Calibrator  
Manufacturer : SVANTEK  
Model : SV35  
Serial Number : 44792  
ID : UAE.EFM.020/2559

Class : 1  
Range : 94 , 114 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 : 26 December 2022  
Calibration Date : 14 February 2023  
Location of Calibration : LAB 1 Acoustic  
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	31 May 2023
THD Multimeter	2015	1047765	NIMT	31 January 2024

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

### Note

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

**Calibrated By :** Mr. Noppadon Luangart  
Service Calibration Engineer  
**Approved By :** Mr. Pacit Mathavorn  
Calibration Engineer Supervisor  
**Issue Date :** 14 February 2023

Certificate No : 23-ACT-021

Request No : Req-2022-2269

Calibration Results : Without Adjustment

Sound pressure level

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 ( ± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	94.06	0.06	-	-	0.11	0.25
114 dB / 1000 Hz	114.07	0.07	-	-	0.11	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 ( ± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	1000.00	0.00	-	-	0.10	0.70
114 dB / 1000 Hz	1000.00	0.00	-	-	0.10	0.70

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

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 ( ± %)
	Measured (%)		Measured (%)			
94 dB / 1000 Hz	0.04		-		0.40	2.5
114 dB / 1000 Hz	0.03		-		0.40	2.5

### Note :

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

End of Calibration







Certificate No : 22-ACT-034

Request No : Req-2022-0092

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	
		UUC	ERR		Limit	
FAST / A	REF	(dB)	(dB)	(± dB)	(± dB)	
UUC Range	42.8	43.0	0.2	0.3	1.1	1.1
	11.4	114.0	0.0			

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance
			UUC	ERR		
A / 37-139	Toneburst	Ref	(dB)	(dB)	(± dB)	Limit
UUC Time Response	(ms)	(dB)				(± dB)
Fast	200	135.0	135.0	0.0	0.3	1
	2	118.0	117.7	-0.3		+1.0, -2.5
	0.25	109.0	108.8	-0.2		+1.5, -5.0
Slow	200	128.6	128.5	-0.1		1
	2	109.0	108.9	-0.1		+1.0, -5.0
SEL	200	129.0	129.0	0.0	1	1
	2	109.0	109.1	+0.1		+1.0, -2.5
	0.25	100.0	100.0	0.0		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance
		UUC	ERR		
FAST / C / 95-142	REF	(dB)	(dB)	(± dB)	Limit
STD Setting	(dB)				(± dB)
Complete cycle	137.4	136.8	-0.60	0.2	3.0
	136.4	136.1	-0.30		2.0
Negative half cycle	136.4	136.2	-0.20		2.0

Page : 6/6.

Certificate No : 22-ACT-034

Request No : Req-2022-0092

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
			Limit
FAST / A / 37-139	UUC	(± dB)	(± dB)
STD Setting	(dB)		
Positive one-half cycle	141.7		
	141.8		
Negative one-half cycle	-0.1		
Deviated	0.2	1.5	

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
			Limit
FAST / A / 37-139	UUC	(± dB)	(± dB)
STD Setting	(dB)		
Initial	138.0		
	138.0		
Final	0.0		
Deviated	0.1	0.3	

End of Certificate



Certificate of Calibration

Customer

Name

Address

: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

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

10260

Certificate No : 22-ACT-101

Request No : Req-2022-0231

Unit Under Calibration Details

Measurement item :

Manufacturer

Model

Serial Number

ID

: Sound Level Meter

: LARSON DAVIS

: LxT2

: 0005405

: UAE.EFM.041/2564

Microphone Class : 2

Microphone Model : 375A04

Microphone SN: 329360

Preamplifier Model : PRMLxT2C

Preamplifier SN : 073800

Instrument Status : Used

Calibration Environment and Details

Temperature

Humidity

Barometric Pressure

Received Date

Calibrated Date

Calibration Procedure

Location of Calibration

: 23 °C ± 2 °C

: 50 %RH ± 20 %RH

: 1013 hPa ± 10 hPa

: 31 January 2022

: 11 February 2022

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

: Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSL
Audio Generator	Svanek	Svan401	131	18 October 2022	WK Electric

Note

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

Calibrated By :

Mr. Noppadon Luangart

Calibration Officer

Approved By :

Mr. Pacit Mathavorn

Calibration Engineer Supervisor

Issue Date :

11 February 2022

เอกสารไม่ควบคุม

1. Indication at the calibration check frequency

UUC Setting	Nominal		Before Adjust		Adjust		UNCERTAINTY	Acceptance Limit
	Level	(dB)	UUC	ERR	UUC	ERR		
FAST / A / 37-139								
Calibrator Setting								
1000 Hz 114.00 dB	113.85		113.9	+0.05	113.9	0.05	( ± dB)	( ± dB)
							0.20	0.3

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

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	( ± dB)
A	27.3	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	( ± dB)
A	27.6	0.10
C	27.3	0.10
Z	33.2	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance Limit
	A	C	Z		
FAST / 37-139					
STD Setting	(dB)	(dB)	(dB)	( ± dB)	( ± dB)
125 Hz	0.0	0.1	0.1	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.2	0.2	0.2	0.60	3.0
8000 Hz	-0.1	-0.1	0.0	0.70	5.0

เอกสารไม่ควบคุม

Certificate No : 22-ACT-101

Request No : Req-2022-0231

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)
FAST / 37-139	Weighting Responce curve					
STD Setting	A (dB)	C (dB)	Z (dB)			
63 Hz	-0.2	0.0	0.0		0.2	2.0
125 Hz	-0.1	0.0	0.0			1.5
250 Hz	-0.1	0.0	0.0			1.5
500 Hz	-0.1	0.0	0.0			1.5
1000 Hz	0.0	0.0	0.0			1.0
2000 Hz	0.0	0.0	0.0			2.0
4000 Hz	0.0	0.0	0.0			3.0
8000 Hz	0.0	0.0	0.0			5
16000 Hz	-0.1	-0.1	-0.1	-0.1		+5, -INF.

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF	ERR		
FAST / 37-139					
UUC Weighting					
A	114.00	114.0	0.0		0.2
C	114.00	114.0	0.0	0.2	0.2
Z	114.00	114.0	0.0		0.2

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF	ERR		
37-139 / A					
UUC Time Responce					
Fast	114.00	114.0	0.0		0.1
Slow	114.00	114.0	0.0	0.2	0.1
Leq	114.00	114.0	0.0		0.1

เอกสารไม่ควบคุม

Certificate No : 22-ACT-101

Request No : Req-2022-0231

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	UUC (dB)		
FAST / A / 37-139			
STD Setting			
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated		Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	FAST / A / 37-139	REF (dB)	UUC (dB)	ERR (dB)		
STD dB						
139.00		139	139.0	0.0		1.1
134.00		134	134.0	0.0		1.1
129.00		129	129.0	0.0		1.1
124.00		124	124.0	0.0		1.1
119.00		119	119.0	0.0		1.1
114.00		114	114.0	0.0		1.1
109.00		109	109.0	0.0		1.1
104.00		104	104.0	0.0		1.1
99.00		99	99.0	0.0		1.1
94.00		94	93.9	-0.1		1.1
89.00		89	88.9	-0.1		1.1
84.00		84	83.9	-0.1	0.3	1.1
79.00		79	78.9	-0.1		1.1
74.00		74	74.0	0.0		1.1
69.00		69	69.0	0.0		1.1
64.00		64	64.1	0.1		1.1
59.00		59	59.0	0.0		1.1
54.00		54	54.0	0.0		1.1
49.00		49	49.0	0.0		1.1
44.00		44	44.1	0.1		1.1
39.00		39	39.3	0.3		1.1
38.00		38	38.4	0.4		1.1

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 : 23-SLM-027
	Request No : Req-2023-0155

### Unit Under Calibration Details

Measurement Item :	: Sound Level Meter	Microphone Class : 2
Manufacturer	: LARSON DAVIS	Microphone Model : 375A04
Model	: LxT2	Microphone S/N : 328669
Serial Number	: 0006617	Preamplifier Model : PRMLxT2C
ID	: UAE.EFM.048/2564	Preamplifier S/N : 071532
Resolution	: 0.1 dB	Infrasonic 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 January 2023
Calibrated Date	: 30 January 2023
Calibration Procedure	: In-house method (CP)
Location of Calibration	: Lab Acoustic

### Reference Standard

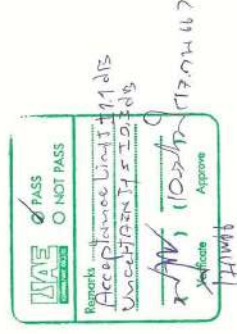
Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EPA000234	29 June 2023	TSI
Audio Generator	SvanteK	Svan401	131	12 October 2023	Wk Electric

Note

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

Calibrated By: me  
Mr. Noppadon Luangart  
Calibration Officer

Approved By : AS  
Mr. Paet Maflavorn  
Calibration Engineer Supervisor  
Issue Date : 30 January 2022







Certificate No : 23-SLM-027  
Request No : Req-2023-0155

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance Limit
FAST / A	REF (dB)	UUC (dB)	ERR (dB)	(± dB)	(± dB)
UUC Range	46.70	46.8	0.1	0.3	1.1
37-139	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance Limit
A / 37-139	Toneburst (ms)	Ref (dB)	UUC (dB)	ERR (dB)	(± dB)	(± dB)
UUC Time Response	200	135.0	135.0	0.0		1
Fast	2	118.0	117.8	-0.2		+1.0, -2.5
	0.25	109.0	108.6	-0.4		+1.5, -5.0
Slow	200	128.6	128.5	-0.1	0.3	1
	2	109.0	108.9	-0.1		+1.0, -5.0
SEL	200	135.0	135.0	0.0		1
	2	118.0	117.8	-0.2		+1.0, -2.5
	0.25	109.0	108.6	-0.4		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance Limit
FAST / C / 95-142	REF (dB)	UUC (dB)	ERR (dB)	(± dB)	(± dB)
STD Setting	137.4	136.6	-0.80		3.0
Complete cycle	136.4	136.2	-0.20	0.2	2.0
Positive half cycle	136.4	136.2	-0.20		2.0
Negative half cycle	136.4	136.2	-0.20		2.0

Certificate No : 23-SLM-027  
Request No : Req-2023-0155

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC (dB)	(± dB)	(± dB)
STD Setting	114.0		
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	REF (dB)	UUC (dB)	ERR (dB)	(± dB)	(± dB)
STD dB	140	140.0	0.0		1.1
140.00	139	139.0	0.0		1.1
139.00	134	134.0	0.0		1.1
134.00	129	129.0	0.0		1.1
129.00	124	124.0	0.0		1.1
124.00	119	119.0	0.0		1.1
119.00	114	114.0	0.0		1.1
114.00	109	109.0	0.0		1.1
109.00	104	104.0	0.0		1.1
104.00	99	98.9	-0.1		1.1
99.00	94	93.9	-0.1		1.1
94.00	89	88.9	-0.1	0.3	1.1
89.00	84	83.9	-0.1		1.1
84.00	79	78.9	-0.1		1.1
79.00	74	73.9	-0.1		1.1
74.00	69	68.9	-0.1		1.1
69.00	64	63.9	-0.1		1.1
64.00	59	58.9	-0.1		1.1
59.00	54	53.9	-0.1		1.1
54.00	49	49.0	0.0		0.8
49.00	44	44.2	0.2		1.1
44.00	43	43.2	0.2		1.1
43.00	42	42.3	0.3		1.1
42.00	41	41.4	0.4		1.1
41.00					1.1

Certificate of Calibration

**Customer**

**Name** : UNITED ANALYST AND ENGINEERING

**Address** : CONSULTANT CO.,LTD.

81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,

Prakanong, Bangkok 10260

**Certificate No** : 23-ACT-110

**Request No** : Req-2023-1407

Unit Under Calibration Details

**Measurement item** : Acoustic Calibrator

**Manufacturer** : SVANTEK

**Model** : SV 35A

**Serial Number** : 73246

**ID** : UAE.EFM.104/2561

**Class** : 1

**Range** : 94 , 114 dB / 1000 Hz

**Inrument Status** : Used

Calibration Environment and Details

**Temperature** : ( 23 ±2 °C )

**Humidity** : ( 50 ± 20 %RH )

**Barometric Pressure** : (1013 ±10.0 hPa)

**Received Date** : 26 June 2023

**Calibration Date** : 27 June 2023

**Location of Calibration** : LAB 1 Acoustic


**Calibration Procedure** : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators


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

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

Note

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

**Calibrated By** :  Mr. Noppadon Luangart

**Approved By** :  Mr. Pacit Mathavorn

**Service Calibration Engineer**

**Calibration Engineer Supervisor**

**Issue Date** : 27 June 2023

**Certificate No** : 23-SLM-027

**Request No** : Req-2023-0155

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC	( ± dB)	( ± dB)
STD Setting	(dB)		
Positive one-half cycle	142.5		
Negative one-half cycle	142.4		
Deviated	0.1	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC	( ± dB)	( ± dB)
STD Setting	(dB)		
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate





### 1. Indication at the calibration check frequency

UUC Setting	Nominal		Before Adjust		Adjust		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
	Level (dB)	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)			
FAST / A / 25 - 138								
Calibrator Setting								
1000 Hz 114.00 dB	93.95	93.8	-0.15	93.9	-0.05	0.20	0.3	

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

## 2. Self-generated noise, Microphone installed

UUC Setting	Measured		UNCERTAINTY ( $\pm$ dB)
	FAST/25-138	UUC Weighting	
A		15.0	0.10

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

UUC Setting	Measured (dB)	UNCERTAINTY ( $\pm$ dB)	
FAST / 25 - 138			
UUC Weighting			
A	11.9	0.10	
C	17.2	0.10	
Z	22.7	0.10	

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

UUC Setting	Deviation from various Frequency				UNCERTAINTY	Acceptance Limit
	Weighting Response curve					
	A	C	Z			
FAST / 23 - 138						
STD Setting	(dB)	(dB)	(dB)		( $\pm$ dB)	( $\pm$ dB)
12.5 Hz	0.1	0.2	0.2		0.50	1.5
1000 Hz	0.0	0.0	0.0		0.60	1.0
4000 Hz	0.2	0.2	0.2		0.60	3.0
8000 Hz	-0.8	-0.8	-0.9		0.70	5.0

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

# เอกสารไม่ควบคุม

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

Z-Parameter and Test Frequency	ULC Setting		Deviation from various Frequency				UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	FAST / 25 - 138	STD Setting	Weighting Response curve		Z (dB)			
			A (dB)	C (dB)				
Z-Parameter and Test Frequency		63 Hz	-0.1	-0.1	0.0	0.2	2.0	
		125 Hz	-0.1	0.0	0.0		1.5	
		250 Hz	0.0	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	0.0	0.0	0.0		2.0	
		4000 Hz	0.0	0.0	0.0		3.0	
		8000 Hz	0.1	0.1	0.0		5	
		16000 Hz	-1.2	1.3	0.0		+5, -1INF.	

## 6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
		REF (dB)	UUC (dB)		
FAST / 25 - 138					
UUC Weighting					
A	94.00		94.0	0.0	0.2
C	94.00		94.0	0.0	0.2
Z	94.00		94.0	0.0	0.2

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
		UUC (dB)	ERR (dB)		
UUC Time Response	Fast	94.00	0.0	0.2	0.1
	Slow	94.00	0.0		0.1
	Leq	94.00	0.0		0.1

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

## เอกสารไม่ควบคุม

Certificate No	: 22-ACT-065
Request No	: Req-2022-0227

## 7. Long Term Stability

UUC Setting	Measured UUC (dB)	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
FAST / A / 25 - 138			
STD Setting			
Initial	94.0		
Final	94.0		
Deviated	0.0	0.1	0.3

### 8. Level linearity on the reference level range

UIC Setting		Anticipated REF (dB)	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / A / 25 - 138	STD dB		UIC (dB)	ERR (dB)		
	137.00	137	137.0	0.0	0.3	0.8
	136.00	136	136.0	0.0		0.8
	135.00	135	135.0	0.0		1.1
	134.00	134	134.0	0.0		1.1
	129.00	129	129.0	0.0		1.1
	124.00	124	124.0	0.0		1.1
	119.00	119	119.0	0.0		1.1
	114.00	114	114.0	0.0		1.1
	109.00	109	109.0	0.0		1.1
	104.00	104	104.0	0.0		1.1
	99.00	99	99.0	0.0		1.1
	94.00	94	94.0	0.0		1.1
	89.00	89	89.0	0.0		1.1
	84.00	84	84.0	0.0		1.1
	79.00	79	79.0	0.0		1.1
	74.00	74	74.0	0.0		1.1
	69.00	69	69.0	0.0		1.1
	64.00	64	64.0	0.0		1.1
	59.00	59	59.0	0.0		1.1
	54.00	54	54.0	0.0		1.1
	49.00	49	49.0	0.0	1.1	
	44.00	44	44.0	0.0	1.1	
	39.00	39	39.0	0.0	1.1	
	34.00	34	34.0	0.0	1.1	
	29.00	29	29.0	0.0	1.1	
	28.00	28	28.0	0.0	1.1	
	27.00	27	27.0	0.0	1.1	
	26.00	26	25.9	-0.1	1.1	
	25.00	25	24.9	-0.1	1.1	

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

# เอกสารไม่ควบคุม

Certificate No	: 22-ACT-065
Request No	: Req-2022-0227

### 9. Level linearity including the level range control

UIC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	
		REF (dB)	UUC (dB)			ERR (dB)
		UUC Range				
FAST / A						
UUC Range						
25 - 138	94	29.5	29.5	0.0	1.1	
			94.0	0.0	1.1	

## 10. Tone burst response

UUC Setting		STD Toneburst (ms)	Anticipated Ref (dB)	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
				UUC (dB)	ERR (dB)		
Fast	A/25-138	200	134.0	134.0	0.0	0.3	1.0
	UUC Time Response	2	117.0	116.9	-0.1		+1.0, -2.5
		0.25	108.0	107.9	-0.1		+1.5, -5.0
Slow		200	127.6	127.6	0.0		1.0
		2	108.0	108.0	0.0		+1.0, -5.0
		200	128.0	128.0	0.0		1.0
SEL		2	108.0	107.9	-0.1	+1.0, -2.5	
		0.25	99.0	98.8	-0.2	+1.5, -5.0	

## 11. Peak C Sound level

UIC Setting	Anticipated REF (dB)	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
		UUC (dB)	ERR (dB)		
FAST / C / 25 - 138					
STD Setting					
Complete cycle	133.4	133.4	0.00		3.0
Positive half cycle	132.4	132.1	-0.30	0.2	2.0
Negative half cycle	132.4	132.2	-0.20		2.0

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

## เอกสารไม่ควบคุม





Continuation of Calibration Certificate

Cert. No. : ACL22086  
Job No. : VC65AC0045  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Continuation of Calibration Certificate

Cert. No. : ACL22086  
Job No. : VC65AC0045  
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1



Continuation of Calibration Certificate

Cert. No. : ACL22086  
 Job No. : VC65AC0045  
 Pages : 4 of 8

**Result of calibration :**

**1. Absolute sensitivity**

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

**2. Self-generated noise**

2.1 Normal test

Measured Value (dB)
14.2

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	12.0
C - weight	18.4
Flat	23.9

**3. Acoustical signal tests of frequency weightings**

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.2	0.2	0.2
1000	0.0	0.0	0.0
8000	0.3	0.4	0.4
			±5.0

Continuation of Calibration Certificate

Cert. No. : ACL22086  
 Job No. : VC65AC0045  
 Pages : 5 of 8

**4. Electrical signal tests of frequency weightings**

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
63	-0.1	-0.1	-0.1
125	0.0	0.0	-0.1
250	0.0	-0.1	-0.1
500	0.0	0.0	-0.1
1000	0.0	0.0	0.0
2000	0.0	0.0	0.0
4000	0.0	0.0	0.0
8000	0.0	0.1	0.1
			±2.0
			±1.5
			±1.5
			±1.5
			±1.0
			±2.0
			±3.0
			±5.0

**5. Frequency and time weightings at 1 kHz**

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

**6. Long - term stability**

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

## Continuation of Calibration Certificate

Cert. No. : ACL22086  
Job No. : VC65AC0045  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
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	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

## Continuation of Calibration Certificate

Cert. No. : ACL22086  
Job No. : VC65AC0045  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0



## Continuation of Calibration Certificate

Cert. No. : ACL22086  
Job No. : VC65AC0045  
Pages : 8 of 8

### 11. Overload indication

Measured value ( dB )		Deviated Value ( dB )	Acceptance Limits ( dB )
Positive one-half cycle	Negative one-half cycle		
89.7	89.5	-0.2	±1.5

### 12. High level stability

Frequency Weighting	SLM Display at initial ( dB )	SLM Display at final ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

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451-451/1 Sirinthorn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com

Cert. No. : ACL22089  
Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 01010783 / 194538 / 14661  
**ID No.:** -

**Condition As Found :** GOOD

**Customer :** UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)  
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,  
BANGCHAK SUB-DISTRICT,  
PHRAKHANONG DISTRICT, BANGKOK 10260  
THAILAND.

**Location :** -  
**Ambient Temperature :** ( 23.0 ± 3 ) °C  
**Pressure :** ( 101.3 ± 3 ) kPa  
**Relative Humidity :** ( 50.0 ± 20 ) %

**Received Date :** 11 APRIL 2022  
**Calibration Date :** 18-22 APRIL 2022  
**Date of Issue :** 25 APRIL 2022

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

*T. Petchurai*  
( Thanakul Petchurai )

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Continuation of Calibration Certificate

Cert. No. : ACL22089  
Job No. : VC65AC0045  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Continuation of Calibration Certificate

Cert. No. : ACL22089  
Job No. : VC65AC0045  
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1



Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value ( dB )
14.7

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value ( dB )
A - weight	12.6
C - weight	18.6
Flat	23.8

3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.1	0.1	0.1
1000	-0.1	-0.1	-0.1
8000	-0.7	-0.7	-0.7

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
63	-0.1	-0.1	-0.1
125	-0.1	0.0	0.0
250	0.0	0.0	0.0
500	0.0	0.0	0.0
1000	0.0	0.0	0.0
2000	0.0	0.1	0.0
4000	0.0	0.0	0.0
8000	0.0	0.1	0.1

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial ( dB )	SLM Display at final ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	94.0	94.0	0.0	± 0.3

## Continuation of Calibration Certificate

Cert. No. : ACL22089  
Job No. : VC65AC0045  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
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	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	27.0	0.0	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

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7. Keth.

## Continuation of Calibration Certificate

Cert. No. : ACL22089  
Job No. : VC65AC0045  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.0	-0.4	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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7. Keth.



Continuation of Calibration Certificate

Cert. No. : ACL22089  
Job No. : VC65AC0045  
Pages : 8 of 8

11. Overload indication

Measured value ( dB )		Deviated Value ( dB )	Acceptance Limits ( dB )
Positive one-half cycle	89.6	0.0	±1.5
Negative one-half cycle	89.6	0.0	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial ( dB )	SLM Display at final ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

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451-451/1 Sirinthorn Rd.,Banghumru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com

Cert. No. : ACL22092  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 01010786 / 194541 / 14664  
ID No.:

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)  
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,  
BANGCHAK SUB-DISTRICT,  
PHRAKHANONG DISTRICT, BANGKOK 10260  
THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 11 APRIL 2022  
Calibration Date : 18-22 APRIL 2022  
Date of Issue : 25 APRIL 2022

Calibrated by : Nathakorn Pisupaisan

Approved by :  
( Thanakul Petchurai )

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Continuation of Calibration Certificate

Cert. No. : ACL22092  
Job No. : VC65AC0045  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Continuation of Calibration Certificate

Cert. No. : ACL22092  
Job No. : VC65AC0045  
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value ( dB )
14.6

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value ( dB )
A - weight	12.4
C - weight	18.7
Flat	24.3

3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.1	0.1	0.1
1000	-0.1	-0.1	-0.1
8000	-0.2	-0.2	-0.2

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
63	-0.1	-0.2	-0.1
125	-0.1	-0.1	-0.1
250	0.0	-0.1	-0.1
500	-0.1	0.0	-0.1
1000	0.0	0.0	0.0
2000	0.0	0.0	0.0
4000	0.0	0.0	0.0
8000	0.0	0.1	0.1

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial ( dB )	SLM Display at final ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	94.0	94.0	0.0	± 0.3



## Continuation of Calibration Certificate

Cert. No. : ACL22092  
Job No. : VC65AC0045  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
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	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

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T. Reeh-

## Continuation of Calibration Certificate

Cert. No. : ACL22092  
Job No. : VC65AC0045  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.0	-0.4	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

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Cert. No. : ACL22092  
Job No. : VC65AC0045  
Pages : 8 of 8

11. Overload indication

Measured value ( dB )		Deviated Value ( dB )	Acceptance Limits ( dB )
Positive one-half cycle	Negative one-half cycle	0.1	±1.5
89.5	89.6		

12. High level stability

Frequency Weighting	SLM Display at initial ( dB )	SLM Display at final ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

Certificate of Calibration

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

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator  
Manufacturer : TSI  
Model : 4146  
Serial Number : 41461708009  
ID : UAE.EFM.103/2561  
Location of Calibration : LAB 4 AIR VELOCITY METER  
Sensor Model : -  
Sensor Serial Number : -

Calibration Environment and Details

Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 14 March 2023  
Calibration Date : 23 March 2023  
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	16 June 2023
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	15 June 2023

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 %.

Calibration By : Mr. Noppadon Luangart

Service Calibration Engineer

Approved By : Mr. Pacit Mathavorn

Calibration Engineer Supervisor

Issue Date : 23 March 2023

Certificate No : 23-AFM-080  
Request No : Req-2022-0620

Result of Calibration :

Flow Setting	STD Flow Reading	UUC Flow Reading	Correction Flow	Uncertainty
(LPM)	(LPM)	(LPM)	(LPM)	(LPM)
0.02	0.022	0.021	0.001	0.004
0.05	0.051	0.049	0.002	0.005
0.1	0.100	0.099	0.001	0.007
0.2	0.200	0.198	0.002	0.003
0.5	0.501	0.511	-0.010	0.007
1.0	1.009	1.024	-0.015	0.014
1.7	1.704	1.731	-0.027	0.024
2.0	2.005	2.033	-0.028	0.028
3.0	3.000	3.034	-0.034	0.043
4.0	4.007	4.056	-0.049	0.057
5.0	5.007	5.059	-0.052	0.071

Note

STD : Standard

UUC : Unit Under Calibration

Calibration media : Air

\* Indicates not accredited

End of Certificate



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



MSC-TS17023  
CALIBRATION 0008

Certificate of Calibration

Certificate No. : 23P1855  
Page : 1 of 2

Equipment : Aneroid Barometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: UAE-ANV.122/2550

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 02 June 2023

Reference: 2305-0919WSC

Ambient Temperature: ( 23 ± 2 ) °C

Relative Humidity: ( 50 ± 15 ) %

Atmospheric Pressure: 1007 mbar

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

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

Procedure used:

The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P10, using "DKO-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

1422505048

MP-0094-23

03 May 2024

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

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew  
Issue Date : 08 June 2023

Approved Signatory :

Attapol P.

[ ] Phalinee Prabpaipal

[ ] Sura Suwanasri

[x] Attapol Panurach





Result of calibration:- Without adjustment									
Function:- Absolute Pressure Measurement									
Increasing Pressure									
Applied Pressure (hPa)	958.50	969.59	980.35	990.39	1001.01	1011.15	1020.94	1031.45	
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0	
Error (hPa)	1.50	0.41	-0.35	-0.39	-1.01	-1.15	-0.94	-1.45	
Decreasing Pressure									
Applied Pressure (hPa)	1031.45	1021.61	1012.16	1002.38	992.17	982.20	970.69	959.32	
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0	
Error (hPa)	-1.45	-1.61	-2.16	-2.38	-2.17	-2.20	-0.69	0.68	

The uncertainty of measurement was  $\pm 0.30$  hPa  
\* UUC = Unit Under Calibration  
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95 %.

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## Certificate of Calibration

Certificate No. : 23H1100  
Page : 1 of 2

Equipment : Digital Thermo-Hygrometer  
Manufacturer : Digicon  
Model : TH-02  
Serial No. : 395034176  
ID No. : UAE.EFM.183/2565  
Condition As-Received: Used Item  
Received Date: 18 May 2023  
Calibration Date: 22 May 2023  
Reference: to 24 May 2023  
2305-0641WSC  
Ambient Temperature: (  $25 \pm 3$  ) °C  
Relative Humidity: (  $50 \pm 20$  ) %

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

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

### Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Chilled Mirror Hygrometer	Dew Master	44730	20563A	14 Jun 2023
2) Handheld Thermometer With Sensor	1521	A5A339	2211251	12 Oct 2023
2. The certificate is valid only to the item calibrated on date and place of calibration.				
3. This Certification is traceable to the International System of Unit maintained through:-				
-National Institute of Standards and Technology (NIST) , The United States of America				
-National Institute of Metrology Thailand (NIMT)				

Calibrated by : Kraipon Onrat  
Issue Date : 25 May 2023

Approved Signatory :

[x] Chakrit Waewwarjua  
[ ] Pornthippa Tameyakul  
[ ] Viporn Tantiyawutti

*Chakrit Waewwarjua*

Attapo P.

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a 1165504

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B 0314978



Cert. No.: 23H1100  
Page.: 2 of 2

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

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	42	1.9	1.3
25.0	50.1	52	1.9	1.6
25.0	60.0	61	1.0	1.6
25.0	70.2	69	-1.2	1.6

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

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.014	20.4	0.386	0.42
25.022	25.6	0.578	0.42
30.033	30.2	0.167	0.42
40.000	40.0	0.000	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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*Amk*

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a 1162981

## Certificate of Calibration

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

Certificate No : 22-LXM-103  
Request No : Req-2022-0648  
Page : 1/2

### Unit Under Calibration Details

Instrument Name : Digital Lux Meter  
Manufacturer : EXTECH  
Model : 407026  
Serial Number : A056653  
Resolution : 1 lx  
ID Number : -

Range Calibration : 2000 , 20000 lx  
Instrument Status : New

### Calibration Environment and Details

Temperature :  $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$   
Humidity :  $60\% \text{RH} \pm 20\% \text{RH}$   
Received Date : 29 March 2022  
Calibrated Date : 04 April 2022

Calibration Procedure : The measurement was done in accordance with CP-LXM-01

### Reference Standard

: Photometer and Illuminance Sensor, Serial No.: 3066272, 3059272, which was calibrated on 26 October 2021, Certificate No.: TP-1026-21

### Traceability

: This Certificate is traceable to International System of Unit (SI) Unit through National Institute of Metrology (Thailand)

### Note

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

Approved By :

*Amk*

Mr. Pait Mathavorn

Calibration Engineer Supervisor

Issue Date : 04 April 2022

Calibration Note

UUC Adjustment

: Zero adjustment before use


: Request No : Req-2022-0648

: Page : 2/2

Result of Calibration :

UUC Range (lx)	Standard (lx)	UUC Reading (lx)	Correction (lx)	Uncertainty (± lx)
2000	0	0	0	0.58
	50	50	0	
	100	100	0	
	200	202	-2	
	300	303	-3	
	400	402	-2	
	600	603	-3	
	800	804	-4	
	1000	1005	-5	
	1200	1201	-1	
20000	1400	1396	4	
	1600	1593	7	
	1800	1791	9	
	2000	1990	10	
	3000	2980	20	
	4000	3970	30	
	5000	4970	30	
				2.3 % of Reading

End of Certificate

Calibrated By : 

Mr. Noppadon Luangart

Certificate No : 22-LXM-103

Request No : Req-2022-0648

Page : 2/2

## Certificate of Calibration

Customer

Name

Address

: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

: 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 22-LXM-139

Request No : Req-2022-0916

Page : 1/2

### Unit Under Calibration Details

Instrument Name

Manufacturer

Model

Serial Number

Resolution

ID Number

: Digital Lux Meter

: EXTECH

: 407026

: A052262

: 1 lx

: UAE.EFM.174/2564

Range Calibration

Instrument Status

: 2000 , 20000 lx

: Used

### Calibration Environment and Details

Temperature

Humidity

Received Date

Calibrated Date

: 25 °C ± 2 °C

: 60 %RH ± 20 %RH

: 19 May 2022

: 23 May 2022

Calibration Procedure : The measurement was done in accordance with CP-LXM-01

Reference Standard

Certificate No.:

: Photometer and Illuminance Sensor, Serial No.: 30662/2, 30592/2, which was calibrated on 26 October 2021,

TP-1026-21

Traceability

Metrology (Thailand)

: This Certificate is traceable to International System of Unit (SI) Unit through National Institute of Metrology (Thailand)

### Note

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

Approved By :

Issue Date :



23 May 2022

Mr. Pacit Mathavorn

Calibration Engineer Supervisor



Calibration Note

UUC Adjustment : Zero adjustment before use

Certificate No : 22-LXM-139


Request No : Req-2022-0916

Page : 2/2

Result of Calibration :

UUC Range (lx)	Standard (lx)	UUC Reading (lx)	Correction (lx)	Uncertainty (±lx)
2000	0	0	0	0.5%
	50	50	0	
	100	100	0	
	200	200	0	
	300	301	-1	
	400	401	-1	
	600	603	-3	
	800	803	-3	
	1000	1005	-5	
	1200	1207	-7	
	1400	1408	-8	
	1600	1608	-8	
20000	1800	1803	-3	
	2000	1991	9	
	3000	2970	30	
	4000	3970	30	
	5000	4960	40	

End of Certificate

Calibrated By :   
Mr. Noppadon Luangatt



รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม  
โครงการโรงฟันทองคน (ครั้งที่ 2) บริษัท โกลบอล เพาเวอร์ ซินเนอร์ยี จำกัด (มหาชน)  
ครั้งที่ 2 ประจำปี พ.ศ. 2566 (กรกฎาคม-ธันวาคม พ.ศ. 2566)

บัญชีรายการเครื่องมือห้องปฏิบัติการ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม									
No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration *	Remark
เครื่องมือวิเคราะห์คุณภาพอากาศ									
1	Analytical Balance (Repeatability 0.1 mg)	ผู้ละอองรวม ผู้ละอองขนาดเล็กเกิน 10 ไมครอน	Mettler-Toledo	AB204-S / 1128312528	Mettler-Toledo (Thailand) Ltd.	23MM331	7 Apr 23	5 Apr 24	-
2	Analytical Balance (Repeatability 0.1 mg)		Mettler-Toledo	AB204-S/FACT / B108115858	Mettler-Toledo (Thailand) Ltd.	23MM332	7 Apr 23	5 Apr 24	-
3	UV-VIS Spectrophotometer	ก๊าซออกซิเจนไนโตรเจน ในรูปไนโตรเจนไดออกไซด์	Agilent Technologies	Cary60 66860A / MY15410009	DOE Services Co.,Ltd.	SP23-021	20 May 23	18 May 24	-
4	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DOE Services Co.,Ltd.	SP23-007	6 Jan 23	5 Jan 24	-
5	Ion Chromatography (IC)	กรดกำมะถัน โซเดียมไฮโดรเจนซัลไฟต์	Dionex	DX-120 / 03010223	Archemica Lab Co.Ltd.	Qualification Report Anion (ID#042)	9 Dec 22	8 Dec 23	-
Laboratory Instrument/Equipments.(คุณภาพน้ำ)									
1	pH Meter	ความเป็นกรดและด่าง อุณหภูมิ	Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2301846-001-01	24 Feb 23	23 Feb 24	-
2	pH Meter		Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2301846-001-01	24 Feb 23	23 Feb 24	-
3	BOD Incubator	บีโอดี	Arco	UC4-1320 / (UAE:WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	23TM249	15 Feb 23	14 Feb 24	-
4	BOD Incubator		Arco	UR-1320 / (UAE:WAO.018/2551)	Technology Promotion Association (Thailand-Japan)	23TM375	12 Apr 23	10 Apr 24	-
5	Analytical Balance (Repeatability 0.1 mg)	น้ำหนักและไขมัน	Mettler-Toledo	XSR204 / C117635043	National Food Institute, Ministry of Industry, Thailand	2302827-001-01	10 May 23	8 May 24	-

รายงานผลการปฏิบัติงานตามตารางป้องกันและแก้ไขสถานะความเสี่ยงแล้ว และตามตารางติดตามตรวจสอบผลการแก้ไขแล้ว  
โครงการโรงฟันทอง (ครั้งที่ 2) บริษัท โกลบอล เพาเวอร์ ซินเนอร์ยี จำกัด (มหาชน)  
ครั้งที่ 2 ประจำปี พ.ศ. 2566 (กรกฎาคม-ธันวาคม พ.ศ. 2566)

บัญชีรายการเครื่องมือห้องปฏิบัติการ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม						
No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Remark
บัญชีรายการเครื่องมือห้องปฏิบัติการ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม						
No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Remark
Laboratory Instrument/Equipments.(คุณภาพน้ำ) (ต่อ)						
6	UV-VIS Spectrophotometer	แอมโมเนีย	Agilent Technologies	Cay60 G6860A / MY15410009	DOE Services Co.,Ltd.	-
7	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DOE Services Co.,Ltd.	-
8	UV-VIS Spectrophotometer		Hitachi	U-2900 / 21E22-009	DOE Services Co.,Ltd.	-
9	Analytical Balance (Readability 0.01 mg)	สารที่ละลายได้ทั้งหมด	Mettler-Toledo	XSR205DU / C210685394	Technology Promotion Association (Thailand-Japan)	-
10	Hot Air Oven	สารแขวนลอย	Memmert	UF55 / 8212.0411	Technology Promotion Association (Thailand-Japan)	-
11	Conductivity Meter	ค่าการนำไฟฟ้า	SI Analytics	Lab955 / 16300356	DKSH Technology Limited	-

Due Date of Calibration\* : กำหนดตามผลการสอบเทียบประจำปี อย่างน้อยปีละ 1 ครั้ง



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



METRO-MRA  
MTC-TESTING  
CALIBRATION 0000

Cert.No.: 23MM331  
Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Electronic Balance  
**Manufacturer :** Mettler Toledo  
**Model :** AB204-S  
**Serial No. :** 1128312528  
**ID No. :** UAE.AIR.019/2550

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

**Location :** Balance Room 2

**Received order :** 07 April 2023  
**Calibration Date :** 07 April 2023  
**Ambient Temperature :** 15 °C to 40 °C  
**Relative Humidity :** 30 % to 90 %

**Calibrated by :** Suwit Imjai

**Approved by :**   
Approved Signatory

( ) Ponthippa Tameyakul  
( ) Malee Buikruea

**Issue Date :** 10 April 2023

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 :** Electronic Balance  
**Condition As-Received :** Used Item  
**Reference :** 2304-001SOC-1

Cert.No.: 23MM331  
Page: 2 of 3

### Procedure used :-

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

### Condition of this result of calibration

#### 1. Reference standard instruments:-

- | Instruments  | Model | Serial No. | ID No.  | Test report No. | Due date    |
|--|-------|------------|---------|-----------------|-------------|
| 1) Standard Weight Set (E2)  | 15884 | 24053      | 70RC007 | MM-0010-22      | 20 Jan 2024 |
| 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	99.9999	+0.0001	0.19	2.03
200	200.0001	-0.0001	0.29	2.00

#### 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	0.00007

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Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2304-0015OC-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)
-0.0001	-0.0002	+0.0004	-0.0001	-0.0006

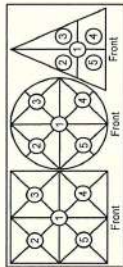
#### 3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty ( $\pm$ mg)	Coverage Factor (k)
Unload	0.0000	0.0000	0.15	2.13
0.1	0.0999	+0.0001	0.15	2.13
1	0.9999	+0.0001	0.15	2.13
5	4.9999	+0.0001	0.15	2.13
10	9.9999	+0.0001	0.15	2.11
20	20.0000	0.0000	0.15	2.11
50	50.0000	0.0000	0.16	2.06
70	69.9999	+0.0001	0.18	2.04
100	99.9999	+0.0001	0.19	2.03
150	150.0003	-0.0003	0.29	2.00
200	200.0005	-0.0005	0.29	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 %.

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Cert.No.: 23MM331  
Page: 3 of 3



Maximum difference between  
off-center and central loading  
(g)  
0.0005



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



MSC18:161723  
CALIBRATION 008

Cert.No.: 23MM332  
Page: 1 of 3

## Certificate of Calibration

Equipment : Electronic Balance  
Manufacturer : Mettler Toledo  
Model : AB204-S /FACT  
Serial No. : B108115858  
ID No. : UAE.AIR.016/2555  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Balance Room 2  
Received order : 07 April 2023  
Calibration Date : 07 April 2023  
Ambient Temperature : 15 °C to 40 °C  
Relative Humidity : 30 % to 90 %  
Calibrated by : Suwit Imjai

Approved by :   
Ponthippa Tameyakul  
Malee Bulkruea  
Approved Signatory

Issue Date : 10 April 2023

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 : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2304-0015OC-2

Cert.No.: 23MM332  
Page: 2 of 3

**Procedure used :-**

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

**Condition of this result of calibration**

**1. Reference standard instruments:-**

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0010-22	20 Jan 2024
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	100.0002	-0.0002	0.21	2.06
200	200.0003	-0.0003	0.29	2.00

**After Adjustment :**

Applied Weight (g)	Standard Deviation of Reading (g)
100	0.00009
200	0.00007

( n = 10 )

**1. Determination of the standard deviation of weighing machine**

Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2304-0015OC-2

Cert.No.: 23MM332  
Page: 3 of 3

**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)
+0.0001	-0.0003	+0.0003	+0.0006	+0.0002

Maximum difference between off-center and central loading (g)  
0.0005

**3. Departure from nominal value**

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.0000	0.0000	0.18	2.17
0.1	0.0999	+0.0001	0.18	2.17
1	0.9998	+0.0002	0.18	2.17
5	5.0000	0.0000	0.18	2.17
10	10.0000	0.0000	0.18	2.17
20	20.0000	0.0000	0.18	2.15
50	50.0001	-0.0001	0.19	2.11
70	70.0001	-0.0001	0.20	2.07
100	100.0002	-0.0002	0.21	2.06
150	150.0004	-0.0004	0.29	2.00
200	200.0005	-0.0005	0.29	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 %.

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เอกสารไม่ควบคุม

## CERTIFICATE OF CALIBRATION

Certificate No. : SP23-021

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 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009

ID No. : N/A

Received Date : 20 May 2023

Calibration Date : 20 May 2023

Issue Date : 23 May 2023

Condition Instrument : Good

Calibrated by :

( Mr.Tanawat Rittidach )

Technical Manager

Approved by :

( Ms. Chonthicha Sangnern )

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.

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FM-708-02 R01 1/11/2021

## REPORT OF CALIBRATION

Certificate No. : SP23-021

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	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

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 : 60 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

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FM-708-02 R01 1/11/2021



## REPORT OF CALIBRATION

Certificate No. : SP23-021

Page 3 of 5

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	0.0000	0.0000	0.0028	2.00
	0.5787	0.5742	0.0045	0.0031	2.00
	1.0490	1.0423	0.0067	0.0029	2.00
	2.1900	2.1847	0.0053	0.0075	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5607	0.5577	0.0030	0.0034	2.00
	1.0247	1.0234	0.0013	0.0035	2.00
	2.1229	2.1171	0.0058	0.0088	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5236	0.5184	0.0052	0.0029	2.00
	0.9634	0.9607	0.0027	0.0029	2.00
	1.9763	1.9715	0.0048	0.0081	2.00
546.1	0.0000	-0.0001	0.0001	0.0028	2.00
	0.5191	0.5159	0.0032	0.0031	2.00
	1.0003	0.9980	0.0023	0.0033	2.00
	1.9987	1.9917	0.0070	0.0087	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5523	0.5501	0.0022	0.0030	2.00
	1.0809	1.0808	0.0001	0.0030	2.00
	2.0391	2.0336	0.0055	0.0081	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5601	0.5585	0.0016	0.0031	2.00
	1.0512	1.0485	0.0027	0.0030	2.00
	1.9294	1.9317	-0.0023	0.0083	2.00

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PM4-708-02 R01 1/11/2021

## REPORT OF CALIBRATION

Certificate No. : SP23-021

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	0.0000	0.0000	0.0050	2.00
	0.7478	0.7436	0.0042	0.0058	2.00
257	0.0000	0.0000	0.0000	0.0050	2.00
	0.8686	0.8648	0.0038	0.0064	2.00
313	0.0000	0.0000	0.0000	0.0050	2.00
	0.2912	0.2908	0.0004	0.0052	2.00
350	0.0000	0.0000	0.0000	0.0050	2.00
	0.6448	0.6398	0.0050	0.0058	2.00

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PM4-708-02 R01 1/11/2021

# CERTIFICATE OF CALIBRATION

**Certificate No.:** SP23-021

**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 :** Agilent Technologies

**Model :** Cary 60

Serial No.: MY15410009

ID No.: N/A

Received Date : 20 May 2023

Calibration Date : 20 May 2023

**Issue Date :** 23 May 2023

Condition Instrument: Good

**Calibrated by:**

Approved by :

ਅਨੰਦ ਸਿੰਘ

( Mr.Tanawut Rittidach )

### 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 DOE Services Co., Ltd.

## REPORT OF CALIBRATION

**Wavelength Accuracy :**

CRMs Values	UUC Reading	Correction	Uncertainty	Coverage factor
(nm.)	(nm.)	(nm.)	(nm.)	$k$
241.72	242.0	-0.28	0.18	2.00
279.45	279.5	-0.05	0.18	2.00
287.81	287.5	0.31	0.18	2.00
334.06	333.5	0.56	0.18	2.00
360.93	360.3	0.63	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.3	0.64	0.18	2.00
453.66	453.0	0.66	0.18	2.00
460.02	459.6	0.42	0.18	2.00
536.59	536.4	0.19	0.18	2.00
637.98	638.3	-0.32	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.5	-0.03	0.18	2.00
528.88	529.0	-0.12	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	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	748.5	0.05	0.18	2.00
807.03	807.0	0.03	0.18	2.00
879.28	879.5	-0.22	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 multiplied by the coverage factor  $k$ ,

which for a normal distribution corresponds to a coverage probability of approximately 95%

- \* Indicates non TIS accredited

- End of Certificate -

## REPORT OF CALIBRATION

Certificate No. : SP23-021

Page 2 of 5

Environment Condition : Ambient Temperature  $25 \pm 5^{\circ}\text{C}$

Relative humidity  $55 \pm 20\% \text{RH}$

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	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

**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 :** 60 nm/min

**Scan Interval of UUC :** 0.15 nm.

**Resolution of UUC :** Photometric 0.0001 Abs.

Wavelength 0.1 nm.

## REPORT OF CALIBRATION

Certificate No. : SP23-021



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	0.0000	0.0000	0.0028	2.00
	0.5787	0.5742	0.0045	0.0031	2.00
	1.0490	1.0423	0.0067	0.0029	2.00
440	2.1900	2.1847	0.0053	0.0075	2.00
	0.0000	0.0000	0.0000	0.0028	2.00
	0.5607	0.5577	0.0030	0.0034	2.00
465	1.0247	1.0234	0.0013	0.0035	2.00
	2.1229	2.1171	0.0058	0.0088	2.00
	0.0000	0.0000	0.0000	0.0028	2.00
	0.5236	0.5184	0.0052	0.0029	2.00
	0.9634	0.9607	0.0027	0.0029	2.00
546.1	1.9763	1.9715	0.0048	0.0081	2.00
	0.0000	-0.0001	0.0001	0.0028	2.00
	0.5191	0.5159	0.0032	0.0031	2.00
590	1.0003	0.9980	0.0023	0.0033	2.00
	1.9987	1.9917	0.0070	0.0087	2.00
	0.0000	0.0000	0.0000	0.0028	2.00
635	0.5523	0.5501	0.0022	0.0030	2.00
	1.0809	1.0808	0.0001	0.0030	2.00
	2.0391	2.0336	0.0055	0.0081	2.00
	0.0000	0.0000	0.0000	0.0028	2.00
	0.5601	0.5585	0.0016	0.0031	2.00
	1.0512	1.0485	0.0027	0.0030	2.00
	1.9294	1.9317	-0.0023	0.0083	2.00



<div> <div>  <b>DQE Services</b> </div> <div> DQE Services Co.,Ltd.  32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230  Phone : +66 (0)2 538 2054, Email : dqueservicesinfo@gmail.com </div> </div>																																			
<div> <div>  <b>MCA</b> </div> <div> MCA-708-02 R01 1/1/2021  CALIBRATION DATA </div> </div>																																			
<div> <div>REPORT OF CALIBRATION</div> <div> Certificate No. : SP23-021 </div> <div> Wavelength Accuracy : </div> </div>																																			
<div> <div>Photometric Accuracy :</div> <table> <tr> <th>Wavelength (nm.)</th><th>CRMs Values (Abs)</th><th>UUC Reading (Abs)</th><th>Correction (Abs)</th><th>Uncertainty (Abs)</th><th>Coverage factor <i>k</i></th></tr> <tr> <td>235</td><td>0.0000 0.7478</td><td>0.0000 0.7436</td><td>0.0000 0.0042</td><td>0.0050 0.0058</td><td>2.00 2.00</td></tr> <tr> <td>257</td><td>0.0000 0.8686</td><td>0.0000 0.8648</td><td>0.0000 0.0038</td><td>0.0050 0.0064</td><td>2.00 2.00</td></tr> <tr> <td>313</td><td>0.0000 0.2912</td><td>0.0000 0.2908</td><td>0.0000 0.0004</td><td>0.0050 0.0052</td><td>2.00 2.00</td></tr> <tr> <td>350</td><td>0.0000 0.6448</td><td>0.0000 0.6398</td><td>0.0000 0.0050</td><td>0.0050 0.0058</td><td>2.00 2.00</td></tr> </table> </div>						Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>	235	0.0000 0.7478	0.0000 0.7436	0.0000 0.0042	0.0050 0.0058	2.00 2.00	257	0.0000 0.8686	0.0000 0.8648	0.0000 0.0038	0.0050 0.0064	2.00 2.00	313	0.0000 0.2912	0.0000 0.2908	0.0000 0.0004	0.0050 0.0052	2.00 2.00	350	0.0000 0.6448	0.0000 0.6398	0.0000 0.0050	0.0050 0.0058	2.00 2.00
Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>																														
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**DQE Services**

DQE Services Co.,Ltd.  
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230  
Phone : +66 (0)2 538 2054, Email : dqueservicesinfo@gmail.com




REPORT OF CALIBRATION

Certificate No. : SP23-021

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	287.5	0.31	0.18	2.00
334.06	333.5	0.56	0.18	2.00
360.93	360.3	0.63	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.3	0.64	0.18	2.00
453.66	453.0	0.66	0.18	2.00
460.02	459.6	0.42	0.18	2.00
536.59	536.4	0.19	0.18	2.00
637.98	638.3	-0.32	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.5	-0.03	0.18	2.00
528.88	529.0	-0.12	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	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	748.5	0.05	0.18	2.00
807.03	807.0	0.03	0.18	2.00
879.28	879.5	-0.22	0.18	2.00




REPORT OF CALIBRATION

Certificate No. : SP23-021

Wavelength Accuracy :


**DQE Services**


DQE Services Co.,Ltd.  
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230  
Phone : +66 (0)2 538 2054, Email : dqueservicesinfo@gmail.com




REPORT OF CALIBRATION

Certificate No. : SP23-021

Wavelength Accuracy :


**DQE Services**


DQE Services Co.,Ltd.  
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230  
Phone : +66 (0)2 538 2054, Email : dqueservicesinfo@gmail.com




REPORT OF CALIBRATION

Certificate No. : SP23-021

Wavelength Accuracy :


**DQE Services**


DQE Services Co.,Ltd.  
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230  
Phone : +66 (0)2 538 2054, Email : dqueservicesinfo@gmail.com




REPORT OF CALIBRATION

Certificate No. : SP23-021

Wavelength Accuracy :


**DQE Services**


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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%

- \* Indicates non TISI accredited

- End of Certificate -

# Qualification Report

PM\_Checklist : CM\_OQ and PQ  
DX-120 (ID#042)

For  
UAE Consultant Co.,Ltd.  
(2<sup>nd</sup> Contract)



## Certificate of Calibration

**DX-120 : (Anion System ID#042)**

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co.,Ltd.

DX-120 S/N : 03010223

for

**UAE Consultant Co.,Ltd.**



Operator Signature : *K. Khannarong*

Date : Dec 9, 2022

(Mr.Channarong Khiao-un)

Test Engineer

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เอกสารไม่ควบคุม



## Dionex Ion Chromatography Preventive Maintenance Report

Customer Organization	Name/ Department
UAE Consultant Co., Ltd. (2 <sup>nd</sup> Contract)	K. Suwan
Engineer Name	Date
Mr. Channarong Khiao-Un	09-Dec-2022

### Instrument Detail

Instrument Model	Application
DX-120(ID#042)	Anion
Instrument components	Serial Number
DX-120	03010223

### Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
AS22	AG22	ASRS-300 4-mm	-	-
Remark:				

Perform By  
Archemica Lab Co., Ltd.

*K. Khiao-Un*

*S. Nam*

Archemica Lab Co., Ltd.  
บริษัท อัครเคมีฯ จำกัด  
ARCHEMICA LAB CO., LTD.

Customer  
9/12/2022

Date

Date

## Preventive Maintenance Check List

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### General Inspection Checklist

Item	Description	Result		Action Taken	N.A.
		Pass	Fail		
1	Power line 220 Vac	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
2	Pneumatic Line	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
3	Pressure outlet 80-100 psi	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
4	Barbed fitting and tee fitting	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
5	Crimped and blocked tubing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
6	Rheodyne Valve for Leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
7	Slider valve for leak	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
8	Inspect slider	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
9	Inspect port 'a' and 'b'	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
10	Inspect pressure bolt	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
11	Inspect fitting and ferrule	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
12	Suppressor for leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
13	Cell for leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
14	Electronic cable connected	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
15	Column selection valve for leak	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
16	Inspect all fitting and line	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
17	Eluent reservoir	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
18	Inspect cap o-ring	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
19	Inspect air for leak	<input type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
20	Piston seal has been replaced	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
21	Back up seal has been replaced	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
22	Pump Lubricate	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
23	Front panel test	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
24	Low limit alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
25	Hi limit alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
26	Conductivity electronic test 160 +/- 1 uS	<input type="checkbox"/>	<input type="checkbox"/>	Checked	<input checked="" type="checkbox"/>
27	Check noise for suppressor (pk to pk <0.005US)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
28	Check column	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
29	Check suppressor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
30	Check pump	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
31	Check cell	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
32	Check leak sensor	<input type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
33	Flow rate	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
34	System pressure	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>
35	Detector background	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Checked	<input type="checkbox"/>

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เอกสารไม่ควบคุม



## Chromeleon Operational Qualification

### General Information

Computer Name (Server): LAB-IC  
Computer Name (Client): LAB-IC  
Version Number: 6.80 SR12 Build 3578 (207169)  
Operator: Mr.Chamarong Khiao-Un

General System Suitability Test: Test passed

### Comparison Formats:

All Parameters: (Exceptions see below)	Significant Digits: (They must match exactly)	10
Time Related Frac. Coll. Parameters: (The parameters are marked with *.)	Max. Deviation:	0.02 s

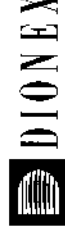


ARCHCHEMICAL LAB CO., LTD.  
บริษัท อาร์ทเคมีคัล แล็บ จำกัด

Suman 9/12/2022  
Reviewer's Signature // Date

Operator's Signature // Date

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## Chromeleon Operational Qualification, Part 1

### Verification of Selected Results

Calibration Type: LOFF  
Integration Type: Area  
Standard Method: External  
Calibration Mode: Total  
Auto Recalibrate: ON

Report Variable	Peak Name	Status
Offset (c0)	n.a.	ok
	n.a.	ok
	n.a.	ok
Slope (c1)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Correlation Coeff.	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Variance	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Std. Deviation	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Rel. Std. Dev.	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Variance Coeff.	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok

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## Chromeleon Operational Qualification, Part 1

### Verification of Selected Results

Report Variable	Peak Name	Status
Calibration Point X	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Calibration Point Y	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Amount [ng]	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Resolution (EP)	Methylparabene	ok
	Ethylparabene	ok
Resolution (USP)	Methylparabene	ok
	Ethylparabene	ok
Peak Asymmetry (EP/USP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Peak Asymmetry (AIA)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok

เอกสารไม่ควบคุม



## Chromeleon Operational Qualification, Part 1

### Verification of Selected Results

Report Variable	Peak Name	Status
Theoretical Plates (EP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Theoretical Plates (USP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Theoretical Plates (JP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok

Test Result:

Passed



9/12/2022

Simon 9/12/2022

Reviewer's Signature // Date

Operator's Signature // Date

เอกสารไม่ควบคุม





## Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category		Report Variable	Peak Name	Status
Sample	No.			ok
	Name			ok
	Sample Type			ok
	Position			ok
	Status			ok
	Inj.Vol.			ok
	Dil.Fac.			ok
	Weight			ok
	Amount			ok
	Program			ok
Chromatogram	Quantification Method			
	Channel			ok
	No. of Peaks			ok
	Start Time			ok
	Signal Min.			ok
Peak Results	Signal Max.			ok
	Signal Dimension			ok
	Noise 2.1-2.3			ok
	No.		Methylparabene	ok
	No.		Ethylparabene	ok
Peak Name	No.		Propylparabene	ok
	Peak Name		Methylparabene	ok
	Peak Name		Ethylparabene	ok
	Peak Name		Propylparabene	ok
	Ret.Time		Methylparabene	ok
	Ret.Time		Propylparabene	ok

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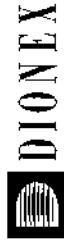


## Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category		Report Variable	Peak Name	Status
Peak Results	Ret.Dev.(abs)		Methylparabene	ok
	Ret.Dev.(abs)		Ethylparabene	ok
	Ret.Dev.(abs)		Propylparabene	ok
	Ret.Dev.(rel)		Methylparabene	ok
	Ret.Dev.(rel)		Propylparabene	ok
	Area		Methylparabene	ok
	Area		Ethylparabene	ok
	Area		Propylparabene	ok
	Rel.Area (Total)		Methylparabene	ok
	Rel.Area (Total)		Ethylparabene	ok
	Rel.Area (Total)		Propylparabene	ok
	Height		Methylparabene	ok
	Height		Ethylparabene	ok
	Height		Propylparabene	ok
	Rel.Height (Total)		Methylparabene	ok
	Rel.Height (Total)		Ethylparabene	ok
	Rel.Height (Total)		Propylparabene	ok
	Amount		Methylparabene	ok
	Amount		Ethylparabene	ok
	Amount		Propylparabene	ok
	Concentration		Methylparabene	ok
	Concentration		Ethylparabene	ok
	Concentration		Propylparabene	ok
	Rel.Amount		Methylparabene	ok
	Rel.Amount		Ethylparabene	ok
	Rel.Amount		Propylparabene	ok
	Peak Width (0%)		Methylparabene	ok
	Peak Width (0%)		Ethylparabene	ok
	Peak Width (0%)		Propylparabene	ok
	Peak Width (5%)		Methylparabene	ok
	Peak Width (5%)		Ethylparabene	ok
	Peak Width (5%)		Propylparabene	ok
	Peak Width (10%)		Methylparabene	ok
	Peak Width (10%)		Ethylparabene	ok
	Peak Width (10%)		Propylparabene	ok

เอกสารไม่ควบคุม

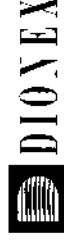


## Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Peak Width (50%)	Methylparabene	ok
	Peak Width (50%)	Ethylparabene	ok
	Peak Width (50%)	Propylparabene	ok
	Left Width (0%)	Methylparabene	ok
	Left Width (0%)	Ethylparabene	ok
	Left Width (0%)	Propylparabene	ok
	Right Width (0%)	Methylparabene	ok
	Right Width (0%)	Ethylparabene	ok
	Right Width (0%)	Propylparabene	ok
	Peak Start	Methylparabene	ok
	Peak Start	Ethylparabene	ok
	Peak Start	Propylparabene	ok
	Peak Stop	Methylparabene	ok
	Peak Stop	Ethylparabene	ok
	Peak Stop	Propylparabene	ok
	Peak Start Value	Methylparabene	ok
	Peak Start Value	Ethylparabene	ok
	Peak Start Value	Propylparabene	ok
	Peak Stop Value	Methylparabene	ok
	Peak Stop Value	Ethylparabene	ok
Peak Calibration	Peak Stop Value	Propylparabene	ok
	BL-Value Peak Start	Methylparabene	ok
	BL-Value Peak Start	Ethylparabene	ok
	BL-Value Peak Start	Propylparabene	ok
	BL-Value Peak Stop	Methylparabene	ok
	BL-Value Peak Stop	Ethylparabene	ok
	BL-Value Peak Stop	Propylparabene	ok
	Type	Methylparabene	ok
	Type	Ethylparabene	ok
	Type	Propylparabene	ok
	Resolution(EP)	Methylparabene	ok
	Resolution(EP)	Ethylparabene	ok
Resolution(USP)	Resolution(USP)	Methylparabene	ok
	Resolution(USP)	Ethylparabene	ok
	Resolution(USP)	Propylparabene	ok
	Resolution(USP)	Methylparabene	ok
Asymmetry(EP)	Asymmetry(EP)	Ethylparabene	ok
	Asymmetry(EP)	Propylparabene	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 Results	Asymmetry(AIA)	Methylparabene	ok
	Asymmetry(AIA)	Ethylparabene	ok
	Asymmetry(AIA)	Propylparabene	ok
	Theoretical Plates(EP)	Methylparabene	ok
	Theoretical Plates(EP)	Propylparabene	ok
	Theoretical Plates(USP)	Methylparabene	ok
	Theoretical Plates(USP)	Ethylparabene	ok
	Theoretical Plates(USP)	Propylparabene	ok
	Theoretical Plates(JP)	Methylparabene	ok
	Theoretical Plates(JP)	Ethylparabene	ok
	Theoretical Plates(JP)	Propylparabene	ok
Peak Calibration	Cal.Mode	Methylparabene	ok
	Cal.Mode	Ethylparabene	ok
	Cal.Mode	Propylparabene	ok
	Auto.Recal.	Methylparabene	ok
	Auto.Recal.	Ethylparabene	ok
	Auto.Recal.	Propylparabene	ok
	Cal.Type	Methylparabene	ok
	Cal.Type	Ethylparabene	ok
	Cal.Type	Propylparabene	ok
	Weights	Methylparabene	ok
	Weights	Ethylparabene	ok
	Weights	Propylparabene	ok
	Offset	Methylparabene	ok
	Offset	Ethylparabene	ok
	Offset	Propylparabene	ok
	Slope	Methylparabene	ok
	Slope	Ethylparabene	ok
	Slope	Propylparabene	ok
	RF-Value	Methylparabene	ok
	RF-Value	Ethylparabene	ok
	RF-Value	Propylparabene	ok
No. of Points	No. of Points	Methylparabene	ok
	No. of Points	Ethylparabene	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	No. of Points	Propylparabene	ok
	No. of Points(disabled)	Methylparabene	ok
	No. of Points(disabled)	Ethylparabene	ok
	No. of Points(disabled)	Propylparabene	ok
	Variance	Methylparabene	ok
	Variance	Ethylparabene	ok
	Variance	Propylparabene	ok
	Var.Coeff	Methylparabene	ok
	Var.Coeff	Ethylparabene	ok
	Var.Coeff	Propylparabene	ok
	Std.Dev.	Methylparabene	ok
	Std.Dev.	Ethylparabene	ok
	Std.Dev.	Propylparabene	ok
	Rel.Std.Dev.	Methylparabene	ok
	Rel.Std.Dev.	Ethylparabene	ok
	Rel.Std.Dev.	Propylparabene	ok
	Corr.Coeff.	Methylparabene	ok
	Corr.Coeff.	Ethylparabene	ok
	Corr.Coeff.	Propylparabene	ok
	Coeff.Det.	Methylparabene	ok
	Coeff.Det.	Ethylparabene	ok
	Coeff.Det.	Propylparabene	ok
	Adj. Coeff.Det.	Methylparabene	ok
	Adj. Coeff.Det.	Ethylparabene	ok
	Adj. Coeff.Det.	Propylparabene	ok
	X	Methylparabene	ok
	X	Ethylparabene	ok
	X	Propylparabene	ok
	Y	Methylparabene	ok
	Y	Ethylparabene	ok
	W	Propylparabene	ok
	W	Methylparabene	ok
	W	Ethylparabene	ok
	F(X)	Propylparabene	ok
	F(X)	Methylparabene	ok
	F(X)	Ethylparabene	ok
	F(X)	Propylparabene	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	Methylparabene	ok
	Residual for Cal.Point X	Ethylparabene	ok
	Residual for Cal.Point X	Propylparabene	ok
	Calibration Point Status	Methylparabene	ok
	Calibration Point Status	Ethylparabene	ok
	Calibration Point Status	Propylparabene	ok
Peak Table	Amount	Methylparabene	ok
	Amount	Ethylparabene	ok
	Amount	Propylparabene	ok
	Peak Tab. Cal.Type	Methylparabene	ok
	Peak Tab. Peak Type	Methylparabene	ok
	Peak Tab. Left Limit	Methylparabene	ok
	Peak Tab. Right Limit	Methylparabene	ok
	Peak Tab. Group	Methylparabene	ok
	Peak Tab. Resp.Factor	Methylparabene	ok
	Peak Tab. Amount	Methylparabene	ok
	Peak Tab. Amnt.Dim	Methylparabene	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	Methylparabene	ok
	PPI	Ethylparabene	ok
	PPI	Propylparabene	ok
	RSD PPI	Methylparabene	ok
	RSD PPI	Ethylparabene	ok
	RSD PPI	Propylparabene	ok
	Match	Methylparabene	ok
	Match	Ethylparabene	ok
	Match	Propylparabene	ok
	RSD Match	Methylparabene	Deviation
	RSD Match	Ethylparabene	Deviation
	RSD Match	Propylparabene	Deviation
	Rel.Max at	Methylparabene	ok
	Rel.Max at	Ethylparabene	ok
	Rel.Max at	Propylparabene	ok

Test Result: Failed



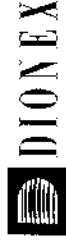
Simon 9/12/2022

Reviewer's Signature // Date

Karnwade 9/12/2022

Operator's Signature // Date

เอกสารไม่ควบคุม



## Chromeleon Operational Qualification, Part 3

Post-Acquisition Steps: Comparison with Expected Results

Calibration Type: LOF  
Integration Type: Area  
Standard Method: External  
Calibration Mode: Total  
Auto Recalibrate: ON

Channel Name	Report Variable	Peak Name	Status
Extract UV Channel: EXT230NM	Area	Methylparabene	ok
	Area	Ethylparabene	ok
	Area	Propylparabene	ok
	Height	Methylparabene	ok
	Height	Ethylparabene	ok
	Height	Propylparabene	ok
	Base Peak Width	Methylparabene	ok
	Base Peak Width	Ethylparabene	ok
	Base Peak Width	Propylparabene	ok
	Base Peak Width	Propylparabene	ok
EXT290NM	Area	Methylparabene	ok
	Area	Ethylparabene	ok
	Area	Propylparabene	ok
	Height	Methylparabene	ok
	Height	Ethylparabene	ok
	Height	Propylparabene	ok
	Base Peak Width	Methylparabene	ok
	Base Peak Width	Ethylparabene	ok
	Base Peak Width	Propylparabene	ok
	Base Peak Width	Propylparabene	ok
Smooth Data:	UV_VIS_1_MA_005_001	Noise (1.9-2.4 min)	ok
	UV_VIS_1_OL_051_001	Noise (1.9-2.4 min)	ok
	EXT290NM_SG_005_010	Noise (1.9-2.4 min)	ok

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### Chromeleon Operational Qualification, Part 3

#### Post-Acquisition Steps: Comparison with Expected Results

Channel Name	Report Variable	Peak Name	Status
Arith. Comb. of Channels:			
ADD_UV_VIS_1_UV_VIS_1	Area	Methylparabene	ok
ADD_UV_VIS_1_UV_VIS_1	Area	Ethylparabene	ok
ADD_UV_VIS_1_UV_VIS_1	Area	Propylparabene	ok
MUL_UV_VIS_1_UV_VIS_1	Area	Methylparabene	ok
MUL_UV_VIS_1_UV_VIS_1	Area	Ethylparabene	ok
MUL_UV_VIS_1_UV_VIS_1	Area	Propylparabene	ok

Test Result:

Passed

*Sunon 9/12/2022*

Reviewer's Signature // Date



*K. Channaporn 9/12/2022*

Operator's Signature // Date

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### Chromeleon Operational Qualification, Part 4

#### System Suitability Test: Comparison with Expected Results

Calibration Type: LOF  
Integration Type: Area  
Standard Method: External  
Calibration Mode: Total  
Auto Recalibrate: ON

Variable Category	Report Variable	Status
SST	Test No.	ok
	Test Name	ok
	Sample Condition	ok
	Sample Condition Result	ok
	Test Condition	ok
	Peak Condition	ok
	Aggregate Condition	ok
	Compare Operator	ok
	Compare Value	ok
	Result of Compare Value	ok
	Channel	ok
	Aggregated Samples	ok
	List of Aggr. Smp.	ok
	Result List for Aggr. Smp.	ok
	Result of Test Condition or Aggregate	ok
	N.A.	ok
	Test Result	ok
	Fail-Action	ok

Test Result: Passed

*Sunon 9/12/2022*

Reviewer's Signature // Date



บริษัท อาร์เคมีคา แล็บ จำกัด  
ARCHEMICA LAB CO., LTD.

*K. Channaporn 9/12/2022*

Operator's Signature // Date

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## Chromeleon Operational Qualification, Part 5

Fraction Collection: Comparison with Expected Results

Calibration Type: LOff  
Integration Type: Area  
Standard Method: External  
Calibration Mode: Total  
Auto Recalibrate: ON

Variable Category	Report Variable		Status
	Fraction Report	Fract. No.	
Tube Report	Fract. Starttime *		ok
	Fract. Endtime *		ok
	No. of Tubes		ok
	Position		ok
	Peak Name		ok
	No. of Peaks		ok
	Position		ok
	Tube Starttime *		ok
	Tube Endtime *		ok
	Max. Tube Volume		ok
	Peak Name		ok
	No. of Peaks		ok
	Fract. No.		ok
	Fract. Starttime *		ok
	Fract. Endtime *		ok
	No. of Tubes		ok
	No. of Peaks		ok



Test Result: Passed

Suran 9/12/2022

Reviewer's Signature // Date

Kadannaporn 9/12/2022

Operator's Signature // Date

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## Performance Qualification

### Instruments:

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00
Chromeleon	6.80 SR12 Build 3578 (207169)	Dionex	33308	n.a.

### Accessories:

Name	Description	Lot / Serial Number	Expire Date
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.	n.a.
Blank	Water	n.a.	n.a.
Sample 1	Nitrate, 5 ppm	220208	Feb-2023
Sample 2	Nitrate, 10 ppm	220208	Feb-2023
Sample 3	Nitrate, 25 ppm	220208	Feb-2023
Sample 4	Nitrate, 50 ppm	220208	Feb-2023
Sample 5	Nitrate, 100 ppm	220208	Feb-2023
Sample 6	Nitrate, 1000 ppm	220208	Feb-2023
Eluent	Water	n.a.	n.a.
Autosampler Reservoir A	Water	n.a.	n.a.



Customer Signature: Sivan 9/12/2022 Date: 9/12/2022  
Customer signature indicates that all information in the following reports has been reviewed and accepted.

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### Limits:

Test	Customized Limits	Dionex Recommended Limits
DX120 Conductivity Noise (nS)	2	2
DX120 Conductivity Drift (nS/hr)	20	20
Injector Precision (Area %RSD)	1.0	1.0
Injector Carry Over (Area %)	0.1	0.1
DX120 Detector Linearity (Corr.)	0.999	0.999
DX120 Detector Linearity (%RSD)	5	5

### Additional Information:

Customer/Company:	UAE Consultant Co., Ltd.	Date:	9-Dec-2022
Qualification Executor:	Mr.Channarong / Archemica	Period between Qualifications:	12 months
		Next Qualification:	Dec-2023



Customer Signature: Sivan Date: 9/12/2022  
Qualification Executor: K. Channarong

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## Performance Qualification

### Detector Noise and Drift

#### Instruments:

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. Inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00

#### Accessories

Name	Description
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")
Eluent	Water

#### Additional Information

Customer/Company:	UAE Consultant Co.,Ltd.	Date:	9-Dec-2022
Qualification Executor:	Mr.Channarong / Archemica	Next Qualification:	Dec-2023

#### Test Results Summary

Test	Result
DX120 Conductivity Noise (nS)	PASS
DX120 Conductivity Drift (nS/hr)	PASS



Customer Signature  
*Suman*

Qualification Executor  
*K. Channarong*  
Date  
9/12/2022

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#### Data for detector noise

Segment number	Noise, nS
1	0.773
2	0.871
3	1.301
4	0.936
5	0.851
6	0.409
7	1.624
8	0.991
9	0.750
10	0.877
11	0.570
12	1.009
13	0.861
14	1.135
15	0.688
16	0.669
17	1.480
18	1.206
19	0.691
20	0.910
Average, nS	0.930
Limit, nS	2
Result	PASS

#### Data for detector drift

20 Minute drift, nS	Drift, nS/hr	Limit, nS/hr	Result
0.550	1.650	20.000	PASS

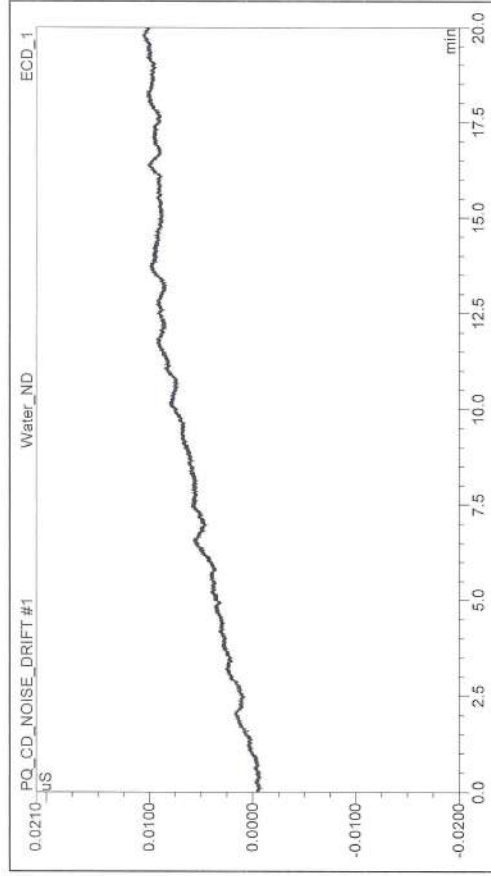


Customer Signature  
*Suman*

Qualification Executor  
*K. Channarong*  
Date  
9/12/2022

เอกสารไม่ควบคุม

### Chromatogram of Detector Noise and Drift



### Performance Qualification

#### Injector Precision

#### Instruments:

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00

#### Accessories

Name	Description
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")
Sample 5	Nitrate, 100 ppm
Eluent	Water

#### Additional Information

Customer/Company:	UAE Consultant Co., Ltd.	Date:	9-Dec-2022
Qualification Executor:	Mr.Channarong / Archemica	Next Qualification:	Dec-2023

#### Test Results Summary

Test	Result
Injector Precision (Area %RSD)	PASS



Customer Signature: *Sunon* Qualification Executor: *K. Channarong* Date: 9/12/2022

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Data for Injector Precision test

Name	Area uS*min Nitrate ECD_1
Inj Precision_1	1.678
Inj Precision_2	1.671
Inj Precision_3	1.672
Inj Precision_4	1.662
Inj Precision_5	1.654
Inj Precision_6	1.648
Inj Precision_7	1.671
Inj Precision_8	1.670
Inj Precision_9	1.674
Inj Precision_10	1.668
Average:	1.667
Std. Dev:	0.009
% RSD:	0.560 %
Limit:	1.0 %
Result:	PASS



Customer Signature

Qualification Executor

Date

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## Performance Qualification

### Injector Carry Over

#### Instruments:

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00

#### Accessories

Name	Description
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")
Sample 6	Nitrate, 1000 ppm
Blank	Water
Eluent	Water

#### Additional Information

Customer/Company:	UAE Consultant Co.,Ltd.	Date:	9-Dec-2022
Qualification Executor:	Mr.Channarong / Archemica	Next Qualification:	Dec-2023

#### Test Results Summary

Test	Result
Injector Carry Over (Area %)	PASS



Signature

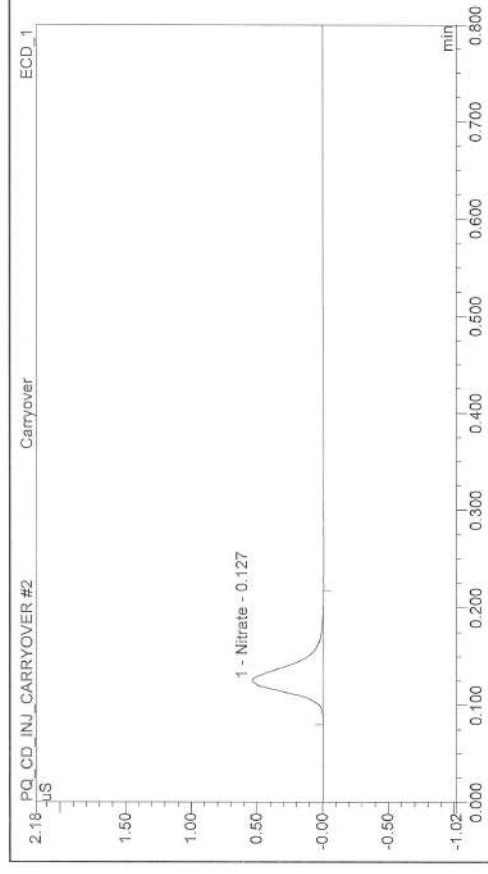
Customer Signature

Qualification Executor

Date

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### Chromatogram for Carry Over test



### Data for Carry Over test

Name	Ret.Time (detected) min	Area uS*min
High Level	0.12	30.066
Carryover	0.13	0.017
Water	0.12	0.010
Carry over:		0.035 %
Limit:		0.1 %
Result:		PASS



Archemica Lab  
บริษัท อาร์เคมีคา จำกัด  
ARCHEMICA LAB CO.,LTD.

Signature

Customer Signature

Qualification Executor

Date

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## Performance Qualification

### Detector Linearity

#### Instruments:

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00

#### Accessories

Name	Description
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")
Sample 1	Nitrate, 5 ppm
Sample 2	Nitrate, 10 ppm
Sample 3	Nitrate, 25 ppm
Sample 4	Nitrate, 50 ppm
Sample 5	Nitrate, 100 ppm
Eluent	Water

#### Additional Information

Customer/Company:	UAE Consultant Co., Ltd.	Date:	9-Dec-2022
Qualification Executor:	Mr.Chamarong / Archemica	Next Qualification:	Dec-2023

#### Test Results Summary

Test	Result
DX120 Detector Linearity (Corr.)	PASS
DX120 Detector Linearity (%RSD)	PASS

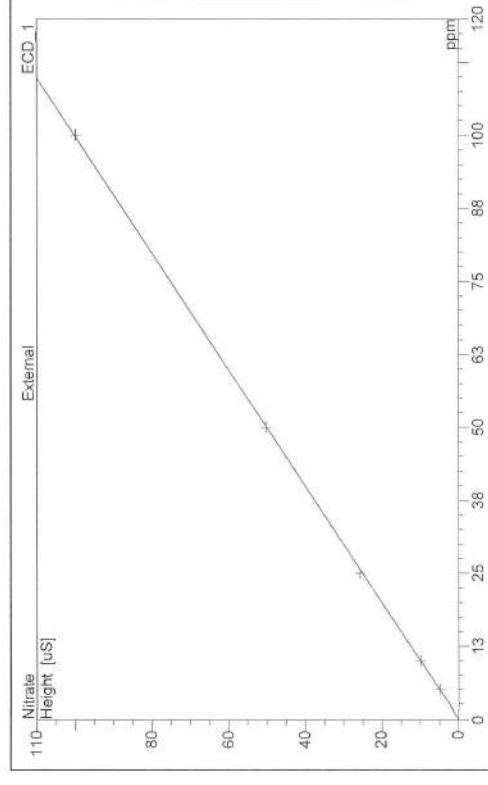
Customer Signature: *Simon* Qualification Executor: *P. Chamarong* Date: *9/12/2022*

เอกสารไม่ควบคุม

### Data for Detector Linearity

Name	Amount ppm Nitrate ECD_1	Height uS Nitrate ECD_1
Detector linearity_1	5.000	4.955
Detector linearity_2	10.000	9.972
Detector linearity_3	25.000	25.762
Detector linearity_4	50.000	50.334
Detector linearity_5	100.000	99.921

#### Linearity Plot



Calibration Type	Lin	Number of Points	5	Offset	0.000	Slope	1.002
------------------	-----	------------------	---	--------	-------	-------	-------

Linearity:	Correlation Coefficient	% RSD
Limit:	1.000	1.052
Result:	0.999	5
	PASS	PASS

Customer Signature: *Simon* Qualification Executor: *P. Chamarong* Date: *9/12/2022*

เอกสารไม่ควบคุม



Expiration of Certification  
February 2023

The Dionex Nitrate Standard was developed to aid the analysis of anions by Ion Chromatography (IC). The single-ion standard was prepared by the dissolution of high-purity salt in  $\geq 18.2$  megohm deionized water, which was tested by IC for ionic contaminants. The bottle label states the nominal concentration value of the ionic component for informational purposes only. The actual ion concentration value was determined by Ion Chromatography. The IC system was standardized using the National Institute of Standards & Technology (NIST), Standard Reference Material, SRM 3185 (Nitrate Standard Solution). Actual concentration values determined for the single-ion is listed below.



## Dionex Nitrate Standard

Vial #	Concentration (mg/L)
1	5.07 $\pm$ 0.03
2	10.09 $\pm$ 0.04
3	24.97 $\pm$ 0.13
4	49.83 $\pm$ 0.13
5	99.6 $\pm$ 1
6	996 $\pm$ 3

The concentration value is based on a proven reliable method of analysis. The estimated uncertainties are two standard deviations of the concentration value. The concentration value is warranted to be stable for one year from the date of manufacture.

The preparation and analyses of the Dionex Nitrate Standard was performed with extreme care by Thermo Scientific Corporation Consumables Manufacturing Department in Sunnyvale California.



## Calibration Report

**Certificate No.:** 2301846-001-01  
**Equipment:** pH Meter  
**Resolution:** 0.01 pH ; 1 mV  
**Model:** SevenEasy TM S20 pH  
**Manufacturer:** Mettler Toledo  
**Serial No.:** 1231155210  
**Type:** Bench top  
**ID No.:** UAE.WAT.010/2553  
**Date of Calibration:** 24 February 2023  
**Location:** Chemical Calibration Laboratory, National Food Institute  
**Environment Condition:** Ambient Temperature: ( 25.1 ± 1.5 ) °C  
**Condition of Equipment:** Good Condition  
**Condition of this Results of Calibration**  
1. Calibration Method In house method : W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)  
2. Reference Standards / Certified Reference Material

Page 2 of 5

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	22E1959	17 June 2023
2.2 Digital Thermometer	2709007	Fluke	CC 650577-01	30 October 2023
2.3 Thermo-Hygro Meter	NFI.BTH 007/18	PONPE 480	QR22-0888	26 April 2023
Certified Reference Material	Lot No.	Manufacturer	Ref N	Expire Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	832806	CPAchem	PH216.L5	8 August 2024
2.5 pH buffer 6.865 (Primary pH buffer Solution)	832807	CPAchem	PH217.L5	8 August 2024
2.6 pH buffer 10.01 (Primary pH buffer Solution)	832609	CPAchem	PH220.L5	8 August 2023
2.7 pH buffer 7.00 (Standard pH buffer Solution)	832610	CPAchem	PH107.L5	8 August 2023
3. This certification is traceable to The International System of Unit (SI Unit)				
3.1 Instruments No.2.1	through			
3.2 Instruments No.2.2	through			
3.3 Instruments No.2.3	through			
3.4 Certified Reference Material No. 2.4 to 2.6	traceable to			
3.5 Certified Reference Material No.2.7	traceable to			
4. This certificate was certified only for the instrument we calibrated.				
5. This result of calibration was found accurate as shown on date and place of calibration only.				

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

 N. ingrat

## Calibration Report

**Certificate No.:** 2301846-001-01  
**Equipment:** pH Meter  
**Resolution:** 0.01 pH ; 1 mV  
**Model:** SevenEasy TM S20 pH  
**Manufacturer:** Mettler Toledo  
**Serial No.:** 1231155210  
**Type:** Bench top  
**ID No.:** UAE.WAT.010/2553  
**Date of Calibration:** 24 February 2023  
**Location:** Chemical Calibration Laboratory, National Food Institute  
**Environment Condition:** Ambient Temperature: ( 25.1 ± 1.5 ) °C  
**Condition of Equipment:** Good Condition  
**Condition of this Results of Calibration**  
1. Calibration Method In house method : W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)  
2. Reference Standards / Certified Reference Material

Page 3 of 5

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0	414.120	414	0.00	0.58	2.00
2	295.814	296	2.00	0.58	2.00
4	177.484	178	4.00	0.58	2.00
6	59.160	59	6.00	0.58	2.00
7	0.000	0	7.00	0.58	2.00
8	-59.158	-59	8.00	0.58	2.00
10	-177.460	-177	10.00	0.58	2.00
12	-295.811	-296	12.00	0.58	2.00
14	-414.117	-414	14.00	0.58	2.00

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

**Equipment:** pH Electrode  
**Manufacturer:** Mettler Toledo  
**Type:** Combined Electrode  
**Model:** InLab Solids  
**ID No.:** N/A  
**Performance of Electrode system** (Three-Point Calibration at pH 4, pH 7 and pH 10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	186	-	0.0071	2.00
6.865	6.90	19	97.68	0.0075	2.00
10.008	10.01	-160	97.29	0.0095	2.00
6.865	6.99	15	-	0.0092	2.00

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

 N. ingrat



## Calibration Report

**Certificate No.:** 2301846-001-01  
**Equipment:** Digital Thermometer with RTD  
 Resolution: 0.1 °C Model: SevenEasy TM S20 pH  
 Serial No.: 1231155210 ID No.: UAE.WAT.010/2553  
 Manufacturer: Mettler Toledo  
**Date of Calibration:** 24 February 2023

Page 4 of 5

**Location:** Chemical Calibration Laboratory, National Food Institute  
**Environment Condition:** Ambient Temperature 25 °C ± 1 °C  
 Relative Humidity 48 % ± 3 %

### Condition of this results of Calibration:

- Calibration Method : - In house method: W-TE-025 by comparison with standard thermometer.  
 - The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.  
 - The temperature scale in use at this laboratory is the International Temperature scale of 1990 ( ITS-90 ).
- Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 0673/65	07-Jun-23	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : - Low Temperature Bath (Micro Bath), Model: 7103, S/N: A39538, AN65 A85181.

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibrated item : Good
- Result of Calibration : ☒ Without adjustment ☐ After adjustment

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

N. Ningsubol

## Calibration Report

**Certificate No.:** 2301846-001-01  
**Equipment:** Digital Thermometer with RTD  
 Resolution: 0.1 °C Model: SevenEasy TM S20 pH  
 Serial No.: 1231155210 ID No.: UAE.WAT.010/2553  
 Manufacturer: Mettler Toledo  
**Date of Calibration:** 24 February 2023

Page 5 of 5

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

### Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 120 mm.
- Description of probe, model : - S/N : -
- Dimension of probe : Diameter 9 mm., Length 120 mm.,
- Sheath material : Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.015	- 0.1	0.11
25.0	25.014	0.0	0.11
35.1	35.016	- 0.1	0.11

### Note

- UUC\* : Unit Under Calibration

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

----- End -----

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

N. Ningsubol

## Calibration Certificate

**Certificate No.:** 2301846-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

**Equipment:** pH Meter  
**Manufacturer:** Mettler Toledo  
**Model:** SevenEasy TM S20 pH  
**Serial No.:** 1231155210  
**ID No.:** UAE.WAT.010/2553  
**Order No.:** 2301846  
**Operation No.:** 2301846-001  
**Date of Receipt:** 17 February 2023  
**Date of Calibration:** 24 February 2023

**Calibrated by** Mr.Worapob Sookong  
**Scientist**  
**Approved by**   
(Mr.Nittapong Niyomchart)  
**Specialist, Division of Calibration Laboratory**  
**Responsible for the Technical Management Team**

**Date of Issue:** 24 February 2023

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

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

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



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**เอกสารไม่ควบคุม**

## Calibration Report

**Certificate No.:** 2301846-001-01  
**Equipment:** pH Meter  
**Resolution:** 0.01 pH ; 1 mV  
**Manufacturer:** Mettler Toledo  
**Model:** SevenEasy TM S20 pH  
**Serial No.:** 1231155210  
**Type:** Bench top  
**ID No.:** UAE.WAT.010/2553

Page 2 of 5

**Date of Calibration:** 24 February 2023

**Location:** Chemical Calibration Laboratory, National Food Institute  
**Environment Condition:** Ambient Temperature: ( 25.1 ± 1.5 ) °C  
**Condition of Equipment:** Good Condition  
**Condition of this Results of Calibration**

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

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	22E1959	17 June 2023
2.2 Digital Thermometer	2709007	Fluke	CC 650577-01	30 October 2023
2.3 Thermo-Hygro Meter	NFI.BTH 007/18	PONPE 480	QR22-0886	26 April 2023
Certified Reference Material	Lot No.	Manufacturer	Ref N	Expire Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	832606	CPAchem	PH216.L5	8 August 2024
2.5 pH buffer 6.865 (Primary pH buffer Solution)	832607	CPAchem	PH217.L5	8 August 2024
2.6 pH buffer 10.01 (Primary pH buffer Solution)	832609	CPAchem	PH220.L5	8 August 2023
2.7 pH buffer 7.00 (Standard pH buffer Solution)	832610	CPAchem	PH107.L5	8 August 2023

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

3.1 Instruments No.2.1	through	NSC-TS1-TIS 17025 Laboratory Accreditation of Calibration No.0008
3.2 Instruments No.2.2	through	NSC-TS1-TIS 17025 Laboratory Accreditation of Calibration No.0061
3.3 Instruments No.2.3	through	NSC-TS1-TIS 17025 Laboratory Accreditation of Calibration No.0292
3.4 Certified Reference Material No. 2.4 to 2.6	traceable to	Primary measurement method- Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

3.5 Certified Reference Material No.2.7  
traceable to  
BIM RefN HI-27 LoIN 04.06.2021; BIM RefN HI-28 LoIN 28.05.2021;  
BIM RefN HI-27 LoIN 04.06.2021; BIM RefN HI-28 LoIN 28.05.2021;  
the Standard Solution preparation and certified by CPAchem Ltd is  
accredited to ISO 17034 and ISO/IEC 17025

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

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

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

  
N. Nittapong Niyomchart



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**เอกสารไม่ควบคุม**



# Calibration Report

**Certificate No.:** 2301846-001-01  
**Equipment:** pH Meter  
**Resolution:** 0.01 pH ; 1 mV  
**Model:** SevenEasy TM S20 pH  
**Type:** Bench top  
**Manufacturer:** Mettler Toledo  
**Serial No.:** 1231155210  
**ID No.:** UAE.WAT.010/2553  
**Date of Calibration:** 24 February 2023  
**Calibration Results:**  
1. Calibration of pH Meter ( Manual Temperature Compensation at 25 °C )

Nominal pH	DC Voltage Standard ( mV )	Average Indicator Reading		Uncertainty ( ±mV )	Coverage Factor ( k )
		mV	pH		
0	414.120	414	0.00	0.58	2.00
2	295.814	296	2.00	0.58	2.00
4	177.484	178	4.00	0.58	2.00
6	59.160	59	6.00	0.58	2.00
7	0.000	0	7.00	0.58	2.00
8	-59.158	-59	8.00	0.58	2.00
10	-177.460	-177	10.00	0.58	2.00
12	-295.811	-296	12.00	0.58	2.00
14	-414.117	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode ( Manual Temperature Compensation at 25 °C )  
**Equipment:** pH Electrode  
**Type:** Combined Electrode  
**Manufacturer:** Mettler Toledo  
**Model:** InLab Solids  
**Serial No.:** 9018311  
**ID No.:** N/A  
**Performance of Electrode system** (Three-Point Calibration at pH 4, pH 7 and pH 10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty ( ± pH )	Coverage Factor ( k )
	pH	mV			
4.008	4.01	186	-	0.0071	2.00
6.865	6.90	19	97.68	0.0075	2.00
10.008	10.01	-160	97.29	0.0095	2.00
6.865	6.99	15	-	0.0092	2.00

N. Niyomphol

# Calibration Report

**Certificate No.:** 2301846-001-01  
**Equipment:** Digital Thermometer with RTD  
**Resolution:** 0.1 °C  
**Model:** SevenEasy TM S20 pH  
**Serial No.:** 1231155210  
**ID No.:** UAE.WAT.010/2553  
**Manufacturer:** Mettler Toledo  
**Date of Calibration:** 24 February 2023

**Location:** Chemical Calibration Laboratory, National Food Institute  
**Environment Condition:**  
Ambient Temperature 25 °C ± 1 °C  
Relative Humidity 48 % ± 3 %

## Condition of this results of Calibration:

1. Calibration Method : - In house method; W-TE-025 by comparison with standard thermometer.  
- The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.  
- The temperature scale in use at this laboratory is the International Temperature scale of 1990 ( ITS-90 ).
2. Reference Standard Instrument : -

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 0673/65	07-Jun-23	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : - Low Temperature Bath (Micro Bath), Model: 7103, S/N: A39538, AN65 A85181.

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

N. Niyomphol



## Calibration Report

Certificate No.: 2301846-001-01

Equipment: Digital Thermometer with RTD

Resolution: 0.1 °C Model: SevenEasy TM S20 pH

Serial No.: 1231155210 ID No.: UAE.WAT.010/2553

Manufacturer: Mettler Toledo

Date of Calibration: 24 February 2023

Page 5 of 5

Calibration point:

15.0, 25.0 and 35.0 °C

Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 120 mm.

- Description of probe, model : - S/N : -

Dimension of probe : Diameter 9 mm., Length 120 mm.,

Sheath material : Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.015	- 0.1	0.11
25.0	25.014	0.0	0.11
35.1	35.016	- 0.1	0.11

Note

- UUC\* : Unit Under Calibration

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

----- End -----

FCS-012 Revision: 01 Date: 20-04-65

  
N. Ingubol

## Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : Arco

Model : UC4-1320

Serial No. : 13URC4S013201

ID No. : UAE.WAO.015/2561

Submitted by :

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

Location :

Lab Floor 2

Received Order :

15 February 2023

Calibration Date :

15 February 2023

Ambient Temperature :

( 26 ± 10 ) °C

Relative Humidity :

( 50 ± 30 ) %

Calibrated by :

Preecha Hlahib

Approved by :



Approved Signatory

( ) Ponthippa Tameyakul

( ☒ ) Malee Butkruea

( ) Suwit Imjai

Issue Date :

24 February 2023

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.



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2302-0297OC-1

Cert. No.: 23TM249  
Page : 2 of 3

#### Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 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	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34972A	MY57013711	22LM93	02 Jul 2023

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

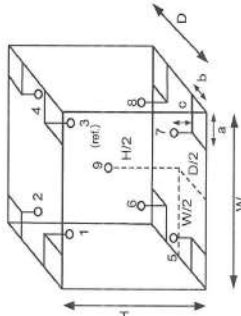
3. This certification is traceable to the International System of Unit.

#### Result of Calibration :-

( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available



#### 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	22-18RTD-2/1
2	18RTD-2/2
3	18RTD-2/3
4	18RTD-2/4
5	18RTD-2/5
6	18RTD-2/6
7	18RTD-2/7
8	18RTD-2/8
9 (ref.)	18RTD-2/9

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	29	31
REL.Humid. ( % )	63	67
AC Supply ( Volt )	220	220

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Value



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2302-0297OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 23TM249  
Page : 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor k
20.0	20.0	19.3	0.32	0.57	1.0	0.60	2
Measured Temperature ( °C )							
Position							
1	2	3	4	5	6	7	8
20.086	19.916	20.386	19.976	19.973	19.838	19.837	19.821
							9 (ref.)
							19.949

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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Value





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-T&T-1817025  
CALIBRATION 0098

Cert. No.: 23TM375  
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 : 11 April 2023

Calibration Date : 12 April 2023

Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$

Relative Humidity :  $(50 \pm 30) \%$

Calibrated by : Krisda Malee

Approved by :   
Approved Signatory

( ) Pornthippa Tameyakul  
( ) Malee Butkruea  
( ) Suwit Injai

Issue Date : 24 April 2023

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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A 0053360



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2304-0156OC-2

Cert. No.: 23TM375  
Page : 2 of 3

### Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 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 Model Serial No. Cert. No. Due Date  
1 ) Data Acquisition 34972A MY59003411 22LM165 26 Nov 2023

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

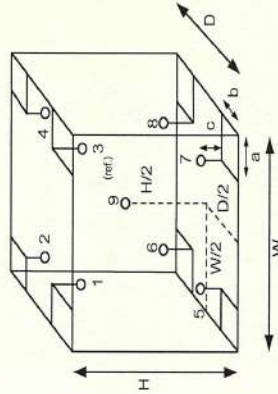
3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available

Environment during calibration	
Beginning	Finished
Temp. ( °C )	28
REL.Humid. ( % )	42
AC Supply ( Volt )	219
	220



### Probe Installation Details :

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

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

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เอกสารไม่ควบคุม

A 1158259





Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2304-0156OC-2  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 23TM375  
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	0.48	0.42	1.2	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.040	20.170	20.263	20.093	19.749	19.704	19.920	20.191	20.020	0.66

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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a 1158258



สถาบันพัฒนาอุตสาหกรรมอาหาร  
Foundation for Industrial Development National Food Institute  
Food Industrial Laboratory Service Center  
national food institute  
ministry of industry



## Calibration Certificate

Certificate No.: 2302827-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
Address: 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR204

Serial No.: C117635043

ID No.: UAE.WAS.012/2564

Order No.: 2302827

Operation No.: 2302827-001

Date of Receipt: 10 May 2023

Date of Calibration: 10 May 2023

Calibrated by Mr. Manas Somsak  
Specialist

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

Date of Issue: 18 May 2023

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 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.:** 2302827-001-01  
**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** XSR204  
**Resolution:** 0.0001 g  
**ID No.:** C117635043  
**Capacity:** 220 g

**Date of Calibration:** 10 May 2023  
**Page 2 of 4**

**Environment Condition:** Ambient Temperature 21.4 ± 0.2 °C Relative Humidity: 43.4 ± 0.9 %  
**Place of Calibration:** Balance room (Water Analysis Unit), 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           | M23040535       | 8 April 2024 |
- | Instrument         | Model  | Serial No.    | Calibrated By  | Certificate No. | Due Date         |
|--------------------|--------|---------------|----------------|-----------------|------------------|
| Thermo-Hygro Meter | 608-H1 | NFLETH 016/23 | Quality Reborn | QR23-0489       | 21 February 2024 |
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:

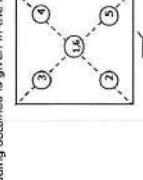
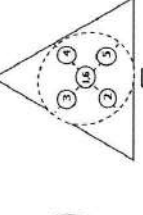
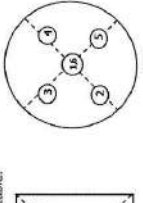
### 1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
100	0.000032
200	0.000032

### 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	100.0002	100.0002	100.0002	100.0003	100.0002	0.0001

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

# Calibration Report

**Certificate No.:** 2302827-001-01  
**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** XSR204  
**Resolution:** 0.0001 g  
**ID No.:** C117635043  
**Capacity:** 220 g

**Date of Calibration:** 10 May 2023  
**Page 3 of 4**

**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	0.000085	2.00
0.01	0.01000	0.0100	0.0000	0.000085	2.00
0.02	0.02001	0.0200	0.0000	0.000085	2.00
0.05	0.05000	0.0500	0.0000	0.000085	2.00
0.1	0.10001	0.1000	0.0000	0.000085	2.00
0.2	0.20001	0.2000	0.0000	0.000085	2.00
0.5	0.50002	0.5000	0.0000	0.000085	2.00
1	1.00000	1.0000	0.0000	0.000086	2.00
2	2.00002	2.0000	0.0000	0.000086	2.00
3	3.00003	3.0000	0.0000	0.000087	2.00
5	5.00002	5.0000	0.0000	0.000087	2.00
10	10.00001	10.0000	0.0000	0.000088	2.00
20	20.00003	20.0000	0.0000	0.000092	2.00
30	30.00004	30.0000	0.0000	0.000098	2.00
40	40.00007	40.0000	0.0000	0.00011	2.00
45	45.00009	45.0001	0.0000	0.00013	2.00

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







## REPORT OF CALIBRATION

Certificate No. : SP23-021

Page 2 of 5

Environment Condition : Ambient Temperature  $25 \pm 5^{\circ}\text{C}$

Relative humidity  $55 \pm 20\% \text{RH}$

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	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

**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 :** 60 nm/min

**Scan Interval of UUC :** 0.15 nm.

**Resolution of UUC :** Photometric 0.0001 Abs.

Wavelength 0.1 nm.

## REPORT OF CALIBRATION



Certificate No. : SP23-021


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	0.0000	0.0000	0.0028	2.00
	0.5787	0.5742	0.0045	0.0031	2.00
	1.0490	1.0423	0.0067	0.0029	2.00
440	2.1900	2.1847	0.0053	0.0075	2.00
	0.0000	0.0000	0.0000	0.0028	2.00
	0.5607	0.5577	0.0030	0.0034	2.00
465	1.0247	1.0234	0.0013	0.0035	2.00
	2.1229	2.1171	0.0058	0.0088	2.00
	0.0000	0.0000	0.0000	0.0028	2.00
	0.5236	0.5184	0.0052	0.0029	2.00
	0.9634	0.9607	0.0027	0.0029	2.00
546.1	1.9763	1.9715	0.0048	0.0081	2.00
	0.0000	-0.0001	0.0001	0.0028	2.00
	0.5191	0.5159	0.0032	0.0031	2.00
590	1.0003	0.9980	0.0023	0.0033	2.00
	1.9987	1.9917	0.0070	0.0087	2.00
	0.0000	0.0000	0.0000	0.0028	2.00
635	0.5523	0.5501	0.0022	0.0030	2.00
	1.0809	1.0808	0.0001	0.0030	2.00
	2.0391	2.0336	0.0055	0.0081	2.00
	0.0000	0.0000	0.0000	0.0028	2.00
	0.5601	0.5585	0.0016	0.0031	2.00
	1.0512	1.0485	0.0027	0.0030	2.00
	1.9294	1.9317	-0.0023	0.0083	2.00

<div> <div>  <b>DQE Services</b> </div> <div> DQE Services Co.,Ltd.  32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230  Phone : +66 (0)2 538 2054, Email : dqueservicesinfo@gmail.com </div> </div>					
<div> <div>  MCA CALIBRATION </div> <div> MCA CALIBRATION </div> </div>					
<div> <div>REPORT OF CALIBRATION</div> <div> <div>Certificate No. : SP23-021</div> <div>Photometric Accuracy :</div> </div> </div>					
<div> <div>Wavelength (nm.)</div> <div>CRMs Values (Abs)</div> <div>UUC Reading (Abs)</div> <div>Correction (Abs)</div> <div>Uncertainty (Abs)</div> <div>Coverage factor k</div> </div>					
235	0.0000 0.7478	0.0000 0.7436	0.0000 0.0042	0.0050 0.0058	2.00 2.00
257	0.0000 0.8686	0.0000 0.8648	0.0000 0.0038	0.0050 0.0064	2.00 2.00
313	0.0000 0.2912	0.0000 0.2908	0.0000 0.0004	0.0050 0.0052	2.00 2.00
350	0.0000 0.6448	0.0000 0.6398	0.0000 0.0050	0.0050 0.0058	2.00 2.00


**DQE Services**

DQE Services Co.,Ltd.  
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230  
Phone : +66 (0)2 538 2054, Email : dqueservicesinfo@gmail.com



REPORT OF CALIBRATION

Certificate No. : SP23-021

Wavelength Accuracy :

CRMs Values (nm.)

UUC Reading (nm.)

Correction (nm.)

Uncertainty (nm.)

Coverage factor k

241.72

242.0

-0.28

0.18

2.00

279.45

279.5

-0.05

0.18

2.00

287.81

287.5

0.31

0.18

2.00

334.06

333.5

0.56

0.18

2.00

360.93

360.3

0.63

0.18

2.00

418.59

418.0

0.59

0.18

2.00

445.94

445.3

0.64

0.18

2.00

453.66

453.0

0.66

0.18

2.00

460.02

459.6

0.42

0.18

2.00

536.59

536.4

0.19

0.18

2.00

637.98

638.3

-0.32

0.18

2.00

431.38

431.0

0.38

0.18

2.00

472.50

472.5

0.00

0.18

2.00

513.47

513.5

-0.03

0.18

2.00

528.88

529.0

-0.12

0.18

2.00

573.17

573.0

0.17

0.18

2.00

585.35

585.0

0.35

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

748.5

0.05

0.18

2.00

807.03

807.0

0.03

0.18

2.00

879.28

879.5

-0.22

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%

- \* Indicates non TISI accredited

- End of Certificate -

## CERTIFICATE OF CALIBRATION

Certificate No. : SP23-007

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 315

**Equipment :** UV-Vis Spectrophotometer

**Manufacturer :** Hitachi

**Model :** U-1900

**Serial No. :** 2021-064

**ID No. :** UAE.WAS.006/2552

**Received Date :** 6 January 2023

**Calibration Date :** 6 January 2023

**Issue Date :** 10 January 2023

**Condition Instrument :** Used

**Calibrated by :**

( Mr.Tanawat Rittdach )

Technical Manager

**Approved by :**

( Ms. Chonthicha Sangngern )

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.

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FM-708-02 R01 1/11/2021

## REPORT OF CALIBRATION

Certificate No. : SP23-007

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	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

**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 :** 4.0 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.

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FM-708-02 R01 1/11/2021



## REPORT OF CALIBRATION

Certificate No. : SP23-007

Page 3 of 5

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
	0.5787	0.575	0.0037	0.0031	2.00
	1.0490	1.044	0.0050	0.0029	2.00
440	2.1900	2.181	0.0090	0.0080	2.00
	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.558	0.0027	0.0034	2.00
465	1.0247	1.021	0.0037	0.0035	2.00
	2.1229	2.115	0.0079	0.0081	2.00
	0.0000	0.000	0.0000	0.0028	2.00
546.1	0.5236	0.520	0.0036	0.0030	2.00
	0.9634	0.961	0.0024	0.0029	2.00
	1.9763	1.968	0.0083	0.0070	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.518	0.0011	0.0031	2.00
	1.0003	1.000	0.0003	0.0033	2.00
635	1.9987	1.993	0.0057	0.0084	2.00
	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
	1.0809	1.082	-0.0011	0.0030	2.00
	2.0391	2.031	0.0081	0.0080	2.00
	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.562	-0.0019	0.0032	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.923	0.0064	0.0079	2.00

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## REPORT OF CALIBRATION

Certificate No. : SP23-007

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	0.000	0.0000	0.0050	2.00
	0.7478	0.743	0.0048	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8686	0.861	0.0076	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2912	0.291	0.0002	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6448	0.639	0.0058	0.0055	2.00

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REPORT OF CALIBRATION

Certificate No. : SP23-007

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.54	240.8	0.74	0.18	2.00
279.40	278.5	0.90	0.18	2.00
288.70	288.0	0.70	0.18	2.00
334.22	333.5	0.72	0.18	2.00
361.26	360.5	0.76	0.18	2.00
418.48	417.8	0.68	0.21	2.00
446.70	445.9	0.80	0.18	2.00
453.20	452.5	0.70	0.18	2.00
460.06	459.5	0.56	0.18	2.00
536.90	536.0	0.90	0.18	2.00
637.94	637.1	0.84	0.18	2.00
440.74	440.0	0.74	0.18	2.00
472.22	471.5	0.72	0.18	2.00
513.70	513.0	0.70	0.18	2.00
528.72	528.0	0.72	0.18	2.00
574.60	574.0	0.60	0.18	2.00
585.48	584.6	0.88	0.20	2.00
684.63	684.0	0.63	0.18	2.00
740.27	740.0	0.27	0.20	2.00
748.28	747.5	0.78	0.18	2.00
807.16	806.5	0.66	0.18	2.00
879.70	879.0	0.70	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%

- \* Indicates non TISI accredited

- End of Certificate -

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FM-708-02 R01 1/11/2021

CERTIFICATE OF CALIBRATION

Certificate No. : SP23-008

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 : 6 January 2023

Calibration Date : 6 January 2023

Issue Date : 10 January 2023

Condition Instrument : Used

Calibrated by : 

( Mr.Tanawut Rittidach )

Approved by : 

( 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.

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FM-708-02 R01 1/11/2021

### REPORT OF CALIBRATION

Certificate No. : SP23-008 Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 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	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

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.

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### REPORT OF CALIBRATION

Certificate No. : SP23-008 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
	0.5787	0.574	0.0047	0.0031	2.00
	1.0490	1.044	0.0050	0.0029	2.00
	2.1900	2.182	0.0080	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.558	0.0027	0.0034	2.00
	1.0247	1.021	0.0037	0.0035	2.00
	2.1229	2.114	0.0089	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.520	0.0036	0.0030	2.00
	0.9634	0.960	0.0034	0.0029	2.00
	1.9763	1.969	0.0073	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.516	0.0031	0.0031	2.00
	1.0003	0.997	0.0033	0.0033	2.00
	1.9987	1.991	0.0077	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.550	0.0023	0.0030	2.00
	1.0809	1.078	0.0029	0.0030	2.00
	2.0391	2.032	0.0071	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.558	0.0021	0.0031	2.00
	1.0512	1.049	0.0022	0.0030	2.00
	1.9294	1.922	0.0074	0.0079	2.00

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## REPORT OF CALIBRATION

Certificate No. : SP23-008

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 0.7478	0.000 0.744	0.0000 0.0038	0.0050 0.0057	2.00 2.00
257	0.0000 0.8686	0.000 0.863	0.0000 0.0056	0.0050 0.0059	2.00 2.00
313	0.0000 0.2912	0.000 0.290	0.0000 0.0012	0.0050 0.0051	2.00 2.00
350	0.0000 0.6448	0.000 0.639	0.0000 0.0058	0.0050 0.0055	2.00 2.00

DQE Services Co., Ltd.

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Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

**DQE Services**

## REPORT OF CALIBRATION

Certificate No. : SP23-008

Page 5 of 5

### Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor <i>k</i>
241.72	241.0	0.72	0.18	2.00
279.45	278.8	0.65	0.18	2.00
287.81	287.9	-0.09	0.18	2.00
334.06	333.5	0.56	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.8	0.14	0.18	2.00
453.66	453.0	0.66	0.18	2.00
460.02	459.5	0.52	0.18	2.00
536.59	536.5	0.09	0.18	2.00
637.98	638.0	-0.02	0.18	2.00
431.38	430.6	0.78	0.18	2.00
472.50	472.0	0.50	0.18	2.00
513.47	513.0	0.47	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.7	-0.53	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.0	0.40	0.18	2.00
740.72	740.5	0.22	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.0	0.03	0.18	2.00
879.28	879.5	-0.22	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%.

- \* Indicates non TISI accredited

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- End of Certificate -

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



Cert.No.: 23MM113  
Page.: 1 of 3

## Certificate of Calibration

**Equipment:** Electronic Balance  
**Manufacturer:** Mettler Toledo  
**Model:** XSR205  
**Serial No.:** C210685394  
**ID No.:** UAE.WAO.010/2565

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

**Location:** Balance Room

**Received order:** 26 April 2023  
**Calibration Date:** 26 April 2023  
**Ambient Temperature:** 15 °C to 40 °C  
**Relative Humidity:** 30 % to 90 %

**Calibrated by:** Man Pattanapongpaiboon

**Approved by:**   
Approved Signatory

( ) Pornthippa Tameyakul  
( ) Malee Butkruea  
(✓) Suwit Imjai

**Issue Date:** 2 May 2023

The Uncertainties are for a confidence probability of approximately 95 %

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

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**Equipment:** Electronic Balance  
**Condition As-Received:** Used Item  
**Reference:** 2304-0459OC-2

Cert.No.: 23MM113  
Page: 2 of 3

### Procedure used :-

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

### Condition of this result of calibration

1. Reference standard instruments :-  

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0010-22	20 Jan 2024
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 :		Resolution		Resolution	
0 g to 81 g	81 g to 220 g	g	Resolution	0.00001 g	g
Before Adjustment :					
Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)	
80	79.99992	+0.00008	0.15	2.00	
200	199.9995	+0.0005	0.29	2.00	

### After Adjustment :

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

Applied Weight (g)	Standard Deviation of Reading (g)
80	0.000007
200	0.00004

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Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2304-0459OC-2  
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)
-0.0001	-0.0001	0.0000	-0.0001	-0.0001

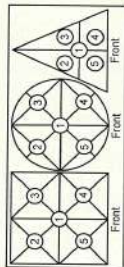
## 3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.00000	0.00000	0.014	2.11
0.05	0.04999	+0.00001	0.015	2.09
0.1	0.09999	+0.00001	0.015	2.07
1	1.00000	0.00000	0.018	2.04
5	5.00000	0.00000	0.026	2.00
20	20.00002	-0.00002	0.045	2.00
50	50.00002	-0.00002	0.080	2.00
80	80.00002	-0.00002	0.15	2.00
100	100.00000	0.00000	0.17	2.00
150	150.00000	0.00000	0.29	2.00
200	199.99999	+0.00001	0.29	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 %.

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Maximum difference between  
off-center and central loading  
(g)  
0.0001

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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



Cert. No.: 23TM373  
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 : 11 April 2023  
Calibration Date : 11 - 12 April 2023  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Krisda Malee

Approved by :   
( / ) Pornthippa Tameyakul  
( / ) Malee Butkruea  
( ) Suwit Imjai  
Approved Signatory

Issue Date : 24 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2304-0156OC-1

Cert. No.: 23TM373  
Page : 2 of 3

#### Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 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	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY59003411	22LM165	26 Nov 2023

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

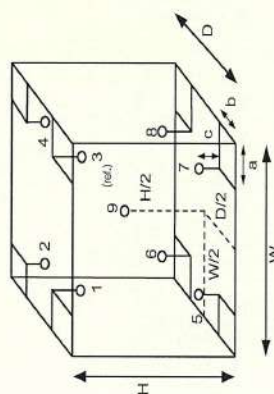
3. This certification is traceable to the International System of Unit.

#### Result of Calibration :-

(\*) Without Adjustment

Temperature Source

Close



#### 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	18-20TC-01
2	18-20TC-02
3	18-20TC-03
4	18-20TC-04
5	18-20TC-05
6	18-20TC-06
7	18-20TC-07
8	18-20TC-08
9 (ref.)	18-20TC-09

Environment during calibration	
	Finished
Temp. ( °C )	27
REL.Humid. ( % )	45
AC Supply ( Volt )	221
	220



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2304-0156OC-1  
Result of Calibration :-  
(\*) Without Adjustment  
Function of UUC\* :  
Temperature Source  
Fresh air setting :  
Close

Cert. No.: 23TM373  
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
104.0	104.0	104.0	0.054	0.59	0.95	2
120.0	120.0	120.0	0.12	0.89	1.5	2
180.0	180.0	180.0	0.12	1.5	2.5	2

Calibration Point ( °C )	Measured Temperature ( °C )								Uncertainty ( ± °C )	
	Position									
	1	2	3	4	5	6	7	8		9 (ref.)
104.0	104.512	104.016	104.542	104.407	103.704	103.729	104.167	104.167	104.001	0.42
120.0	120.317	119.768	120.524	120.232	119.363	119.209	119.888	119.797	119.735	1.1
180.0	180.878	179.819	181.357	180.871	179.303	179.139	180.230	180.055	179.960	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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a 1158260



# Certificate of Calibration



**Equipment:** CONDUCTIVITY METER  
**Model:** Lab 955  
**Serial No. (or ID.):** 16300356  
**Manufacturer:** SI Analytics  
**Electrode Serial No.** 16070067  
**Condition:** In Condition

**Certificate No.:** C24230059  
**Issued Date:** 16 March 2023  
**Job No.:** KSPR2304472  
**Page:** 1 of 2  
**Model :** LF413T  
**Brand :** SI Analytics

**Customer:** United Analyst and Engineering Consultant Company Limited  
3 Soi Udomsuk 41 Sukhumvit Road,  
Bangckak, Prakanong, Bangkok 10260 Thailand

**Environment Condition:** Temperature 23 °C ± 2 °C  
Humidity 50 %RH ± 15 %RH

**Calibration Place:** Environment Laboratory, DKSH Technology Limited.  
2533 Sukhumvit Road, Bangkok,  
Phrakhanong, Bangkok 10260 Thailand

**Calibration By:** Mr. Atachai Ngamchanat  
**Calibration Date:** 16 March 2023  
**The Method used:** In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14  
**Traceability:** This certificate is traceable to the SI Units maintained by CRM of NIST (SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 838312, 838313, 838316

(Mr. Atachai Ngamchanat)

Person in charge

(Mr. Nitinun Srihawan)

Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.  
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).  
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

DKSH Technology Limited  
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260  
Phone : +66 2639 7000 Email : info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C24-08; 12 Sep 2022



Certificate No.: C24230059

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## Calibration Results:

### Before Adjustment

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty ( ± )
25.000 µS/cm	24.5 µS/cm	0.500 µS/cm	2.00	0.21 µS/cm
1413.0 µS/cm	1403 µS/cm	10.0 µS/cm	2.00	9.0 µS/cm
111.3 mS/cm	108.5 mS/cm	2.80 mS/cm	2.00	0.67 mS/cm

### After Adjustment ; at 1413 µS/cm

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty ( ± )
25.000 µS/cm	24.8 µS/cm	0.200 µS/cm	2.00	0.21 µS/cm
1413.0 µS/cm	1413 µS/cm	0.0 µS/cm	2.00	9.0 µS/cm
111.3 mS/cm	108.8 mS/cm	2.50 mS/cm	2.00	0.67 mS/cm

The End of Certificate

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ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

ชนิดเครื่องมือ: CONDUCTIVITY METER      รุ่น: Lab 955      เลขที่ใบงาน: KSPR2304472      หมายเลขเครื่อง: 16300356

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
16 Mar 2023			16 Mar 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด ( ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด – เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. ช่องจัดหลายตัวอย่าง (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>	
		pH Meter and Conductivity Meter			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด ( Electrode and Connection Cable )	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl )	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันลม Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
		Turbidimeter			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นเกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
		Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	รวมท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ : Electrode วัดอุณหภูมิได้ 25.1°C โดย Control Waterbath ที่ 25.0  $\pm$  0.1°C

Mr.Atachai Ngamchanat

Service Engineer

บริษัท ดีเคเอส เอช จำกัด  
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CAL-FM-R31-03: 20 Jul 2022