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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	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Thermo Scientific	G25A 1270	Jiranaatee Associates Co., Ltd.	CO-00466	12 Jun 23	11 Jun 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)	23P1401	9 May 23	8 May 24	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> ) Hydrogen Chloride	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1856	2 Jun 23	1 Jun 24	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> ) Hydrogen Chloride	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1201	5 Jun 23	5 Jun 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778105	UAE Consultant Co., Ltd.	211112023	21 Nov 23	20 Nov 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1200636463	UAE Consultant Co., Ltd.	011112023	1 Nov 23	31 Oct 24	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-78933-390	UAE Consultant Co., Ltd.	131112023	13 Nov 23	12 Nov 24	-
9	Standard Gases (Mixture)	Nitrogen Dioxide	Aligas	EB0143262 2015PSIG	Aligas an Air Liquide company	E04NI99EI5A01D3	21 Jun 21	21 Jun 24	-
10	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0105	Thai Meteorological Department	120/24	13 Mar 24	12 Mar 25	-
11	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Quest Technologies, Inc	QC-20 QOOF110030	Innovative Instrument Co., Ltd.	23-ACT-116	4 Aug 23	3 Aug 24	-
12	Sound Level Meter	L <sub>Aeq</sub> 1 hour, L <sub>Aeq</sub> 24 hours, L <sub>Amax</sub> , L <sub>A90</sub>	Larson Davis	LX12 0005288	Innovative Instrument Co., Ltd.	23-SLM187	2 Jun 23	1 Jun 24	-
13	Sound Level Meter	L <sub>Aeq</sub> 1 hour, L <sub>Aeq</sub> 24 hours, L <sub>Amax</sub> , L <sub>A90</sub>	Larson Davis	LX12 0005289	Innovative Instrument Co., Ltd.	23-SLM-224	28 Jun 23	27 Jun 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
Stack									
1	Pre-Test Console	Total Suspended Particulate Hydrogen Chloride	Apex Instruments, USA.	XC-572-V 0803018	Envi Equipment Service Co., Ltd.	E23-12097	24 Dec 23	23 Dec 24	-
2	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide Carbon Monoxide	Testo	Testo 350 60899617	Entech Industrial Solution Co., Ltd.	G 660614	5 Oct 23	4 Oct 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>Workplace</b>									
1	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 32 TPW010011	Innovative Instrument Co.,Ltd.	24-TPM-149	21 Mar 24	20 Mar 25	-
2	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPS030006	Innovative Instrument Co.,Ltd.	23-TPM-483	17 Oct 23	16 Oct 24	-
3	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 32 TPT060013	Innovative Instrument Co.,Ltd.	24-TPM-043	23 Jan 24	22 Jan 25	-
4	Primary Flow Calibrator	Calibrate personal pump UAE.EFM.224/2562	TSI Inc	4146 41461922008	Innovative Instrument Co., Ltd.	24-AFM-010	23 Jan 24	22 Jan 25	-
5	Aneroid Barometer	Total Dust Respirable Dust Oil Mist Hydrogen Chloride Sodium Nitrate Sodium tetraborate decahydrate as Total Dust - Phosphoric Acid Acetone Kerosene Calcium Hydroxide	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24P1370	22 Apr 24	21 Apr 25	-
6	Dial Thermo-Hygrometer	Total Dust Respirable Dust Oil Mist Hydrogen Chloride Sodium Nitrate Sodium tetraborate decahydrate as Total Dust - Phosphoric Acid Acetone Kerosene Calcium Hydroxide	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1200	6 Jun 23	5 Jun 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>Workplace</b>									
7	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35 44792	Innovative Instrument Co.,Ltd.	24-ACT-038	25 Mar 24	24 Mar 25	-
8	Sound Level Meter	$L_{Aeq} 8 \text{ hrs}$ , $L_{Amax}$	Rion, Japan	NL-42 00321434	Sithiporn Associates Co., Ltd.	ACL24048	18 Jan 24	17 Jan 25	-
9	Sound Level Meter	$L_{Aeq} 8 \text{ hrs}$ , $L_{Amax}$	Rion, Japan	NL-42 00609500	Sithiporn Associates Co., Ltd.	ACL24058	18 Jan 24	17 Jan 25	-
10	Sound Level Meter	$L_{Aeq} 8 \text{ hrs}$ , $L_{Amax}$	Rion, Japan	NL-42 00408980	Sithiporn Associates Co., Ltd.	ACL24050	18 Jan 24	17 Jan 25	-
11	Digital Lux Meter	Lux	Extech Instrument, Taiwan	407026 A 037236	Innovative Instrument Co., Ltd.	24-LXM-050	29 Feb 24	28 Feb 25	-
12	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 117688	Innovative Instrument Co.,Ltd.	24-NDM-110	26 Apr 24	25 Apr 25	-
13	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 117693	Innovative Instrument Co.,Ltd.	24-NDM-107	26 Apr 24	25 Apr 25	-
14	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 117694	Innovative Instrument Co.,Ltd.	24-NDM-108	26 Apr 24	25 Apr 25	-
15	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 117696	Innovative Instrument Co.,Ltd.	24-NDM-104	25 Apr 24	24 Apr 25	-
16	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 117721	Innovative Instrument Co.,Ltd.	24-NDM-106	26 Apr 24	25 Apr 25	-
17	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 117730	Innovative Instrument Co.,Ltd.	24-NDM-109	26 Apr 24	25 Apr 25	-
18	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 143226	Innovative Instrument Co.,Ltd.	23-NDM-180	7 Aug 23	6 Aug 24	-

## CERTIFICATE OF CALIBRATION

Certificate No. : CO-004-66

Page 1 of 2 Pages

**MEASUREMENT ITEM**  
: Top Load Orifice  
**MANUFACTURER**  
: Andersen Instruments  
**MODEL/TYPE**  
: G25A  
**SERIAL NUMBER**  
: 1270  
**ID NUMBER**  
: UAE.ANV.009/2542  
**CONDITION AS-RECEIVED**  
**CUSTOMER**  
: Used Item  
: United Analyst and Engineering Consultant Co., Ltd.  
: 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Phrakhanong,  
Bangkok 10260

**RECEIVED DATE**  
: 02 Jun 2023  
**MEASUREMENT DATE**  
: 12 Jun 2023  
**ISSUE DATE**  
: 12 Jun 2023

### ENVIRONMENTAL CONDITIONS:

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

### CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.  
Measurement Condition : The average values during measurement are 23.3 °C and 55.0%RH.

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

### TABULATION OF RESULTS:

The table on next page give the measured values.

**Calibration procedure:**  
The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/MC/W2-dp. The W6-GJ-004 was used as a calibration guideline.

**Traceability:**  
This certificate provides a traceability of the measurement to recognized the national standards and to realization of the international system of units (SI) through the VSL (National Metrology Institute of Netherlands) via Certificate number: G2211901

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

### MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The humid air was used as a medium in the system. The standard conditions are 25 °C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1: The results of Q Standard calibration data

Plate	Flow rate m <sup>3</sup> /min	Pressure [Pa] mmHg	Temperature [T <sub>a</sub> ] °C	Temperature [T <sub>m</sub> ] °C	Δp <sub>meter</sub> mmHg	Δp <sub>Orifice</sub> inH <sub>2</sub> O	γ	Standard Flow [Q <sub>s</sub> ] m <sup>3</sup> /min
1	0.705	755.787	24.17	23.48	47.401	1.708	1.305	0.661
2	0.999	755.849	23.95	23.54	51.522	3.383	1.837	0.930
3	1.119	755.810	23.39	22.98	35.502	4.448	2.109	1.068
4	1.170	755.752	23.42	23.02	26.462	4.999	2.235	1.131
5	1.425	755.681	23.52	23.12	26.582	7.431	2.725	1.376

Slope (m): 1.98581  
Intercept (b): -0.00879  
Correlation coefficient (r): 0.99984  
Uncertainty (k=2): 0.015 m<sup>3</sup>/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m <sup>3</sup> /min	Pressure [Pa] mmHg	Temperature [T <sub>a</sub> ] °C	Temperature [T <sub>m</sub> ] °C	Δp <sub>meter</sub> mmHg	Δp <sub>Orifice</sub> inH <sub>2</sub> O	γ	Standard Flow [Q <sub>s</sub> ] m <sup>3</sup> /min
1	0.705	755.787	24.17	23.48	47.401	1.708	0.820	0.663
2	0.999	755.849	23.95	23.54	51.522	3.383	1.153	0.933
3	1.119	755.810	23.39	22.98	35.502	4.448	1.321	1.068
4	1.170	755.752	23.42	23.02	26.462	4.999	1.401	1.131
5	1.425	755.681	23.52	23.12	26.582	7.431	1.708	1.377

Slope (m): 1.24382  
Intercept (b): -0.00554  
Correlation coefficient (r): 0.99984  
Uncertainty (k=2): 0.015 m<sup>3</sup>/min

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

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



Approved signatory:  
Mr. Parinya Booncharoen  
Calibration Department Manager



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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-9000-34 FAX. 0-2719-9484

## Certificate of Calibration

Certificate No. : 23P1401  
Page : 1 of 2

**Equipment :** U-Tube Manometer

**Manufacturer:** Dwyer

**Model :** 1221-36-WIM

**Serial No.:** -

**ID No.:** UAE.EFM.022/2560

**Condition As-Received:** Used Item

**Received Date:** 26 April 2023

**Calibration Date:** 09 May 2023

**Reference:** 2304-0703WSC

**Ambient Temperature:** ( 23 ± 2 ) °C

**Relative Humidity:** ( 50 ± 15 ) %

**Atmospheric Pressure:** 1010 mbar

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

81 Soi Udomsak 41, Sukhumvit Road, Bangkok,

Phrakhanong, Bangkok 10260

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

### Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1169	MP-0137-22	24 Aug 2023

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 and oil as pressure media.

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Ausararo  
Issue Date : 11 May 2023

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

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Cert.No.: 23P1401  
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			AP (inH <sub>2</sub> O)	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	0.00
2.00	1.00	0.98		1.98	-0.02
4.00	2.00	1.98		3.98	-0.02
6.00	3.00	2.98		5.98	-0.02
8.00	4.00	3.98		7.98	-0.02
10.00	5.00	4.98		9.98	-0.02
12.00	6.00	6.00		12.00	0.00
14.00	7.00	7.00		14.00	0.00
16.00	8.00	8.00		16.00	0.00
18.00	9.00	9.00		18.00	0.00
20.00	10.00	10.00		20.00	0.00
22.00	11.00	11.00		22.00	0.00
24.00	12.02	12.00		24.02	0.02
26.00	13.02	13.00		26.02	0.02
28.00	14.02	14.00		28.02	0.02
30.00	15.04	15.00		30.04	0.04
32.00	16.04	16.00		32.04	0.04
34.00	17.02	17.00		34.02	0.02
36.00	18.00	17.06		35.06	0.16

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

\* UUC = Unit Under Calibration

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

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

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Attapol P.

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a 1160340



## Certificate of Calibration

Certificate No. : 23P1856  
Page : 1 of 2

Equipment : Aneroid Barometer  
Manufacturer : Barigo  
Model : -  
Serial No. : -  
ID No. : UAE.EMA2.110/2555

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

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: 1006 mbar

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

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

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

### Condition of this result of calibration

#### 1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DPI142	1422505046	MP-0004-23	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.*  
[ ] Phalinnee Prabpalai  
[ ] Sura Suwannasri  
[x] Attapol Panurach

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### Result of calibration:- Without adjustment

Function:- Absolute Pressure Measurement

Range: 720 mmHg to 800 mmHg

Scale Interval : 1 mmHg ( The Fifth Estimate )

#### Increasing Pressure

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

#### Decreasing Pressure

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

The uncertainty of measurement was ± 0.24 mmHg

\* UUC = Unit Under Calibration

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

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*Attapol P.*

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a 1165292



## 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

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

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 ) %

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

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

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

### Condition of this result of calibration

#### 1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Hygro-M2 Dew Point Monitor	5112	2360195	20703	02 Aug 2023
2) Handheld Thermometer With Sensor	1523	3240076	231305	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), NSO-ONSC Accredited No. Calibration 0008

Calibrated by : Somchai Durmwor  
Issue Date : 07 June 2023

Approved Signatory : *Chakrit Waeewanjua*  
[x] Chakrit Waeewanjua  
[ ] Pornthippa Tameyskul  
[ ] Viporn Tantiyawutti

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### 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 base on standard uncertainty multiplied  
by coverage factor k = 2.00, providing confidence level approximately 95%.

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*Chakrit Waeewanjua*

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a 1165294



# MULTI-POINT GAS TEST REPORT

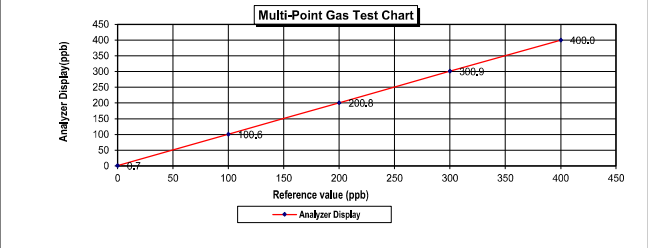
Test Date : Nov 21, 2023

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

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	0.7	0.70	0.70	0.70
Level 2	20.00%	100.0	100.6	0.60	0.60	0.60
Level 3	40.00%	200.0	200.8	0.80	0.40	0.40
Level 4	60.00%	300.0	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)		0.40	



Calculate by

21 / Nov / 2023

Approve by

22 / Nov / 2023

# MULTI-POINT GAS TEST REPORT

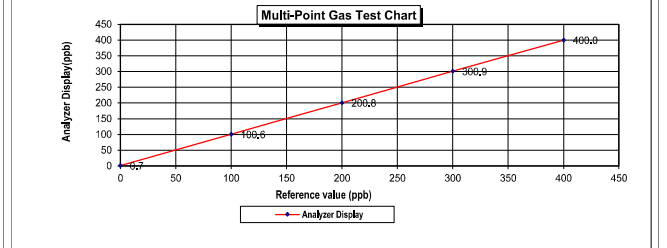
Test Date : Nov 21, 2023

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

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	0.7	0.70	0.70
Level 2	20.00%	100.0	100.6	0.60	0.60
Level 3	40.00%	200.0	200.8	0.80	0.40
Level 4	60.00%	300.0	300.9	0.30	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)		0.40



Calculate by

21 / Nov / 2023

Approve by

22 / Nov / 2023

# MULTI-POINT GAS TEST REPORT

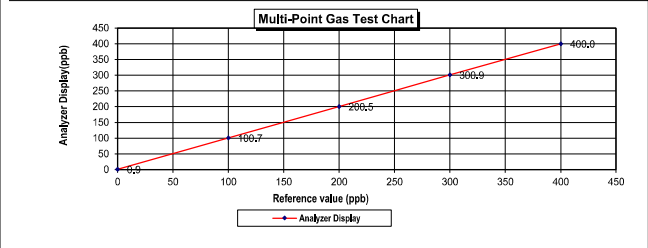
Test Date : Nov 1, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : 1200636463

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	0.9	0.90	0.90	0.90
Level 2	20.00%	100.0	100.7	0.70	0.70	0.70
Level 3	40.00%	200.0	200.5	0.50	0.25	0.25
Level 4	60.00%	300.0	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)		0.43	



Calculate by

01 / Nov / 2023

Approve by

01 / Nov / 2023

# MULTI-POINT GAS TEST REPORT

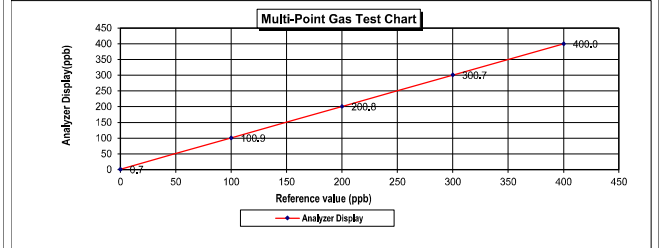
Test Date : Nov 13, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42C  
Manufacturer : Thermo Environmental Instruments Serial Number : 42C-78933-390

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	0.7	0.70	0.70	0.70
Level 2	20.00%	100.0	100.9	0.90	0.89	0.89
Level 3	40.00%	200.0	200.8	0.80	0.40	0.40
Level 4	60.00%	300.0	300.7	0.70	0.23	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.44



Calculate by

13 / Nov / 2023

Approve by

13 / Nov / 2023

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: ED4N00E15A0105 Reference Number: 122-402135167-1  
Cylinder Number: EB0143262 Cylinder Volume: 144.4 CF  
Laboratory: 124 - Durham (SAF) - NC Cylinder Pressure: 2015 PSIG  
PGVP Number: B2202 Valve Outlet: S60  
Gas Code: CO,NO,NOX,SC2,BALN Certification Date: Jun 21, 2021  
Expiration Date: Jun 21, 2024

Certification performed in accordance with EPA Testability Protocol for Analysis and Certification of Stationary Sources (May 2012) approved EPA GCPR-16581. During the assay process, analytical methodology does not include cylinder for analytical verification. This cylinder has a special designed property to deliver below a confidence level of 0.5%. There are no significant impurities which allow the use of this cylinder on-site. All concentrations are in ppmv unless noted otherwise. Do not use this cylinder below 100 psig, i.e. 0.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 09/21/2021
NITRIC OXIDE	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 09/21/2021
SULFUR DIOXIDE	45.00 PPM	44.58 PPM	G1	+/- 1.5% NIST Traceable	08/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	104.9 PPM	G1	+/- 0.7% NIST Traceable	08/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No.	Concentration	Uncertainty	Expiration Date
NTRM	2051110	CC7M308	49.35 PPM NITRIC OXIDE/NITROGEN	+/- 1.3%	Feb 02, 2025
PRM	7386	CE68565	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.3%	Feb 20, 2020
GMS	00142362102	CC685981	4.343 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1%	Feb 02, 2025
NTRM	10011043	CC473277	45.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14038118	CC454277	350.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 16, 2025

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
N code: 9700 AHR800-333 CO	FTIR	Jun 03, 2021
N code: 9700 AHR800-333 NO	FTIR	Jun 03, 2021
N code: 9700 AHR800-333 NO2	FTIR	Jun 03, 2021
N code: 9700 AHR800-333 SO2	FTIR	Jun 03, 2021

Test Data Available Upon Request

NOTES: PO #522-007A07

GROSS WT: 23.40kg

NET WT: 4.72kg



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

Approved for Release



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## Calibration Certificate

Issued by: Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue: 13 March, 2024

Certification No.: 120/24

Page: 1 of 5

Object: Wind Speed & Wind Direction Data Logger

Manufacturer: SCARLET/TECH

Type: WL-21

Mfg Code: Wireless Receiver 2205DR0105

Wind Sensor 2205DT0105

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

81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition: Temperature 25.1 °C Barometric Pressure 1011.4 hPa

NATIONAL STANDARD WIND TUNNEL: Wind Aloft Plotting Board

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

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

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

Serial Number 110730029 (sensor 120629585)

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

STANDARD THERMOMETER: Theodor Friedrich : Dry No. 8390/84 Wet No. 6389/84

Tests: tests 645 Serial No. 02848057 : ThermoSchneider No. 918802

STANDARD BAROMETER: Digital Barometer Vaisala Type PTB220 No. V1220015

Digital Barometer Vaisala Type PTB330 No. AA380001

Calibrated by: Watcharapol Subwat

Sign: Mr. Pisod Prommit

(Authorized Signature)  
for the Chief

Mechanical Engineer

Sub-Standard Instrument

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## The Result of Calibration

13 March, 2024

Certification No. 120/24

Page: 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1009.59	1009	0.59
1009.45	1009	0.45
1010.10	1010	0.10
1010.94	1011	-0.06
1011.46	1012	-0.54
1011.84	1012	-0.16
1012.06	1012	0.06
1013.04	1013	0.04
1013.18	1013	0.18
1012.89	1013	-0.11
1013.20	1013	0.20
1013.44	1014	-0.56
1013.61	1014	-0.19
1014.19	1014	0.19
1015.90	1016	-0.04
1016.23	1016	0.23
1015.64	1016	0.64
1015.23	1016	0.23
1012.87	1013	-0.13
1013.63	1014	-0.37

Average

0.04

Calibrated by: Watcharapol Subwat  
Mechanical Engineer

Calibration & Test Section  
Meteorological Instruments Bureau

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## The Result of Calibration

Certification No. 120/24

13 March, 2024

Page: 2 of 5

Standard	HOOK GAGE NO. 1425	TESTED ANEMOMETER
Ultrasonic Anemometer	Pressure Vacuum Velocity	Velocity Correction
m/sec	inches H2O inches H2O m/sec	m/sec m/sec
1.00	- - -	1.0 0.00
3.02	- - -	3.0 0.02
5.00	- - -	5.0 0.00
7.04	- - -	6.9 0.14
9.02	- - -	8.9 0.12
11.02	- - -	11.0 0.02
13.01	- - -	13.0 0.01
15.01	- - -	15.0 0.01
17.02	- - -	17.0 0.02
20.02	- - -	20.0 0.02

Wind Direction	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by: Watcharapol Subwat  
Mechanical Engineer

Calibration & Test Section  
Meteorological Instruments Bureau

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### Certificate of Calibration

#### Customer

Name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No: 23-SLM-187  
Address: 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260 Request No: Req-2023-1166

#### Unit Under Calibration Details

Measurement Item: Sound Level Meter Microphone Class: 2  
Manufacturer: LARSON DAVIS Microphone Model: 375802  
Model: LxT2 Microphone S/N: 011731  
Serial Number: 4005288 Preamplifier Model: PRMLX7B  
ID: UAE.EFM.104.2562 Preamplifier S/N: 056075  
Resolution: 0.1 dB Instrument Status: Used

#### Calibration Environment and Details


Temperature: 23 °C ± 2 °C  
Humidity: 50 %RH ± 20 %RH  
Barometric Pressure: 1013 hPa ± 10 hPa  
Received Date: 26 May 2023  
Calibrated Date: 2 June 2023  
Calibration Procedure: In-house method CP-SLM-01 based on IEC 61672-3:2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration: Lab Acoustic

#### Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	198273	6 October 2023	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	29 June 2023	TSI
Audio Generator	Svanok	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:   
Mr. Noppadon Luangrat  
Calibration Officer

Approved By:   
Mr. Paeit Muthavorn  
Calibration Engineer Supervisor  
Issue Date: 2 June 2023

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: 23-SLM-187  
Request No: Req-2023-1166

#### 1. Indication at the calibration check frequency

UUC Setting FAST / A / 37-139 Calibrator Setting	Nominal Level (dB)	Before Adjust		After Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
1000 Hz 114 dB	114.54	114.6	+0.06	114.5	-0.04	0.2	0.3

Note: Absolute sensitivity was established by the use of Sound Calibrator Brand 2M, Model AC-380, S/N: AC-300001087

#### 2. Self-generated noise, Microphone installed

UUC Setting FAST / 37-139	Measured (dB)	UNCERTAINTY (± dB)
UUC Weighting		
A	30.7	0.1

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

UUC Setting FAST / 37-139	Measured (dB)	UNCERTAINTY (± dB)
UUC Weighting		
A	30.5	0.1
C	30.3	0.1
Z	34.1	0.1

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

UUC Setting FAST / 37-139 STD Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A (dB)	C (dB)	Z (dB)		
125 Hz	0.0	0.1	0.0	0.6	2.0
1000 Hz	0.0	0.0	0.0	0.6	1.0
4000 Hz	1.2	1.2	1.2	0.6	3.0
8000 Hz	2.9	2.8	2.9	0.7	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

Certificate No: 23-SLM-187  
Request No: Req-2023-1166

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

UUC Setting FAST / 37-139 STD Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A (dB)	C (dB)	Z (dB)		
63 Hz	-0.1	0.0	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	0.1	0.1	0.0		2.0
4000 Hz	0.0	0.1	0.0		3.0
8000 Hz	0.0	0.1	0.0		5
16000 Hz	0.0	-0.1	0.0		+5, -INF.

#### 6. Frequency and time weightings at 1kHz

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

UUC Setting 37-139 / A UUC Time Response	STD REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
Fast	114.00	114.0	0.0	0.2	0.1
Slow	114.00	114.0	0.0		0.1
Leq	114.00	114.0	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: 23-SLM-187  
Request No: Req-2023-1166

#### 7. Long Term Stability

UUC Setting FAST / A / 37-139 STD Setting	Measured UUC (dB)	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.2

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

UUC Setting FAST / A / 37-139 STD dB	Anticipated REF (dB)	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
139.00	139	139.0	0.0	0.3	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	54.1	0.1		1.1
49.00	49	49.1	0.1		1.1
44.00	44	44.2	0.2		1.1
39.00	39	39.7	0.7		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 : 23-SLM-187  
Request No : Req-2023-1166

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

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
		UUC	ERR		
FAST / A	REF	(dB)	(dB)	(± dB)	Limit
UUC Range	(dB)	(dB)	(dB)	(± dB)	(± dB)
37-139	45.0	-45.2	0.2	0.3	1.1
	114	114.0	0.0		1.1

#### 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)	(dB)	(± dB)	(± dB)
Fast	200	135.0	135.0	0.0	0.2	1
	2	118.0	117.9	-0.1		+1.0, -2.5
	0.25	109.0	108.8	-0.2		+1.5, -5.0
Slow	200	128.6	128.5	-0.1	0.2	1
	2	109.0	108.9	-0.1		+1.0, -5.0
	200	129.0	129.0	0.0		1
SEL	2	109.0	108.9	-0.1	0.2	+1.0, -2.5
	0.25	100.0	99.9	-0.1		+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)	(dB)	(± dB)	(± dB)
Complete cycle	137.4	136.9	-0.50	0.2	3.0
Positive half cycle	136.4	136.3	-0.10		2.0
Negative half cycle	136.4	136.3	-0.10		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

Certificate No : 23-SLM-187  
Request No : Req-2023-1166

#### 12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		
STD Setting	(dB)	(± dB)	(± dB)
Positive one-half cycle	142.3	0.2	1.5
Negative one-half cycle	142.5		
Deviated	-0.2	0.2	1.5

#### 13. High Level Stability

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

End of Certificate

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 of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
Name : 81 Soi Udornsook 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok  
Address : 10260  
Certificate No : 23-SLM-224  
Request No : Req-2023-1412

#### Unit Under Calibration Details

Measurement item : Sound Level Meter  
Manufacturer : LARSON DAVIS  
Model : LxT2  
Serial Number : 0005289  
ID : UAEFFM1052562  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : 375B02  
Microphone S/N : 011732  
Preamplifier Model : PRMLxT2B  
Preamplifier S/N : 056076  
Instrument Status : Used


#### Calibration Environment and Details

Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 26 June 2023  
Calibrated Date : 28 June 2023  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2012 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

#### Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	29 June 2023	TSL
Audio Generator	Svante	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 :   
Mr. Noppadol Luangrui  
Calibration Officer

Approved By :   
Mr. Pait Mahavorn  
Calibration Engineer Supervisor  
Issue Date : 28 June 2023

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 : 23-SLM-224  
Request No : Req-2023-1412

#### 1. Indication at the calibration check frequency

UUC Setting	Nominal Level	Before Adjust		After Adjust		UNCERTAINTY	Acceptance
		UUC	ERR	UUC	ERR		
FAST / A / 37-139	(dB)	(dB)	(dB)	(dB)	(dB)	(± dB)	Limit
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)	(± dB)	(± dB)
1000 Hz 114 dB	113.77	114.1	+0.33	113.8	+0.03	0.2	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN, 73246

#### 2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting	(dB)	(± dB)
A	30.0	0.1

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting	(dB)	(± dB)
A	29.7	0.1
C	29.1	0.1
Z	33.7	0.1

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance
	A	C	Z		
FAST / 37-139	(dB)	(dB)	(dB)	(± dB)	(± dB)
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
125 Hz	0.0	0.2	0.0	0.6	2.0
1000 Hz	0.0	0.0	0.0	0.6	1.0
4000 Hz	1.1	1.1	1.1	0.6	3.0
8000 Hz	2.4	2.4	2.4	0.7	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



Certificate No : 23-SLM-224  
Request No : Req-2023-1412

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

UUC Setting		Deviation from various Frequency			UNCERTAINTY	Acceptance
FAST / 37-139		Weighting Respose curve				
STD Setting		A (dB)	C (dB)	Z (dB)	( ± dB)	( ± dB)
63 Hz		-0.1	0.0	0.0	0.2	2.6
125 Hz		-0.1	0.1	0.0		1.5
250 Hz		0.0	0.0	0.0		1.5
500 Hz		0.0	0.1	0.0		1.5
1000 Hz		0.0	0.0	0.0		1.0
2000 Hz		0.1	0.1	0.0		2.0
4000 Hz		0.0	0.1	0.1		3.0
8000 Hz		0.0	0.0	0.1		5
16000 Hz		0.0	0.0	-0.1		+5, -INF

6. Frequency and time weightings at 1kHz

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

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

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

Certificate No : 23-SLM-224  
Request No : Req-2023-1412

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
		REF	ERR		
FAST / A / 37-139	REF	UUC	ERR	0.3	1.1
STD dB	(dB)	(dB)	(dB)		
142.00	142	142.0	0.0		
138.00	139	139.0	0.0		
134.00	134	134.0	0.0		
128.00	129	129.0	0.0		
124.00	124	124.0	0.0		
119.00	119	119.0	0.0		
114.00	114	114.0	0.0		
108.00	109	109.0	0.0		
104.00	104	104.0	0.0		
99.00	99	98.9	-0.1		
94.00	94	93.9	-0.1		
89.00	89	88.9	-0.1		
84.00	84	83.9	-0.1		
79.00	79	78.9	-0.1		
74.00	74	73.9	-0.1		
69.00	69	68.9	-0.1		
64.00	64	63.9	-0.1		
59.00	59	58.9	-0.1		
54.00	54	53.9	-0.1		
49.00	49	49.0	0.0		
44.00	44	44.1	0.1		
39.00	39	39.4	0.4		

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 : 23-SLM-224  
Request No : Req-2023-1412

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
		REF	ERR		
FAST / A	REF	UUC	ERR	0.3	1.1
UUC Range	(dB)	(dB)	(dB)		
37-139	44.8	44.9	0.1		
	114	114.0	0.0		

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
			Ref	ERR		
A / 37-139	Toneburst	Ref	UUC	ERR	0.2	1
UUC Time Response	(ms)	(dB)	(dB)	(dB)		
Fast	200	135.0	134.9	-0.1		
	2	118.0	117.8	-0.2		
	0.25	109.0	108.6	-0.4		
Slow	200	128.6	128.5	-0.1		
	2	109.0	108.8	-0.2		
	200	129.0	129.0	0.0		
SEL	2	109.0	109.0	0.0		
	0.25	100.0	99.8	-0.2		

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
		REF	ERR		
FAST / C / 95-142	REF	UUC	ERR	0.2	2.0
STD Setting	(dB)	(dB)	(dB)		
Complete cycle	137.4	136.7	-0.70		
Positive half cycle	136.4	136.2	-0.20		
Negative half cycle	136.4	136.2	-0.20		

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 : 23-SLM-224  
Request No : Req-2023-1412

12. Overload indication

UUC Setting	Measured	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
FAST / A / 37-139	UUC		
STD Setting	(dB)	0.2	1.5
Positive one-half cycle	143.9		
Negative one-half cycle	144.0		
Deviated	-0.1		

13. High Level Stability

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

End of Certificate

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 OF CALIBRATION

Customer : United Analyst and Engineering Consultant Co., Ltd.  
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260  
Description of Equipment : Console meter  
Manufacturer : Apex Instrument  
Model Number : XC-572-V  
Serial Number : 0803018  
ID/Control No. : UAE.ANV.193/2551 S/N 0803018  
Environment Conditions : Temperature (25 ± 2) °C  
Humidity (50 ± 15) % RH  
Cal. Date : 24/12/2023  
Issue Date : 24/12/2023

## Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

This certificate is traceable to national standard, which realize the units of measurement according to the International System of Units (SI).

## Result of Calibration

This certificate may not be reproduced other than in full except with prior Written approval of the Technical Manager, Envi Equipment Service Company Limited.

These reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level

Calibrated by : Mr. Sanya Sangnil

Approved by :

(Mr. Mano Fuekhud)  
Technical Manager

เอกสารไม่ควบคุม

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

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	24/12/2023	10:45 AM	Std Temp	293	K
Console Serial Number	0803018	Calibration Reference No.	SER23-12040			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	765.81			K <sub>1</sub>	0.386	
DGM Serial Number	00009766	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Data									
Run Time		Metering Console				Calibration Meter			
Elapsed	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
(Q)	(P <sub>m</sub> )	(V <sub>m</sub> )	(V <sub>ref</sub> )	(t <sub>m</sub> )	(t <sub>ref</sub> )	(V <sub>wf</sub> )	(V <sub>wf</sub> )	(t <sub>m</sub> )	(t <sub>ref</sub> )
min	mm H <sub>2</sub> O	m <sup>3</sup>	m <sup>3</sup>	°C	°C	m <sup>3</sup>	m <sup>3</sup>	°C	°C
12.30	13.0	0.1650	0.3050	27	27	186.76006	186.89848	25	25
12.27	13.0	0.3050	0.4450	27	27	186.89848	187.03686	25	25
8.55	26.0	0.4520	0.5920	27	27	187.04374	187.18152	25	25
8.55	26.0	0.5920	0.7320	28	28	187.18152	187.31926	25	25
14.05	40.0	0.7430	1.0230	28	28	187.32982	187.60284	25	25
14.02	40.0	1.0230	1.3030	28	28	187.60284	187.87292	25	25
10.33	70.0	1.3160	1.5960	28	28	187.88578	188.15852	25	25
10.30	70.0	1.5960	1.8760	28	28	188.15852	188.43032	25	25
9.03	90.0	1.8870	2.1670	29	29	188.44084	188.71052	24	24
9.02	90.0	2.1670	2.4470	29	29	188.71052	188.97928	24	24



เอกสารไม่ควบคุม

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

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	24/12/2023	10:45 AM	Std Temp	293	K
Console Serial Number	0803018	Calibration Reference No.	SER23-12040			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	765.81			K <sub>1</sub>	0.386	
DGM Serial Number	00009766	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

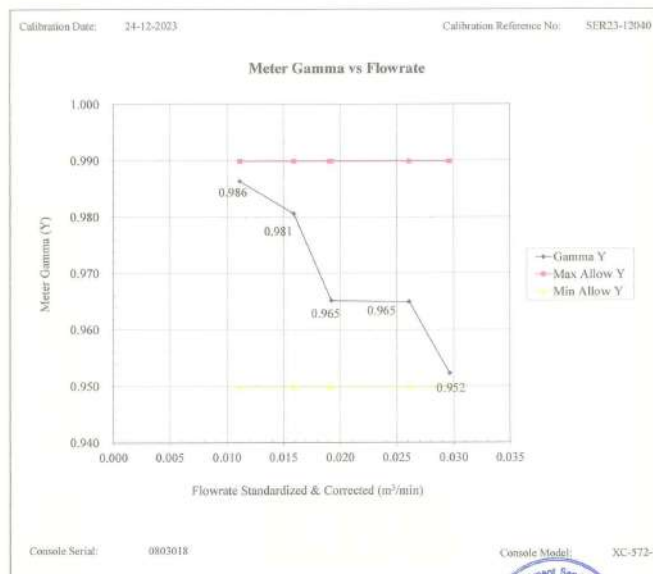
Calibration Data									
Results									
Standardized Data		Dry Gas Meter							
		Calibration Factor		Flowrate					
		Value	Variation	Std & Corr	.0212 m <sup>3</sup> /min				
Dry Gas Meter	Calibration Meter	(Y)	(ΔY)	(Q <sub>actual</sub> )	(ΔH <sub>g</sub> )				
(V <sub>meas</sub> )	(Q <sub>ref</sub> )	(V <sub>wf</sub> )	(Q <sub>wf</sub> )	(Y)	(ΔY)	(Q <sub>actual</sub> )	(ΔH <sub>g</sub> )	(ΔH <sub>g</sub> )	(ΔH <sub>g</sub> )
m <sup>3</sup>	m <sup>3</sup> /min	m <sup>3</sup>	m <sup>3</sup> /min			m <sup>3</sup> /min	mm H <sub>2</sub> O		
0.139	0.011	0.137	0.011	0.986	0.017	0.011	46.929	-0.077	
0.139	0.011	0.137	0.011	0.986	0.016	0.011	46.702	-0.304	
0.139	0.016	0.136	0.016	0.981	0.011	0.016	45.888	-1.118	
0.139	0.016	0.136	0.016	0.980	0.011	0.016	45.915	-1.091	
0.278	0.020	0.270	0.019	0.970	0.001	0.019	48.680	1.674	
0.278	0.020	0.267	0.019	0.960	-0.010	0.019	49.510	2.504	
0.279	0.027	0.270	0.026	0.967	-0.003	0.026	46.441	-0.565	
0.279	0.027	0.269	0.026	0.963	-0.007	0.026	46.462	-0.545	
0.281	0.031	0.268	0.030	0.954	-0.016	0.030	46.694	-0.313	
0.281	0.031	0.267	0.030	0.951	-0.019	0.030	46.840	-0.166	
		0.970	Y Average			47.006	ΔH <sub>g</sub> Average		

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.

For ΔH<sub>g</sub>, orifice pressure differential that equates to 0.75 cfm (0.0212 m<sup>3</sup>/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1 mm) H<sub>2</sub>O.

เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	24/12/2023	10:45 AM	Std Temp	293	K
Console Serial Number	0803018	Calibration Reference No.	SER23-12040			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	765.81			K <sub>1</sub>	0.386	
DGM Serial Number	00009766	Calibration Meter Gamma	0.999			Console Leak Check	PASS	



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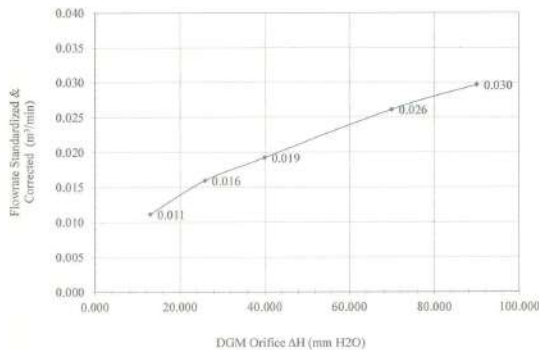


Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	24/12/2023	10:45 AM	Std Temp	293	K
Console Serial Number	0803018	Calibration Reference No.	SER23-12040			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	765.81 mmHg			K1	0.386	
DGM Serial Number	00009766	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Date: 24-12-2023

Calibration Reference No: SER23-12040

Meter Pressure vs Flowrate



Console Serial: 0803018

Console Model: XC-572-V



เอกสารไม่ควบคุม

THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions			
Console Model Number	XC-572-V	Date	Time	24/12/2023	00:45 PM
Console Serial Number	0803018	Calibration Reference No.	SER23-12040		
DGM Model Number	SK25EX	Reference Thermometer	DIGICON		
DGM Serial Number	00009766	Serial Number	183169105		
Meter Box Model Number	JENCO 765 KF				
Meter Box Serial Number	JC 16095				

Results										
Channel and test point	Console Thermocouple Simulator									
	Meter Box Channel Temperature Reading ( °C )									
Stack	-17.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	1038.0
Aux	-17.0	25.0	38.0	94.0	150.0					
Probe	-17.0	25.0	38.0	94.0	150.0					
Filter	-17.0	26.0	38.0	94.0	150.0					
Oven	-	-	-	-	-					
Exit	-17.0	26.0	38.0							

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



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Certificate No: G 660614  
Date of issue : 06-Oct-23

Instrument description : Flue Gas Analyzer  
Instrument model : Testo 350 New  
Control unit serial no. : 03099402/701  
Instrument serial no. : 60899617/701  
ID no. or control no. : UAE.FPM. 007/2560  
Manufacturer : Testo SE & Co. KGaA  
Probe description : -  
Probe model : -  
Probe serial no. : -  
Customer name : United Analyst and Engineering Consultant Co., Ltd.  
Customer address : 81 Soi Udomsuk 41, Sukhumvit Rd., Bangchak, Phrakhanong, Bangkok 10260

Total pages of certificate : 2 Pages  
Receiving no. : L-233264  
Receiving date : 26-Sep-23  
Parameter of calibration : Gas Calibration(Oxygen 2.498,10.04,21.02 %vol, Carbon Monoxide 80.14,302,1003 ppm, Nitrogen Dioxide 30.34,80.96,201.9 ppm, Nitric Oxide 30.01,151.5,322.5 ppm, Sulphur Dioxide 50.36,100.8,600.8 ppm)

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

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

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

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.  
This certificate is applied only to item under test Environmental condition.  
This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory.  
Calibration certificates without signature and seal not valid and The results relate only to the items tested/calibrated.  
This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 05-Oct-23

Mr. Kwanchai Khomduang  
Calibration Technician

Mrs. Nongluck Wongsettee  
Technical Manager



Certificate No.: G 660614

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen ( O2 ) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen ( O2 ) 10.04 % Vol	CG-0153-21	Nimtt	18-Nov-26
Oxygen ( O2 ) 21.02 % Vol	CG-0041-22	Nimtt	10-Feb-27
Carbon monoxide ( CO ) 80.14 ppm	CG-0040-22	Nimtt	14-Feb-27
Carbon monoxide ( CO ) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide ( CO ) 1003 ppm	2584/23	Linde	10-Sep-25
Nitrogen Dioxide ( NO2 ) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide ( NO2 ) 80.96 ppm	3240/21	Linde	26-Jun-24
Nitrogen Dioxide ( NO2 ) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide ( NO ) 30.01 ppm	CG-0014-23	Nimtt	19-Feb-25
Nitric Oxide ( NO ) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide ( NO ) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide ( SO2 ) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide ( SO2 ) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide ( SO2 ) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 22.1 °C Humidity : 66.7 %RH Pressure : 1009.4 mbar  
Calibration conditions  
Gas Temperature : 23 °C Flow rate : 1,100 ml/min Gas pressure : 1019.4 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty
O2 (%Vol)	2.498	2.48	-0.018	0.15
O2 (%Vol)	10.04	10.07	0.03	0.20
O2 (%Vol)	21.02	21.10	0.08	0.30
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	302	304	2	6.0
CO (ppm)	1003	1008	5	12
NO2 (ppm)	30.34	28.2	-2.14	8.0
NO2 (ppm)	80.96	80.5	-0.46	8.0
NO2 (ppm)	201.9	204.7	2.8	12
NO (ppm)	30.01	29	-1.01	8.0
NO (ppm)	151.5	152	0.5	8.0
NO (ppm)	322.5	322	-0.5	12
SO2 (ppm)	50.36	50	-0.36	6.0
SO2 (ppm)	100.8	103	2.2	6.0
SO2 (ppm)	600.8	606	5.2	13

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

End of Report



### Certificate of Calibration

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

Certificate No : 24-TPM-149  
Request No : Req-2024-0544

Page : 1/2

#### Unit Under Calibration Details

Calibration Parameter : Temperature  
Instrument Name : Thermal Environment Monitor  
Manufacturer : TSI QUEST  
Model : QT-32  
Serial Number : TPW010011  
Resolution : 0.1 °C  
ID Number : UAE.EFM.120/2565

Range Calibration : -20 °C to 60 °C  
Type of Sensor : RTD  
Sensor Diameter (mm) : 4.5  
Calibration Position (mm) : 67.5  
Instrument Status : Used

#### Calibration Environment and Details

Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 15 %RH  
Received Date : 5 March 2024  
Calibrated Date : 21 March 2024

Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/RTD100, SN: 12000077, ID: AR-TPM Which was calibrated on 27 October 2023, Calibration Certificate No. : QRC23-2574

Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0292

#### Note

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

Approved By :   
Mr. Noppadon Luangart  
Technical Manager  
Issue Date : 21 March 2024

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.  
136-108-TPM-01 Rev.01 Issue date 13/02/20

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Calibration Note :  
UUC Adjustment : Not Adjust

Certificate No : 24-TPM-149  
Request No : Req-2024-0544  
Page : 2/2

#### Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
WET	20.033	20.2	-0.2	0.13
	25.033	25.2	-0.2	0.13
	30.033	30.2	-0.2	0.13
	35.036	35.3	-0.2	0.13
	40.038	40.2	-0.2	0.13
	45.041	45.1	-0.1	0.13
	50.044	50.1	-0.1	0.13
	60.047	60.1	-0.1	0.13
DRY	20.032	20.2	-0.2	0.13
	25.033	25.2	-0.2	0.13
	30.034	30.2	-0.2	0.13
	35.036	35.2	-0.2	0.13
	40.038	40.2	-0.2	0.13
	45.039	45.0	0.0	0.13
	50.043	50.0	0.0	0.13
	60.047	60.0	0.0	0.13
GLOBE	20.031	20.2	-0.2	0.13
	25.033	25.2	-0.2	0.13
	30.034	30.2	-0.2	0.13
	35.037	35.2	-0.2	0.13
	40.038	40.2	-0.2	0.13
	45.041	45.0	0.0	0.13
	50.044	50.0	0.0	0.13
	60.048	60.0	0.0	0.13

End of Certificate

Calibrated By :   
Mr. Sirinchoek Jirapokdeesakul

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.  
136-108-TPM-01 Rev.01 Issue date 13/02/20

เอกสารไม่ควบคุม



### Certificate of Calibration

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

Certificate No : 23-TPM-483  
Request No : Req-2023-2174

Page : 1/2

#### Unit Under Calibration Details

Calibration Parameter : Temperature  
Instrument Name : Thermal Environment Monitor  
Manufacturer : 3M  
Model : QT-32  
Serial Number : TPS030806  
Resolution : 0.1 °C  
ID Number : UAE.EFM.081/2561

Range Calibration : -20 °C to 60 °C  
Type of Sensor : RTD  
Sensor Diameter (mm) : 4.5  
Calibration Position (mm) : 67.5  
Instrument Status : Used

#### Calibration Environment and Details

Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 15 %RH  
Received Date : 11 October 2023  
Calibrated Date : 17 October 2023

Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/RTD100, SN: 08000057, ID: 02-TPM Which was calibrated on 27 February 2023, Calibration Certificate No. : QRC23-0494

Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0292

#### Note

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

Approved By :   
Mr. Noppadon Luangart  
Technical Manager  
Issue Date : 17 October 2023

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.  
136-108-TPM-01 Rev.01 Issue date 13/02/20

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Calibration Note :  
UUC Adjustment : Not Adjust

Certificate No : 23-TPM-483  
Request No : Req-2023-2174  
Page : 2/2

#### Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
WET	20.031	19.9	+0.1	0.13
	25.033	24.9	+0.1	0.13
	30.035	29.8	+0.2	0.13
	35.037	34.8	+0.2	0.13
	40.039	39.9	+0.1	0.13
	45.040	44.9	+0.1	0.13
	50.044	49.9	+0.1	0.13
	60.048	59.8	+0.2	0.13
DRY	20.033	19.9	+0.1	0.13
	25.035	24.9	+0.1	0.13
	30.034	29.9	+0.1	0.13
	35.036	34.9	+0.1	0.13
	40.038	40.0	0.0	0.13
	45.041	45.0	0.0	0.13
	50.044	50.0	0.0	0.13
	60.046	59.9	+0.1	0.13
GLOBE	20.031	19.9	+0.1	0.13
	25.033	24.9	+0.1	0.13
	30.034	29.8	+0.2	0.13
	35.036	34.8	+0.2	0.13
	40.040	39.9	+0.1	0.13
	45.041	44.9	+0.1	0.13
	50.042	49.9	+0.1	0.13
	60.047	59.8	+0.2	0.13

End of Certificate

Calibrated By :   
Mr. Sirinchoek Jirapokdeesakul

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.  
136-108-TPM-01 Rev.01 Issue date 13/02/20

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### Certificate of Calibration

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

**Certificate No :** 24-TPM-043  
**Request No :** Req-2023-2688

Page : 1/2

#### Unit Under Calibration Details

Calibration Parameter : Temperature  
Instrument Name : Thermal Environment Monitor  
Manufacturer : TSI QUEST  
Model : QT-32  
Serial Number : TPT060013  
Resolution : 0.1 °C  
ID Number : UAE.EFM.220/2562  
Range Calibration : 20 °C to 60 °C  
Type of Sensor : RTD  
Sensor Diameter (mm) : 4.5  
Calibration Position (mm) : 67.5  
Instrument Status : Used

#### Calibration Environment and Details

Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 15 %RH  
Received Date : 21 December 2023  
Calibrated Date : 23 January 2024  
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

**Reference Standard** : Digital Thermometer with Sensor, Manufacturer: GINGO-GINGO, Model: GT11/RTD100, SN: 08000657, ID: 02-TPM Which was calibrated on 27 February 2023, Calibration Certificate No. : QR23-0494  
**Traceability** : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0292

#### Note

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

Approved By :  
Mr. Noppadon Luangari  
Technical Manager  
Issue Date : 23 January 2024

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.

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**Certificate No :** 24-TPM-049  
**Request No :** Req-2023-2691  
Page : 2/2

#### Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty ±0.13
WET	20.033	20.1	-0.1	0.13
	25.033	25.1	-0.1	0.13
	30.035	30.1	-0.1	0.13
	35.036	35.1	-0.1	0.13
	40.039	40.2	-0.2	0.13
	45.040	45.2	-0.2	0.13
	50.043	50.2	-0.2	0.13
DRY	60.047	60.2	-0.2	0.13
	20.011	20.2	-0.2	0.13
	25.032	25.2	-0.2	0.13
	30.035	30.2	-0.2	0.13
	35.036	35.2	-0.2	0.13
	40.039	40.3	-0.3	0.13
	45.040	45.3	-0.3	0.13
GLOBE	50.042	50.3	-0.3	0.13
	60.052	60.3	-0.2	0.13
	20.032	20.1	-0.1	0.13
	25.032	25.1	-0.1	0.13
	30.035	30.1	-0.1	0.13
	35.035	35.1	-0.1	0.13
	40.039	40.2	-0.2	0.13
	45.040	45.1	-0.1	0.13
	50.044	50.1	-0.1	0.13
	60.045	60.1	-0.1	0.13

End of Certificate

Calibrated By :  
Mr. Sittichak Jirapaksasakul

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.

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### Certificate of Calibration

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

**Certificate No :** 24-AFM-010 Rev.1  
**Request No :** Req-2023-2235

#### Unit Under Calibration Details

Measurement Item : Air Flow Meter  
Manufacturer : TSI  
Model : 4146  
Serial Number : 41461922008  
ID : UAE.EFM.224/2562  
Sensor Model : -  
Sensor Serial Number : -  
Location of Calibration : LAB 4 AIR VELOCITY METER

#### Calibration Environment and Details

Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 18 October 2023  
Calibration Date : 23 January 2024  
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	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	08000657	Qreborn	27 February 2024
Pressure meter	CPG2400	41000KDU/651882	TPA	9 November 2024

#### Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 2943.01.

#### Note :

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor  $k = 2$ , providing a level of confidence approximately 95 %.  
This Certificate was issued to replace to Calibration Certificate No. 24-AFM-010

Calibration By :  
Mr. Noppadon Luangari  
Service Calibration Engineer

Approved By :  
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 24 April 2024

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.

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**Certificate No :** 24-AFM-010 Rev.1  
**Request No :** Req-2023-2235

#### Result of Calibration :

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Uncertainty (l/min)
24.40	101.19	0.020	0.020	0.000	0.0013
24.30	101.15	0.050	0.050	0.000	0.0033
24.40	101.12	0.099	0.100	0.001	0.0028
24.50	100.95	0.200	0.202	0.002	0.0056
24.60	100.91	0.501	0.500	-0.001	0.0074
26.60	100.96	0.994	1.000	0.006	0.015
24.50	100.90	1.691	1.701	0.010	0.025
24.60	100.92	1.997	2.011	0.014	0.029
26.60	101.20	2.993	3.020	0.027	0.042
24.50	101.20	4.019	4.000	-0.019	0.056
24.60	101.20	5.024	5.006	-0.018	0.070

#### Note

STD : Standard UUC : Unit Under Calibration  
- UUC Reference Condition : At 21.1 °C, 101.3 kPa, Air  
- Flow Rate was corrected for non-standard operating condition by using equation :

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

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature  
Meas = Measurement Condition ref = Standard Condition

\* Indicates non accredited

End of Certificate

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.

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## Certificate of Calibration

Certificate No. : 24P1370  
Page : 1 of 2

Equipment : Aneroid Barometer  
Manufacturer: Barigo  
Model : 111MS  
Serial No. : -  
ID No. : UAE.EMA2,065/2552

Condition As-Received: Used Item  
Received Date: 05 April 2024  
Calibration Date: 22 April 2024

Reference: 2404-0243WSC  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1007 mbar  
Submitted by: United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260

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

### Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DPI142	1422505046	MP-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.Scale and conversion factor is 1 kPa = 7,50062 mmHg

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew  
Issue Date : 23 April 2024

Approved Signatory :  
[ ] Phalinee Prathpalai  
[ ] Sura Suwannasri  
[✓] Attapol Panurach

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Cert.No.: 24P1370  
Page: 2 of 2

### Result of calibration:- Without adjustment

Range: 720 mmHg to 770 mmHg

### Function:- Absolute Pressure Measurement

Scale Interval: 1 mmHg ( The Fifth Estimate )

#### Increasing Pressure

Applied Pressure (mmHg)	715,75	726,88	738,53	749,84	761,99	774,19
UUC* Indication (mmHg)	720,0	730,0	740,0	750,0	760,0	770,0
Error (mmHg)	4,25	3,12	1,47	0,16	-1,99	-4,19

#### Decreasing Pressure

Applied Pressure (mmHg)	774,19	761,85	749,40	738,00	726,53	715,75
UUC* Indication (mmHg)	770,0	760,0	750,0	740,0	730,0	720,0
Error (mmHg)	-4,19	-1,85	0,60	2,00	3,47	4,25

The uncertainty of measurement was ± 0,24 mmHg

\* UUC = Unit Under Calibration

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

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## Certificate of Calibration

Certificate No. : 23H1200  
Page : 1 of 2

Equipment : Dial Thermo-Hygrometer  
Manufacturer: Barigo  
Model : -  
Serial No. : -  
ID No. : UAE.ANV.130/2550

Condition As-Received: Used Item  
Received Date: 26 May 2023  
Calibration Date: 30 May 2023  
to 06 June 2023

Reference: 2305-0919WSC  
Ambient Temperature: ( 25 ± 3 ) °C  
Relative Humidity: ( 50 ± 20 ) %  
Submitted by: United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

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

### Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Hygro-M2 Dew Point Monitor	5112	2360195	20703	02 Aug 2023
2) Handheld Thermometer With Sensor	1523	3240076	231305	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), NSQ-ONSQ Accredited No. Calibration 0008

Calibrated by : Somchai Durmoo  
Issue Date : 07 June 2023

Approved Signatory :  
[✓] Chakrit Waewwanjua  
[ ] Ponthippa Tameyakul  
[ ] Viporn Tantiyawutti

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Cert. No.: 23H1200  
Page: 2 of 2

### Result of Calibration:-

Before Adjustment

### Function:

Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	48	7.9	1.6
25.0	60.0	63	3.0	1.7
25.0	80.0	76	-4.0	1.9

### Result of Calibration:-

After Adjustment

### Function:

Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	44	3.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	75	-5.0	1.9

### Result of Calibration:-

Without Adjustment

### Function:

Temperature Measurement

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	39.5	-0.444	0.72

UUC\* : Unit Under Calibration

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

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Certificate of Calibration

Customer

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

Certificate No : 24-ACT-038  
Request No : Req-2024-0579

Unit Under Calibration Details

Measurement item : Acoustic Calibrator  
Manufacturer : SVANTEK  
Model : SV 35  
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 : 8 March 2024  
Calibration Date : 25 March 2024  
Location of Calibration : LAB 1 Acoustic  
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEL	31 May 2024
THD Multimeter	2015	1047765	NIMT	16 January 2025

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

Note

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

Calibrated By :   
Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By :   
Mr. Paeit Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 25 March 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the head of Calibration Laboratory.  
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INA-708-ACT-02 Rev.01 Issue date:8/23

Certificate No : 24-ACT-038  
Request No : Req-2024-0579

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Deviated value	Measured	Deviated value		
94 dB / 1000 Hz	94.02	0.02	-	-	0.13	0.25
114 dB / 1000 Hz	114.02	0.02	-	-	0.13	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Deviated value	Measured (Hz)	Deviated value		
94 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70
114 dB / 1000 Hz	1000.00	0.00	-	-	0.01	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 :

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

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

End of Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the head of Calibration Laboratory.  
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INA-708-ACT-02 Rev.01 Issue date:8/23

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

451-451/1 Srinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email : calibration@sithiporn.com



Cert. No. : ACL24048  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00321434 / 156124 / 11454  
ID No.: UAE.EMA2.083/2555

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 : 21 DECEMBER 2023  
Calibration Date : 18-19 JANUARY 2024  
Date of Issue : 22 JANUARY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :   
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.  
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SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

451-451/1 Srinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email : calibration@sithiporn.com



Cert. No. : ACL24048  
Job No. : VC67AC0034  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow 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-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EELBP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EELBP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EELBP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

- This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
- This certificate is traceable to the international system of unit maintained at :
  - National Institute of Metrology (Thailand).
  - Thailand Institute of Scientific and Technological Research (TISTR).

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## Summary of Measurement Result :

Parameter	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

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T. Kewin

## 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	Acceptance Limits
63	0.0	-0.1	-0.1	±2.0
125	-0.1	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

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T. Kewin

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.98)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
15.7

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

Frequency Weighting	Measured value ( dB )
A - weight	11.6
C - weight	17.8
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	Acceptance Limits
125	0.0	0.0	0.0	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.0	1.0	1.1	±5.0

เอกสารไม่ควบคุม  
T. Kewin

## 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	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

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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
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	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, Lcpeak ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.6	-0.8	±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	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

เอกสารไม่ควบคุม  
T. Ketchur

Cert. No. : ACL24058  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00609500 / 189689 / 01126  
ID No. : UAE.EFM.018/2564

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 : 21 DECEMBER 2023  
Calibration Date : 18-19 JANUARY 2024  
Date of Issue : 22 JANUARY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Ketchur  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

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T. Ketchur

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11. Overload indication

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

เอกสารไม่ควบคุม  
T. Ketchur

Cert. No. : ACL24058  
Job No. : VC67AC0034  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow 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-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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).

## Summary of Measurement Result :

Parameter	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

เอกสารไม่ควบคุม

## 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	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.1	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

เอกสารไม่ควบคุม

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
18.2

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

Frequency Weighting	Measured value (dB)
A - weight	14.4
C - weight	20.7
Flat	26.5

## 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	Acceptance Limits
125	0.0	0.0	0.0	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	1.4	1.5	1.5	±5.0

เอกสารไม่ควบคุม

## 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	34.1	0.1	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.2	0.2	± 1.1
28.0	28.2	0.2	± 1.1
27.0	27.3	0.3	± 1.1
26.0	26.4	0.4	± 1.1
25.0	25.5	0.5	± 1.1

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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, L <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.3	-0.1	±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	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

เอกสารไม่ควบคุม

Cert. No. : ACL24050  
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Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00408980 / 186170 / 90425  
ID No.: UAE.EFM.007/2564

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 : 21 DECEMBER 2023

Calibration Date : 18-19 JANUARY 2024

Date of Issue : 22 JANUARY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchurai  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

เอกสารไม่ควบคุม

Cert. No. : ACL24058  
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11. Overload indication

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

เอกสารไม่ควบคุม

Cert. No. : ACL24050  
Job No. : VC67AC0034  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow 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-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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).

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Cert. No. : ACL24050  
Job No. : VC67AC0034  
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## Summary of Measurement Result :

Parameter	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

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## 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	Acceptance Limits
63	-0.1	-0.1	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

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T. KewinCert. No. : ACL24050  
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## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.98)	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	12.0
C - weight	18.9
Flat	24.2

## 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	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	1.8	1.9	1.8	±5.0

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Job No. : VC67AC0034  
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## 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	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 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	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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T. Kewin

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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
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	128.0	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	±3.0
One	136.4	136.1	-0.3	±3.0

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.1	0.1	±2.0
Positive half cycle	135.4	135.3	-0.1	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

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Cert. No. : ACL24050  
Job No. : VC67AC0034  
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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INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE  
7/19 MOO 13, SOI SINTINAKORN 11 TAMBON BANG KAEU,  
AMPHOE BANG PHI SAMUT PRAKAN PROVINCE 10540 THAILAND  
TEL: 0660-2116-5860-1 FAX: 0660-2116-7140



Certificate of Calibration

Certificate No : 24-LXM-050

Request No : Req-2024-0181

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

Unit Under Calibration Details

Instrument Name : Light Meter  
Manufacturer : EXTECH  
Model : 407026  
Serial Number : A037236  
Resolution : 1 lx  
ID Number : UAE.EFM.084/25561

Range Calibration : 2000 , 20000 lx  
Instrument Status : Used

Calibration Environment and Details

Temperature : 25 °C ± 2 °C  
Humidity : 60 %RH ± 20 %RH  
Received Date : 26 January 2024  
Calibrated Date : 29 February 2024  
Calibration Procedure : The measurement was done in accordance with CP-LXM-01

**Reference Standard** : Photometer and Illuminance Sensor, Serial No.: 30662/2, 30592/2, which was calibrated on 31 October 2023, Certificate No.: TP-1045-23

**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 :   
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 13 May 2024

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INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE  
7/19 MOO 13, SOI SINTINAKORN 11 TAMBON BANG KAEU,  
AMPHOE BANG PHI SAMUT PRAKAN PROVINCE 10540 THAILAND  
TEL: 0660-2116-5860-1 FAX: 0660-2116-7140



Calibration Note

EUC Adjustment : Zero adjustment before use

Certificate No : 24-LXM-050

Request No : Req-2024-0181

Page : 2/2

Result of Calibration :

UUC Range (lx)	Standard (lx)	UUC Reading (lx)	Correction (lx)	Uncertainty (± lx)
2000	0	0	0	0.0058
	50	50	0	2.2 % of Reading
	100	100	0	2.2 % of Reading
	200	201	-1	2.2 % of Reading
	300	301	-1	2.2 % of Reading
	400	403	-3	2.2 % of Reading
	600	604	-4	2.2 % of Reading
	800	803	-3	2.2 % of Reading
	1000	1005	-5	2.2 % of Reading
	1200	1205	-5	2.2 % of Reading
	1400	1407	-7	2.2 % of Reading
	1600	1599	1	2.2 % of Reading
	1800	1796	4	2.2 % of Reading
	2000	1990	10	2.2 % of Reading
	3000	2980	20	2.2 % of Reading
20000	4000	3960	40	2.2 % of Reading
	5000	4940	60	2.2 % of Reading

\* Indicates non accredited

End of Certificate

Calibrated By :   
Mr. Noppadol Luangart

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Certificate of Calibration

Customer

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

Certificate No : 24-NDM-107  
Request No : Req-2024-0832

Unit Under Calibration Details

Measurement item : Noise Downstream Microphone Class : 2  
Manufacturer : SVANTER Microphone Model : SV27  
Model : SV 104 Microphone S/N : 112806  
Serial Number : 117693 Preamplifier Model : -  
ID : UAE.EFM.115.2565 Preamplifier S/N : -  
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 10 April 2024  
Calibrated Date : 26 April 2024  
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017  
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Multi-frequency Calibrator	Quest	Questcal	EFA000234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Sine Generator	Svantek	Sva491	131	9 October 2024	WK Electric
Timer	EXTech	-	05-ACT	14 March 2025	TPA

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

Calibrated By :   
Mr. Noppadon Luangrat  
Service Calibration Engineer

Approved By :   
Mr. Pacht Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 26 April 2024

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

PM-708-NDM-01 Rev.02 Issue date: 11/23

Certificate No : 24-NDM-107  
Request No : Req-2024-0832

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	(%)	Limit
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
1000 Hz 114 dB	120	120	3.18	3.13	-1.6	3.1	-21, +26

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances
FAST / 55-140	A	C	(± dB)	(± dB)
STD Setting	(dB)	(dB)		
63 Hz	0.2	0.2	0.40	2.0
125 Hz	-0.2	0.0	0.40	1.5
250 Hz	0.0	0.2	0.40	1.5
500 Hz	0.1	0.2	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.1	0.2	0.40	2.0
4000 Hz	2.3	2.4	0.40	3.0
8000 Hz	0.7	0.7	0.40	5.0

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

PM-708-NDM-01 Rev.02 Issue date: 11/23

Certificate No : 24-NDM-107  
Request No : Req-2024-0832

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting	FAST / A / High									
1000 Hz	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0
Level A	(dB)	54.6	80.1	90.1	100.0	110.0	114.0	120.0	130.0	140.0
Error	(dB)	-0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9
Level A	(dB)				88.9	98.9	108.9	112.9	118.9	128.9
Error	(dB)				0.0	0.0	0.0	0.0	0.0	-0.1
63 Hz	Ref	(dB)					87.8	93.8	103.8	113.8
Level A	(dB)						87.8	93.8	103.8	113.8
Error	(dB)						0.0	0.0	0.0	0.0
Tolerances Limit	(±dB)						1.0			
UNCERTAINTY	(±dB)						0.3			

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	(%)	Limit
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)		
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	0.99	-1.00		
1000 Hz 110 dB	180	180	2.00	1.98	-1.00		
1000 Hz 120 dB	36	36	4.00	3.94	-1.50		
1000 Hz 120 dB	72	72	8.00	7.87	-1.63		
1000 Hz 120 dB	90	90	10.00	9.90	-1.00		
1000 Hz 120 dB	180	180	20.00	19.76	-1.20	5.6	
1000 Hz 120 dB	360	360	40.00	39.42	-1.45		
1000 Hz 120 dB	720	720	80.00	78.66	-1.68		

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

PM-708-NDM-01 Rev.02 Issue date: 11/23

Certificate No : 24-NDM-107  
Request No : Req-2024-0832

4. Response to short duration

a. Response for sinusoidal signals – reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	(%)	Limit
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.052	-0.29, +0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	(%)	Limit
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00		-21, +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00	5.6	-29, +41
Burst 1 ms, 108 dB	143	143	1.00	1.01	+1.00		-29, +41

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Different	(%)	Limit
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
Continuous Rectangle +			10.13				-21, +26
Continuous Rectangle -	29		10.13		0.00	3.7	

\* Indicates non accredited

End of Certificate

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

PM-708-NDM-01 Rev.02 Issue date: 11/23





Certificate of Calibration

Customer

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

Certificate No : 24-NDM-104  
Request No : Req-2024-0718

Unit Under Calibration Details

Measurement item : Noise Dosimeter  
Manufacturer : SVANTEK  
Model : SV 104  
Serial Number : 117696  
ID : UAEJFM1172565  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : SV27  
Microphone SN : 112804  
Preamplifier Model : -  
Preamplifier SN : -  
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 28 March 2024  
Calibrated Date : 25 April 2024  
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017  
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Multifrequency Calibrator	Quest	Questval	EFA000234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Sine Generator	Svantsk	Svan401	131	9 October 2024	WK Electric
Timer	EXTECH	-	05-ACT	14 March 2025	TPA

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. Pachi Mahavorn  
Calibration Engineer Supervisor  
Issue Date : 25 April 2024

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

INA-708-NDM-01 Rev.02 Issue date:7/11/23

Certificate No : 24-NDM-104  
Request No : Req-2024-0718

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
Calibrator Setting							
1000 Hz 114 dB	120	120	3.18	3.20	+0.6	3.1	-21, +26

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
	A	C		
FAST / 55-140	(dB)	(dB)	(± dB)	(± dB)
STD Setting				
63 Hz	0.1	0.1	0.40	2.0
125 Hz	-0.2	0.0	0.40	1.5
250 Hz	0.0	0.1	0.40	1.5
500 Hz	0.1	0.3	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.3	0.3	0.40	2.0
4000 Hz	2.0	2.1	0.40	3.0
8000 Hz	0.8	0.8	0.40	5.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.  
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INA-708-NDM-01 Rev.02 Issue date:7/11/23

Certificate No : 24-NDM-104  
Request No : Req-2024-0718

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting	FAST / A / High											
	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0	
1000 Hz	Level A	(dB)	54.5	80.1	90.1	100.0	110.0	114.0	119.9	129.9	139.9	
	Error	(dB)	-0.5	0.1	0.1	0.0	0.0	0.0	-0.1	-0.1	-0.1	
	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9	
8000 Hz	Level A	(dB)			89.0	98.9	108.9	112.9	118.9	128.9	138.9	
	Error	(dB)			0.1	0.0	0.0	0.0	0.0	0.0	-0.1	
	Ref	(dB)					87.8	93.8	103.8	113.8		
63 Hz	Level A	(dB)					87.8	93.7	103.7	113.7		
	Error	(dB)					0.0	-0.1	-0.1	-0.1		
Tolerances Limit		(±dB)	1.0									
UNCERTAINTY		(±dB)	0.3									

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	0.99	-1.00		
1000 Hz 110 dB	180	180	2.00	1.98	-1.00		
1000 Hz 120 dB	36	36	4.00	3.94	-1.50		
1000 Hz 120 dB	72	72	8.00	7.87	-1.63	5.6	
1000 Hz 120 dB	90	90	10.00	9.90	-1.00		
1000 Hz 120 dB	180	180	20.00	19.76	-1.20		
1000 Hz 120 dB	360	360	40.00	39.42	-1.45		
1000 Hz 120 dB	720	720	80.00	78.66	-1.68		

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

INA-708-NDM-01 Rev.02 Issue date:7/11/23

Certificate No : 24-NDM-104  
Request No : Req-2024-0718

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)
Calibrator Setting							
4000 Hz 95 dB	2846	2846	1.00	0.98	-0.02	0.052	-0.29, +0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
Calibrator Setting							
Burst 1 ms, 95 dB	2846	2846	1.00	0.98	-2.00	5.6	-21, +26
Burst 1 ms, 100 dB	900	900	1.00	0.98	-2.00		-29, +41
Burst 1 ms, 108 dB	143	143	1.00	0.99	-1.00		-29, +41

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Different		
FAST / A / 55-140	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
Calibrator Setting							
Continuous Rectangle +	29		10.13		0.00	3.7	-21, +26
Continuous Rectangle -			10.13				

\* Indicates non accredited

End of Certificate

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


INA-708-NDM-01 Rev.02 Issue date:7/11/23




Certificate of Calibration					
Customer					
Name	UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.			Certificate No :	24-NDM-106
Address	81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260			Request No :	Req-2024-0831
Unit Under Calibration Details					
Measurement item :	Noise Dosimeter	Microphone Class :	2		
Manufacturer :	SVANTEK	Microphone Model :	SV27		
Model :	SV 104	Microphone S/N :	73969		
Serial Number :	117721	Preamplifier Model :	-		
ID :	UAE.UFM.1182565	Preamplifier S/N :	-		
Resolution :	0.1 dB	Instrument Status :	Used		
Calibration Environment and Details					
Temperature :	23 °C ± 2 °C				
Humidity :	50 %RH ± 20 %RH				
Barometric Pressure :	1013 hPa ± 10 hPa				
Received Date :	10 April 2024				
Calibrated Date :	26 April 2024				
Calibration Procedure :	In-house method CP-NDM-01 based on IEC 61252 : 2017				
Location of Calibration :	Lab Acoustic				
Reference Standard					
Instrument	Brand	Model	SN	Due calibration	Traceability
Multi-frequency Calibrator	Quest	Quest-cal	EFA000234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Sine Generator	Svantek	Svan401	131	9 October 2024	WK Electric
Timer	EXTECH	-	05-ACT	14 March 2025	TPA

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. Noppadol Luangart  
Service Calibration Engineer

Approved By :   
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor

Issue Date : 26 April 2024

Certificate No : 24-NDM-106							
Request No : Req-2024-0831							
1. Absolute acoustical sensitivity							
UUC Setting		Time		Exposure Measurement			UNCERTAINTY Limit
FAST / A / 55-140		Ref	UUC	Ref	UUC	Error	
Calibrator Setting		(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)
1000 Hz 114 dB		120	120	3.18	3.13	+1.6	3.1
Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079							
2. Frequency weightings							
UUC Setting		Deviation from various Frequency Weighting		UNCERTAINTY		Tolerances	
FAST / A / 55-140		A	C	(± dB)		(± dB)	
STD Setting		(dB)	(dB)				
563 Hz		-0.2	-0.1	0.40		2.0	
125 Hz		0.0	0.2	0.40		1.5	
250 Hz		-0.1	0.1	0.40		1.5	
500 Hz		-0.1	0.1	0.40		1.5	
1000 Hz		0.0	0.0	0.40		-	
2000 Hz		0.4	0.5	0.40		2.0	
4000 Hz		2.1	2.3	0.40		3.0	
8000 Hz		0.3	0.4	0.40		5.0	

Certificate No : 24-NDM-106

Request No : Req-2024-0831

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting		FAST / A / High										
1000 Hz	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0	
	Level A	(dB)	54.7	80.1	90.1	100.0	110.0	114.0	119.9	129.9	139.9	
	Error	(dB)	-0.3	0.1	0.1	0.0	0.0	0.0	-0.1	-0.1	-0.1	
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9	
	Level A	(dB)			89.0	98.9	108.9	112.9	118.9	128.9	138.9	
	Error	(dB)			0.1	0.0	0.0	0.0	0.0	0.0	-0.1	
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8	
	Level A	(dB)						87.8	93.8	103.8	113.8	
	Error	(dB)						0.0	0.0	0.0	0.0	
Tolerances Limit		(±dB)	1.0									
UNCERTAINTY		(±dB)	0.3									

b. Sound exposure meter linearity of error

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 55-140		Ref	UUC	Ref	UUC	Error		
Calibrator Setting		(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
1000 Hz 116 dB		27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB		45	45	0.50	0.50	0.00		
1000 Hz 110 dB		90	90	1.00	0.99	-1.00		
1000 Hz 110 dB		180	180	2.00	1.98	-1.00		
1000 Hz 120 dB		36	36	4.00	3.94	-1.50		
1000 Hz 120 dB		72	72	8.00	8.05	+0.63	5.6	
1000 Hz 120 dB		90	90	10.00	9.90	-1.00		
1000 Hz 120 dB		180	180	20.00	19.76	-1.20		
1000 Hz 120 dB		360	360	40.00	39.42	-1.45		
1000 Hz 120 dB		720	720	80.00	78.66	-1.68		

Certificate No : 24-NDM-106

Request No : Req-2024-0831

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.052	-0.29 ~ +0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00	5.6	-21 ~ +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00		-29 ~ +41
Burst 1 ms, 108 dB	143	143	1.00	1.01	+1.00		-29 ~ +41

5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement		UNCERTAINTY	Tolerances Limit
FAST / A / 55-140	UUC	UUC	Different		
Calibrator Setting	(s)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
Continuous Rectangle +	29	10.13	+2.37	3.7	-21 ~ +26
Continuous Rectangle -		10.37			

\* Indicates non accredited

End of Certificate

Certificate of Calibration

Customer

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

Certificate No : 24-NDM-109  
Request No : Req-2024-0834

Unit Under Calibration Details

Measurement item : Noise Dosimeter  
Manufacturer : SVANTEK  
Model : SV 104  
Serial Number : 117739  
ID : UAE.EFM.119.2565  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : SV27  
Microphone S/N : 77362  
Preamplifier Model : -  
Preamplifier S/N : -  
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 10 April 2024  
Calibrated Date : 26 April 2024  
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017  
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Multi-frequency Calibrator	Quest	Quest-cal	EFA000234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Sine Generator	SvanteK	Svan401	131	9 October 2024	WK Electric
Timer	EXTech	-	05-ACT	14 March 2025	TPA

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. Noppadol Luangrat  
Service Calibration Engineer

Approved By :   
Mr. Pacht Mathuvorn  
Calibration Engineer Supervisor  
Issue Date : 26 April 2024

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

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PSA-708-NDM-01 Rev.02 Issue date:7/11/23

Certificate No : 24-NDM-109  
Request No : Req-2024-0834

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	Limit
1000 Hz 114 dB	120	120	3.18	3.13	-1.6	3.1	-21, +26

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances
	A	C		
FAST / A / 55-140	(dB)	(dB)	(± dB)	(± dB)
STD Setting				
63 Hz	-0.1	-0.1	0.40	2.0
125 Hz	0.0	0.2	0.40	1.5
250 Hz	0.0	0.1	0.40	1.5
500 Hz	0.0	0.1	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.2	0.2	0.40	2.0
4000 Hz	1.5	1.5	0.40	3.0
8000 Hz	0.4	0.4	0.40	5.0

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PSA-708-NDM-01 Rev.02 Issue date:7/11/23

Certificate No : 24-NDM-109  
Request No : Req-2024-0834

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting	FAST / A - High									
	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0
1000 Hz	Level A	(dB)	54.7	80.1	90.1	100.0	110.0	114.0	120.0	130.0
	Error	(dB)	-0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9
	Level A	(dB)			88.9	98.9	108.9	112.9	118.9	128.9
	Error	(dB)			0.0	0.0	0.0	0.0	0.0	-0.1
63 Hz	Ref	(dB)						87.8	93.8	103.8
	Level A	(dB)						87.8	93.8	103.8
	Error	(dB)						0.0	0.0	0.0
Tolerances Limit		(±dB)	1.0							
UNCERTAINTY		(±dB)	0.3							

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	1.01	+1.00		
1000 Hz 110 dB	180	180	2.00	2.02	+1.00		
1000 Hz 120 dB	36	36	4.00	4.03	+0.75		
1000 Hz 120 dB	72	72	8.00	8.05	+0.63		
1000 Hz 120 dB	90	90	10.00	10.13	+1.30	5.8	
1000 Hz 120 dB	180	180	20.00	20.22	+1.10		
1000 Hz 120 dB	360	360	40.00	40.34	+0.85		
1000 Hz 120 dB	720	720	80.00	80.49	+0.61		

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PSA-708-NDM-01 Rev.02 Issue date:7/11/23

Certificate No : 24-NDM-109  
Request No : Req-2024-0834

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	Limit
Calibrator Setting							(Pa <sup>2</sup> h)
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.052	-0.29 - +0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	Limit
Calibrator Setting							(%)
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00	5.6	-21 - +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00		-29 - +41
Burst 1 ms, 108 dB	143	143	1.00	1.01	+1.00		-29 - +41

5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	UUC	UUC	Different			
Calibrator Setting	(s)	(Pa h)	(%)	(%)	(%)	
Continuous Rectangle +	29	10.13	0.00	3.7	-21 - +26	
Continuous Rectangle -		10.13				

\* Indicates non accredited

End of Certificate

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

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PSA-708-NDM-01 Rev.02 Issue date:7/11/23



Certificate of Calibration

Customer

Name UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 23-NDM-180  
Address 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260 Request No : Req-2023-1488

Unit Under Calibration Details

Measurement item : Noise Dosimeter Microphone Class : 2  
Manufacturer : SVANTEK Microphone Model : SV 27  
Model : SV 104 Microphone S/N : 132120  
Serial Number : 143226 Preamplifier Model : -  
ID : - Preamplifier S/N : -  
Resolution : 0.1 dB Intrument Status : New

Calibration Environment and Details


Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 12 July 2023  
Calibrated Date : 7 August 2023  
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017  
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	188272	25 July 2024	TSL
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Sine Generator	Svantek	Svan401	131	12 October 2023	WK Electric
Timer	EXTECH	-	05-ACT	20 March 2024	TPA

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. Noppadol Luangant  
Calibration Officer

Approved By :   
Mr. Patch Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 7 August 2023

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 : 23-NDM-180  
Request No : Req-2023-1488

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref (Pa <sup>1</sup> h)	UUC (Pa <sup>2</sup> h)	Error (%)		
FAST / A / 55-140 Calibrator Setting	(a)	(a)	3.18	3.20	+0.63	3.1	+21, +26

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN: 38079

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY (± dB)	Tolerances Limit (± dB)
	A (dB)	C (dB)		
FAST / 55-140 STD Setting	(dB)	(dB)	(± dB)	(± dB)
63 Hz	0.0	0.1	0.40	2.0
125 Hz	-0.2	0.3	0.40	1.5
250 Hz	-0.6	-0.1	0.40	1.5
500 Hz	-0.4	0.0	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.3	0.7	0.40	2.0
4000 Hz	1.8	1.9	0.40	3.0
8000 Hz	-2.3	-2.4	0.40	5.0

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Certificate No : 23-NDM-180  
Request No : Req-2023-1488

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting	FAST / A / High											
	Ref (dB)	55.0 (dB)	80.0 (dB)	90.0 (dB)	100.0 (dB)	110.0 (dB)	114.0 (dB)	120.0 (dB)	130.0 (dB)	140.0 (dB)		
1000 Hz	Level A	54.5	80.1	90.1	100.1	110.1	114.0	120.0	130.0	140.0		
	Error	-0.5	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0		
	Ref	(dB)		88.9	98.9	108.9	112.9	118.9	128.9	138.9		
8000 Hz	Level A	(dB)		89.0	99.0	109.0	112.9	118.9	128.9	138.8		
	Error	(dB)		0.1	0.1	0.0	0.0	0.0	0.0	-0.1		
	Ref	(dB)					87.8	93.8	103.8	113.8		
63 Hz	Level A	(dB)					87.8	93.8	103.7	113.7		
	Error	(dB)					0.0	0.0	-0.1	-0.1		
	Tolerances Limit	(±dB)					1.0					
UNCERTAINTY		(±dB)					0.3					

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref (Pa <sup>1</sup> h)	UUC (Pa <sup>2</sup> h)	Error (%)		
FAST / A / 55-140 Calibrator Setting	(a)	(a)	(Pa <sup>1</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	0.99	-1.00		
1000 Hz 110 dB	180	180	2.00	1.98	-1.00		
1000 Hz 120 dB	36	36	4.00	4.03	+0.75		
1000 Hz 120 dB	72	72	8.00	8.05	+0.63	5.6	-21, +26
1000 Hz 120 dB	90	90	10.00	10.13	+1.30		
1000 Hz 120 dB	180	180	20.00	20.22	+1.10		
1000 Hz 120 dB	360	360	40.00	40.34	+0.85		
1000 Hz 120 dB	720	720	80.00	80.49	+0.61		

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เอกสารไม่ควบคุม

Certificate No : 23-NDM-180  
Request No : Req-2023-1488

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (Pa <sup>1</sup> h)	Tolerances Limit (Pa <sup>2</sup> h)
	Ref	UUC	Ref (Pa <sup>1</sup> h)	UUC (Pa <sup>2</sup> h)	Error (Pa <sup>2</sup> h)		
FAST / A / 55-140 Calibrator Setting	(a)	(a)	(Pa <sup>1</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.032	-0.29 ~ +0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref (Pa <sup>1</sup> h)	UUC (Pa <sup>2</sup> h)	Error (%)		
FAST / A / 55-140 Calibrator Setting	(a)	(a)	(Pa <sup>1</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00	5.6	-21 ~ +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00		-29 ~ +41
Burst 1 ms, 108 dB	143	143	1.00	1.01	+1.00		-29 ~ +41

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement		UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	UUC (Pa <sup>1</sup> h)	Different (%)		
FAST / A / 55-140 Calibrator Setting	(a)	(a)	(Pa <sup>1</sup> h)	(%)	(%)	(%)
Continuous Rectangle +	29		10.13	0.00	3.7	-21 ~ +26
Continuous Rectangle -			10.13			

\* Indicates non accredited

End of Certificate

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

รายการใบรับรองสอบเทียบเครื่องมือหลักประจำห้องปฏิบัติการสำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือสำหรับวิเคราะห์คุณภาพน้ำ และดิน									
1	pH Meter	Biochemical Oxygen Demand	Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2401718-001-01	11 Mar 24	10 Mar 25	-
2	BOD Incubator		Arco	UC4-1320 / (UAE:WAO.006/2553)	Technology Promotion Association (Thailand-Japan)	2467588	1 Apr 24	30 Mar 25	-
3	BOD Incubator		Arco	UC4-1320 / (UAE:WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	24TM303	10 Feb 24	9 Feb 25	-
4	Analytical Balance (Readability 0.01 mg)	Total Suspended Solids Total Dissolved Solids	Mettler-Toledo	XSR205DU / C210685394	National Food Institute, Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25	-
5	Hot Air Oven		Memmert	UF55 / B216.1666	National Food Institute, Ministry of Industry, Thailand	2400141-001-01	11 Oct 24	10 Oct 25	-
6	Analytical Balance (Readability 0.1 mg)	Fat oil & Grease	Mettler-Toledo	M5603S / B007010311	National Food Institute, Ministry of Industry, Thailand	2402284-001-01	2 Apr 24	1 Apr 25	-
7	Conductivity Meter	Conductivity	SI Analytics	Lab955 / 16300356	DKSH Technology Limited	C24240057	14 Mar 24	13 Mar 25	-
8	UV-VIS Spectrophotometer	Phenol, Ammonia Nitrogen,Sulphate, Nitrate Nitrogen,Phosphate,	Agilent Technologies	Cary60 G6860A / MY15410009	DOE Services Co.,Ltd.	SP24-018	7 May 24	6 May 25	-
9	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DOE Services Co.,Ltd.	SP24-008	16 Jan 24	15 Jan 25	-
10	UV-VIS Spectrophotometer		Hitachi	U-2900 / 21E22-009	DOE Services Co.,Ltd.	SP24-001	4 Jan 24	3 Jan 25	-

รายการใบรับรองสอบเทียบเครื่องมือหลักประจำห้องปฏิบัติการสำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือสำหรับวิเคราะห์คุณภาพน้ำ และดิน									
11	Atomic Absorption Spectrophotometer (AAS)	Lead, Chromium, Hexavalent, Mercury, Copper, Zinc, Nickel, Iron, Fe, Zinc, Chromium Trivalent, Manganese	Agilent Technologies	Verian AA240FS/ MY13160001	Thailand Institute pf Scientific and Technological Research	MTC.ACL.NO. 358/67	2 Feb 24	1 Feb 25	-
12	Inductively Coupled Plasma (ICP)		Agilent Technologies	System ID:G8015A / G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Nov 23	12 Nov 24	-
13	Cold Vapor Atomic (CVAAS)	Mercury	Milestone	RA-4500 / 17780278	Coax Group Corporation Co., Ltd.	Preventive Maintenance Checklist	9 Jul 24	8 Jul 25	-
14	Incubator (Cooled Incubator)	Fecal Coliform Total Coliform Bacteria	Memmert	IPP 260 / V618.0033	Technology Promotion Association (Thailand-Japan)	24TM651	2 Apr 24	2 Apr 25	-
15	Incubator (Cooled Incubator)		Memmert	IPP 260 / V616.0066	Technology Promotion Association (Thailand-Japan)	24TM650	2 Apr 24	2 Apr 25	-
16	Water Bath		Memmert	WNE 14 / L416.0614	Technology Promotion Association (Thailand-Japan)	24TM306/1	10 Feb 24	9 Feb 25	-
17	Water Bath		Memmert	WB 14 / I401.0569	Technology Promotion Association (Thailand-Japan)	23TM1078	10 Jul 23	9 Jul 24	-
18	Auto Clave		ALP	CL-40L / 807298	National Food Institute, Ministry of Industry, Thailand	2304203-001-01	10/8/203	9 Aug 24	-

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

รายการใบรับรองสอบเทียบเครื่องมือหลักประจำห้องปฏิบัติการสำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือสำหรับวิเคราะห์คุณภาพอากาศ									
1	Analytical Balance (Repeatability 0.1 mg)	Respirable Dust Total Dust	Mettler-Toledo	AB204-S/FACT / B108115858	Mettler-Toledo (Thailand) Ltd.	2402420-001-01	19 Apr 24	18 Apr 25	-
2	Analytical Balance (Readability 0.001 mg)		Mettler-Toledo	XP6 / B322373893	National Food Institute, Ministry of Industry, Thailand	2402420-002-01	19 Apr 24	18 Apr 25	-
3	UV-VIS Spectrophotometer	NO <sub>x</sub> as NO <sub>2</sub>	Agilent Technologies	Cary60 G6860A / MY15410009	DOE Services Co.,Ltd.	SP24-018	7 May 24	6 May 25	-
4	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DOE Services Co.,Ltd.	SP24-008	16 Jan 24	15 Jan 25	-
5	Ion Chromatography (IC)	HCl	-	AquionRfIC / 220380031/220360045	Archemica Lab Co.Ltd.	Qualification Report Anion (ID#1047)	23 Apr 24	22 Apr 25	-

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



## Calibration Certificate

Certificate No.: 2401718-001-01  
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 pH  
Serial No.: 1231155210  
ID No.: UAE.WAT.010/2553  
Order No.: 2401718  
Operation No.: 2401718-001  
Date of Receipt: 27 February 2024  
Date of Calibration: 11 March 2024

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: 12 March 2024

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

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

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



## Calibration Report

Certificate No.: 2401718-001-01  
Equipment: pH Meter  
Resolution: 0.01 pH ; 1 mV  
Manufacturer: METTLER TOLEDO  
Model: SevenEasy pH  
Serial No.: 1231155210  
Type: Bench top  
ID No.: UAE.WAT.010/2553  
Date of Calibration: 11 March 2024  
Location: Chemical Calibration Laboratory, National Food Institute  
Environment Condition: Ambient Temperature: ( 23.4 ± 1.5 ) °C Relative Humidity: ( 51 ± 3 ) %  
Condition of Equipment: Good Condition  
Condition of this Results of Calibration  
1. Calibration Method: W-CC-002 : In house method based on direct measurement by using standard voltage calibrator and certified reference material (CRM)  
2. Reference Standards / Certified Reference Material:  
Instruments Serial / ID No. Manufacturer Certificate No. Due Date  
2.1 DC Voltage Calibrator 2709007 Fluke 23E2003 14 June 2024  
2.2 Digital Thermometer 2709007 Fluke CC 660570-01 30 October 2024  
2.3 Thermo-Hygro Meter NPLBTH 014023 testo CC 660353-01 3 April 2024  
Certified Reference Material Lot No. Manufacturer Ref N Expire Date  
2.4 pH buffer 4.008 (Primary pH buffer Solution) 888842 CPChem PH216.L5 13 April 2025  
2.5 pH buffer 6.865 (Primary pH buffer Solution) 888843 CPChem PH217.L5 13 April 2025  
2.6 pH buffer 10.01 (Primary pH buffer Solution) 888844 CPChem PH220.L5 13 April 2024  
2.7 pH buffer 7.00 (Standard pH buffer Solution) C03109 HACH LANGE GmbH S11M064 18 October 2025  
3. This certification is traceable to The International System of Units (SI Unit)  
3.1 Instruments Ng.2.1 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0008  
3.2 Instruments Ng.2.2 and 2.3 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061  
3.3 Certified Reference Material Ng.2.4 to 2.6 traceable to Primary measurement method- Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPChem Ltd is accredited to ISO 17034 and ISO/IEC 17025  
3.4 Certified Reference Material Ng.2.7 traceable to PTB Certificate Nr. PTB-PHQA-563/00504/23 and Certificate Nr. PTB-PHQB-565/06620/22 (PTB: Physikalisch-Technische Bundesanstalt, Braunschweig, Germany)  
4. This certificate was certified only for the instrument we calibrated.  
5. This result of calibration was found accurate as shown on date and place of calibration only.

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



## Calibration Report

Certificate No.: 2401718-001-01  
Equipment: pH Meter  
Resolution: 0.01 pH ; 1 mV  
Manufacturer: METTLER TOLEDO  
Model: SevenEasy pH  
Serial No.: 1231155210  
Type: Bench top  
ID No.: UAE.WAT.010/2553  
Date of Calibration: 11 March 2024  
Page 3 of 5

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	414.121	414	0.00	0.58	2.00
2	295.814	296	2.00	0.58	2.00
4	177.464	178	4.00	0.58	2.00
6	59.160	59	6.00	0.58	2.00
7	0.001	0	7.00	0.58	2.00
8	-59.159	-59	8.00	0.58	2.00
10	-177.461	-177	10.00	0.58	2.00
12	-295.811	-296	12.00	0.58	2.00
14	-414.118	-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.: 3065701 ID No.: N/A

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

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	188	-	0.0071	2.00
7.001	7.00	13	98.9	0.0086	2.00
10.010	10.01	-160	97.2	0.0085	2.00
6.865	6.87	21	-	0.0074	2.00

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



## Calibration Report

Certificate No.: 2401718-001-01  
Equipment: Digital Thermometer with RTD (pH Meter)  
Resolution: 0.1 °C Model: SevenEasy pH  
Serial No.: 1231155210 ID No.: UAE.WAT.010/2553  
Manufacturer: METTLER TOLEDO  
Date of Calibration: 11 March 2024  
Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute  
Environment Condition: Ambient Temperature 23 °C ± 1 °C  
Relative Humidity 51 % ± 2 %

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 087/56	06-Jun-24	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

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

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

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







## กำหนดจุดห้ามใช้งาน

References Certificate Number. : 234TM588

Equipment : BOD Incubator

Model : UR-1320

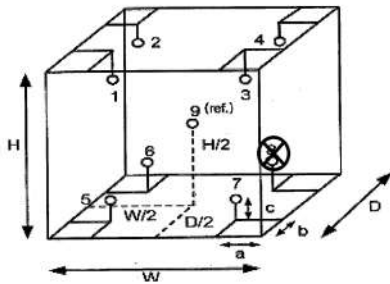
Serial No. : -

ID No. : UAE.WAO.006/2553

Manufacturer : ARCO

Calibration Point : 20.0 °C

Unit Under Calibration Setting : 20.0 °C



รูปภาพเครื่องมือ แสดงจุดที่ได้รับการสอบเทียบ และสัญลักษณ์ ⊗ แสดงจุดห้ามใช้งาน

กำหนดจุดห้ามใช้งานตำแหน่งที่.....8.....

หมายเหตุ เก็บใบแนบ.....

\\uae.net\appl\Lab-BOD\INSTRUMENT\B1-2563\Certificate\ป้ายห้ามใช้งานเครื่องมือ\ป้ายห้ามใช้งานเครื่องมือ 2567\กำหนดจุดห้ามใช้งาน.doc

เอกสารไม่ควบคุม



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



Cert. No.: 24TM303  
Page : 1 of 3

## 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 : 10 February 2024  
Calibration Date : 10 February 2024  
Ambient Temperature : (26 ± 10) °C  
Relative Humidity : (50 ± 30) %  
Calibrated by : Tawatchai Pama

Approved by :   
Approved Signatory

( ) Pornthippa Tameyakul  
(x) Unnophol Harachai  
( ) Suwit Imjai

Issue Date : 19 February 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2402-0234OC-1  
Result of Calibration : ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 24TM303  
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	20.1	19.9	0.37	0.72	1.4	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.873	19.803	20.322	19.690	19.615	19.585	19.612	19.558	19.645	0.58

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2402-0234OC-1  
Procedure Used :-

Cert. No.: 24TM303  
Page : 2 of 3

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

## Condition of this result of calibration

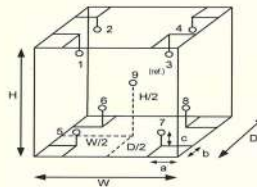
- Reference standard instrument-  
Instrument Serial No. Cert. No. Traceable Due Date  
1 ) Data Acquisition MY59003411 23LM208 TPA 27 Dec 2024
- This certificate is valid only to the item calibrated on date and place of calibration.
- This certificate is traceable to the International System of Unit.

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

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available



## Probe Installation Details :

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

## Dimension of Chamber :

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

	Environment during calibration	
	Beginning	Finished
Temp. (°C)	28	31
REL.Humid. ( % )	70	65
AC Supply ( Volt )	233	234

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

เอกสารไม่ควบคุม







## Calibration Certificate

Certificate No.: 2400141-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address: 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: CHAMBER (Hot Air Oven)  
Manufacturer: MEMMERT  
Model: UF 55  
Serial No.: B216.1666  
ID No.: UAE.WAO.027/2559  
Order No.: 2400141  
Operation No.: 2400141-001  
Date of Receipt: 11 October 2023  
Date of Calibration: 11 October 2023

Calibrated by Mr.Worapob Sooktong  
Scientist  
Approved by (Mr.Pheraphat Tuanjit)  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team  
Date of Issue: 16 October 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

## Calibration Report

Certificate No.: 2400141-001-01  
Equipment: CHAMBER (Hot Air Oven)  
Model: UF 55 Serial No.: B216.1666  
Resolution: 0.1 °C ID No.: UAE.WAO.027/2559  
Manufacturer: MEMMERT

Date of Calibration: 11 October 2023

Page 2 of 3

Location: Laboratory, Floor 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Environment Condition: Ambient Temperature ( 28 ± 1 ) °C  
Relative Humidity ( 63 ± 2 ) %  
Line Voltage ( 228 ± 1 ) Volt

### Condition of this results of Calibration:

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

### 2. Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY49016894	TE 660380-01	22 April 2024	NATIONAL FOOD INSTITUTE
	RTD	CHF201-209/ RTD#201-209			

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibrated Item : Good

### UUC Description :

Time of Record 1 Hour 9 Minute At 104.0, 140.0 and 180.0 °C  
Fresh air Damper - Open Position -  
X Close  
- Not Available

- Result of Calibration : X Without adjustment After adjustment

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

## Calibration Report

Certificate No.: 2400141-001-01  
Equipment: CHAMBER (Hot Air Oven)  
Model: UF 55 Serial No.: B216.1666  
Resolution: 0.1 °C ID No.: UAE.WAO.027/2559  
Manufacturer: MEMMERT

Date of Calibration: 11 October 2023  
Calibration point: 104.0, 140.0 and 180.0 °C

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	28.2	61.4	227.4
MAX	28.3	65.1	229.3

Table 1 : Reporting of Temperature

Calibration point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
104.0	104.05	103.98	104.02	104.08	104.00	104.05	103.99	104.17	104.00	0.53
140.0	140.09	139.99	139.91	140.05	139.99	139.91	139.97	140.26	139.97	0.73
180.0	180.46	180.33	180.25	180.28	180.33	179.96	180.31	180.64	180.16	0.90

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
104.0	104.0	104.0	104.0	0.090	0.18	0.38
140.0	140.0	140.1	140.0	0.075	0.28	0.47
180.0	180.0	180.1	180.0	0.13	0.48	0.88

Note The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity) "   
UUC\* = Unit Under Calibration   
Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.   
Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.   
Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.   
The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k= 2, providing a level of confidence of approximately 95 %.

----- End -----

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

## Calibration Certificate

Certificate No.: 2402284-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
Address: 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance  
Manufacturer: METTLER TOLEDO  
Model: MS6035/01  
Serial No.: B007010311  
ID No.: UAE.TOX.008/2553  
Order No.: 2402284  
Operation No.: 2402284-001  
Date of Receipt: 2 April 2024  
Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong  
Scientist  
Approved by (Mr.Pheraphat Tuanjit)  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team  
Date of Issue: 9 April 2024

The uncertainties are for a confidence probability of approximately 95%

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

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

## Calibration Report

Certificate No.: 2402284-001-01  
Equipment: Electronic Balance  
Model: M56035/01  
Serial No.: 8007010311  
Capacity: 620  
Manufacturer: METTLER TOLEDO  
Resolution: 0.001  
ID No.: UAE.TOX.008/2553

Date of Calibration: 2 April 2024 Page 2 of 3

Environment Condition: Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 48 ± 2.5 %

Place of Calibration: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NIST 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	8505567572	TCS	M23040535	8 April 2024
Standard Weight Class E2	500g	8505567696	TCS	M23040545	8 April 2024

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFLBTH 017/23	Quality Reborn	QR24-0344	9 February 2025

3. This certificate is traceable to SI UNIT  
4. This certificate was certified only for the instrument we calibrated.  
5. This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:

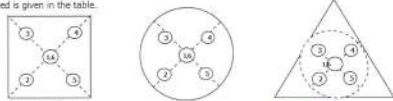
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
300	0.00000
600	0.00048

2. Off-Center Error:

A mass of 200 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1 (g)	2 (g)	3 (g)	4 (g)	5 (g)	6 (g)	(Maximum Difference) (g)
200.000	199.997	199.999	199.999	199.998	200.000	0.003

F-C5-012 Revision: 01 Date: 20-04-65

2008 ต.บางนาจตุรัส 36 หมู่บางนาจตุรัส แขวงบางนาจตุรัส เขตบางนา กรุงเทพมหานคร 10700  
2008 Soi 36, Aun Aun Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand  
Tel: +66(0) 2-422 8568 Fax: +66(0) 2-422 8545



## Calibration Report

Certificate No.: 2402284-001-01  
Equipment: Electronic Balance  
Model: M56035/01  
Serial No.: 8007010311  
Capacity: 620  
Manufacturer: METTLER TOLEDO  
Resolution: 0.001  
ID No.: UAE.TOX.008/2553

Date of Calibration: 2 April 2024 Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0 - 600 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor
Unload	0.0000	0.0000	0.0000	0.00082	2.00
0.1	0.1000	0.1000	0.0000	0.00082	2.00
0.5	0.5000	0.5000	0.0000	0.00082	2.00
1	1.0000	1.0000	0.0000	0.00082	2.00
2	2.0000	2.0000	0.0000	0.00082	2.00
5	5.0000	5.0000	0.0000	0.00082	2.00
10	10.0000	10.0000	0.0000	0.00082	2.00
20	20.0000	20.0000	0.0000	0.00082	2.00
50	50.0000	50.0000	0.0000	0.00082	2.00
100	100.0001	100.0000	0.0000	0.00083	2.00
150	150.0001	150.0000	0.0000	0.00084	2.00
200	200.0002	200.0000	0.0000	0.00086	2.00
300	300.0002	299.999	0.001	0.00090	2.00
400	400.0003	399.998	0.002	0.00100	2.00
500	500.0003	499.997	0.003	0.0011	2.00
600	600.0004	599.996	0.004	0.0012	2.00

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

----- End -----

F-C5-012 Revision: 01 Date: 20-04-65

2008 ต.บางนาจตุรัส 36 หมู่บางนาจตุรัส แขวงบางนาจตุรัส เขตบางนา กรุงเทพมหานคร 10700  
2008 Soi 36, Aun Aun Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand  
Tel: +66(0) 2-422 8568 Fax: +66(0) 2-422 8545



## Certificate of Calibration

Equipment: CONDUCTIVITY METER Certificate No.: C24240057  
Model: Lab 955 Issued Date: 11 March 2024  
Serial No. (or ID.): 16300356 Job No.: WO-0020309  
Manufacturer: SI Analytic Page: 1 of 2  
Electrode Serial No. 16070067 Model: LF413T Brand: SI Analytic  
Condition: In Condition

Customer: United Analyst and Engineering Consultant Company Limited  
3 Soi Udomsuk 41 Sukhumvit Road,  
Bangkok, 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. Pongpisut Suebchantha  
Calibration Date: 11 March 2024

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. 960753, 890591, 890593

Mr. Pongpisut Suebchantha  
(Mr. Pongpisut Suebchantha)

Mr. Nitinun Srihawan  
(Mr. Nitinun Srihawan)

Person in charge

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 the 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.

บริษัท ดีเคเอส เอเซีย จำกัด  
DKSH Technology Limited  
2533 ถนนสุขุมวิท แขวงคลองเตย เขตวัฒนา กรุงเทพมหานคร 10260  
2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260  
Phone: +66 2638 7000 Email: info.calibration@dksh.com Website: www.dksh.com/certificate-thailand

Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม

CAL-FM-C24-08: 12 Sep 2022



## Calibration Results:

## Before Adjustment

Standard	Unit Under Calibration	Reading	Correction	Coverage Factor	Uncertainty ( ± )
Conductivity Solution	Reading			( k )	
25.000 μS/cm	26.7 μS/cm	-1.700 μS/cm	2.00	0.21 μS/cm	
1413.0 μS/cm	1428 μS/cm	-15.0 μS/cm	2.00	9.0 μS/cm	
111.3 mS/cm	108.4 mS/cm	2.9 mS/cm	2.00	0.67 mS/cm	

## After Adjustment ; at 1413 μS/cm

Standard	Unit Under Calibration	Reading	Correction	Coverage Factor	Uncertainty ( ± )
Conductivity Solution	Reading			( k )	
25.000 μS/cm	25.9 μS/cm	-0.900 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	107.5 mS/cm	3.8 mS/cm	2.00	0.67 mS/cm	

The End of Certificate

บริษัท ดีเคเอส อีซี จำกัด  
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-PM-C24-05: 12 Sep 2022

DQE Services Co., Ltd.

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

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



## CERTIFICATE OF CALIBRATION

Certificate No. : SP24-018

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. : UAE.WAT.020/2558

Received Date : 7 May 2024

Calibration Date : 7 May 2024

Issue Date : 9 May 2024

Condition Instrument : Good

Calibrated by :   
( Mr. Tanawut 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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DQE Services Co., Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

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



## REPORT OF CALIBRATION

Certificate No. : SP24-018

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	115663	25 October 2025
Absorbance Standard set	25757	115638	25 October 2025
Wavelength Standard set	25806	115657	25 October 2025
Wavelength Standard set	25758	115665	25 October 2025

Traceability : This certification is traceable to the International System of Unit maintained at National -

Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 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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DQE Services Co., Ltd.

DQE Services

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



## REPORT OF CALIBRATION

Certificate No. : SP24-018

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
	0.5780	0.5747	0.0033	0.0031	2.00
	1.0484	1.0438	0.0046	0.0029	2.00
	2.1876	2.1832	0.0044	0.0080	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5595	0.5581	0.0014	0.0034	2.00
	1.0239	1.0231	0.0008	0.0035	2.00
	2.1230	2.1219	0.0011	0.0080	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5230	0.5184	0.0046	0.0030	2.00
	0.9633	0.9614	0.0019	0.0029	2.00
	1.9753	1.9731	0.0022	0.0070	2.00
546.1	0.0000	0.0000	0.0000	0.0028	2.00
	0.5181	0.5150	0.0031	0.0031	2.00
	1.0002	0.9964	0.0038	0.0033	2.00
	1.9973	1.9914	0.0059	0.0088	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5517	0.5485	0.0032	0.0030	2.00
	1.0803	1.0772	0.0031	0.0030	2.00
	2.0373	2.0293	0.0080	0.0080	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5591	0.5565	0.0026	0.0031	2.00
	1.0518	1.0482	0.0036	0.0030	2.00
	1.9274	1.9202	0.0072	0.0079	2.00

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



REPORT OF CALIBRATION



Certificate No. : SP24-018Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.0000	0.0000	0.0050	2.00
	0.7469	0.7435	0.0034	0.0057	2.00
257	0.0000	0.0000	0.0000	0.0050	2.00
	0.8674	0.8639	0.0035	0.0060	2.00
313	0.0000	0.0000	0.0000	0.0050	2.00
	0.2919	0.2907	0.0012	0.0051	2.00
350	0.0000	0.0000	0.0000	0.0050	2.00
	0.6430	0.6402	0.0028	0.0055	2.00

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



REPORT OF CALIBRATION

Certificate No. : SP24-018Page 5 of 5

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	287.9	-0.09	0.18	2.00
334.06	333.9	0.16	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.1	0.49	0.18	2.00
445.94	445.6	0.34	0.18	2.00
453.66	453.3	0.36	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.0	0.59	0.18	2.00
637.98	638.7	-0.72	0.18	2.00
431.38	430.8	0.58	0.18	2.00
472.50	472.4	0.10	0.18	2.00
513.47	513.7	-0.23	0.18	2.00
528.88	529.1	-0.22	0.18	2.00
573.17	573.5	-0.33	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	685.1	-0.70	0.18	2.00
740.72	741.4	-0.68	0.20	2.00
748.55	749.1	-0.55	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.3	-0.02	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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DQE Services Co.,Ltd.  
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230  
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



CERTIFICATE OF CALIBRATION

Certificate No. : SP24-008Page 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 : 16 January 2024

Calibration Date : 16 January 2024

Issue Date : 19 January 2024

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 used 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 DQE Services Co., Ltd.

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



REPORT OF CALIBRATION

Certificate No. : SP24-008Page 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	115663	25 October 2025
Absorbance Standard set	25757	115638	25 October 2025
Wavelength Standard set	25806	115657	25 October 2025
Wavelength Standard set	25758	115665	25 October 2025

Traceability : This certification is traceable to the International System of Unit maintained at National -  
Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 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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## REPORT OF CALIBRATION

Certificate No. : SP24-008

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
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.046	0.0024	0.0029	2.00
	2.1876	2.186	0.0016	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.558	0.0015	0.0034	2.00
	1.0239	1.024	-0.0001	0.0035	2.00
	2.1230	2.121	0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.520	0.0030	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.516	0.0021	0.0031	2.00
	1.0002	0.999	0.0012	0.0033	2.00
	1.9973	1.994	0.0033	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.550	0.0017	0.0030	2.00
	1.0803	1.080	0.0003	0.0030	2.00
	2.0373	2.032	0.0053	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.558	0.0011	0.0031	2.00
	1.0518	1.051	0.0008	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

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FM-708-02 R01 1/11/2021



## REPORT OF CALIBRATION

Certificate No. : SP24-008

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## Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.748	-0.0011	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.865	0.0024	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.293	-0.0011	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.641	0.0020	0.0055	2.00

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021



## REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 5 of 5

## Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.54	241.1	0.44	0.18	2.00
279.40	278.9	0.50	0.18	2.00
288.70	288.0	0.70	0.18	2.00
334.22	333.8	0.42	0.18	2.00
361.26	360.8	0.46	0.18	2.00
418.48	418.2	0.28	0.18	2.00
446.70	446.0	0.70	0.18	2.00
453.20	453.1	0.10	0.18	2.00
460.06	459.6	0.46	0.18	2.00
536.90	536.4	0.50	0.18	2.00
637.94	637.6	0.34	0.18	2.00
440.74	440.1	0.64	0.18	2.00
472.22	472.0	0.22	0.18	2.00
513.70	513.5	0.20	0.18	2.00
528.72	528.2	0.52	0.18	2.00
574.60	574.3	0.30	0.18	2.00
585.48	585.0	0.48	0.20	2.00
684.63	684.2	0.43	0.18	2.00
740.27	740.0	0.27	0.20	2.00
748.28	747.8	0.48	0.18	2.00
807.16	806.8	0.36	0.18	2.00
879.70	879.2	0.50	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 -

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021



## CERTIFICATE OF CALIBRATION

Certificate No. : SP24-001

Page 1 of 5

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

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

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564

Received Date : 4 January 2024

Calibration Date : 4 January 2024

Issue Date : 5 January 2024

Condition Instrument : Good

Calibrated by :

จตุพร

( Mr.Tanawut Rittidach )

Technical Manager

Approved by :

จตุพร

( Ms.Chonthicha Sangneng )

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 (uncertainty) capability of the laboratory and its uncertainty 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 DQE Services Co., Ltd.

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FM-708-02 R01 1/11/2021





## REPORT OF CALIBRATION

Certificate No. : SP24-001

Page 2 of 5

Environment Condition : Ambient Temperature  $25 \pm 5$  °CRelative humidity  $55 \pm 20$  %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

## Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	115663	25 October 2025
Absorbance Standard set	25757	115638	25 October 2025
Wavelength Standard set	25806	115657	25 October 2025
Wavelength Standard set	25758	115665	25 October 2025

Traceability : This certification is traceable to the International System of Unit maintained at National -

Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021



## REPORT OF CALIBRATION

Certificate No. : SP24-001

Page 3 of 5

Calibration Results : Without adjustment

## Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.045	0.0034	0.0029	2.00
	2.1876	2.192	-0.0044	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.558	0.0015	0.0034	2.00
	1.0239	1.023	0.0009	0.0035	2.00
	2.1230	2.125	-0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.520	0.0030	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.516	0.0021	0.0031	2.00
	1.0002	0.997	0.0032	0.0033	2.00
	1.9973	1.993	0.0043	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.550	0.0017	0.0030	2.00
	1.0803	1.079	0.0013	0.0030	2.00
	2.0373	2.032	0.0053	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.558	0.0011	0.0031	2.00
	1.0518	1.050	0.0018	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

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FM-708-02 R01 1/11/2021



## REPORT OF CALIBRATION

Certificate No. : SP24-001

Page 4 of 5

## Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.743	0.0039	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.862	0.0054	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.289	0.0029	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.641	0.0020	0.0055	2.00

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021



## REPORT OF CALIBRATION

Certificate No. : SP24-001

Page 5 of 5

## Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.2	0.52	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.4	0.41	0.18	2.00
334.06	333.8	0.26	0.18	2.00
360.93	360.6	0.33	0.18	2.00
418.59	418.4	0.19	0.18	2.00
445.94	445.8	0.14	0.18	2.00
453.66	453.4	0.26	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.4	0.19	0.18	2.00
637.98	638.0	-0.02	0.18	2.00
431.38	431.2	0.18	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.4	0.07	0.18	2.00
528.88	528.9	-0.02	0.18	2.00
573.17	573.4	-0.23	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	684.4	0.00	0.18	2.00
740.72	741.0	-0.28	0.20	2.00
748.55	748.8	-0.25	0.18	2.00
807.03	807.1	-0.07	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 -

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FM-708-02 R01 1/11/2021





Request No. 25-67 / 0275

MTC. ACL.No. 358 / 67

## CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"

Model AA240FS, Serial No. MY13160001

2. Working standard solution "Inorganic Ventures"

Multi Analyte Custom Grade Solution, Lot No. S2-MEB675610

SUBMITTED BY : United Analyst and Engineering Consultant Co., Ltd.

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

CALIBRATION PROCEDURE : 1. Performance Verification of Atomic Absorption Spectrophotometer  
(WI-500-02-30)

2. Estimation Uncertainty in Analytical Chemistry (QP-513)

CALIBRATION RANGE: 0.02, 0.10, 0.30, 0.50, 0.70 mg/l at 228.8 nm.Cd, 0.10, 0.20, 0.30, 0.50, 0.70 mg/l at 357.9 nm.Cr,  
0.05, 0.10, 0.30, 0.50, 0.70 mg/l at 324.7 nm.Cu, 0.10, 0.30, 0.50, 0.70, 1.00 mg/l at 248.3 nm.Fe,  
0.20, 0.50, 0.70, 1.00, 1.50 mg/l at 217.0 nm.Pb, 0.05, 0.10, 0.30, 0.50, 0.70 mg/l at 279.5 nm.Mn,  
0.10, 0.30, 0.50, 0.70, 1.00 mg/l at 232.0 nm.Ni, 0.05, 0.10, 0.30, 0.50, 0.70 mg/l at 213.9 nm.Zn

CALIBRATION DATE : 2 February 2024

REFERENCE MATERIAL : Traceable to NIST "Agilent Technologies", "CARLO ERBA"

Cadmium Lot No. 0006589926, Chromium Lot No. 0112384886, Copper Batch No. T117098A, Iron Batch No. T126087A,  
Lead Lot No. 1227873, Manganese Batch No. T109228A, Nickel Batch No. T270178A, Zinc Batch No. T820140A

AMBIENT CONDITIONS : Temperature 25 ± 5 °C Relative humidity 50 ± 20 %

The Atomic Absorption Spectrophotometer has been calibrated against Reference Material traceable to National Institute of Standards and Technology ( NIST ) by The Analytical Chemistry Laboratory. The results are attached herewith.

Calibrated by ..... Atipat

( Mr. Atipat Ratana )

Approved by .....

( Miss Sutadta Deawong )

Director of Analytical Chemistry Laboratory

Ref. 2015267020100454001

Issued Date : 11 March 2024

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## CALIBRATION DATA

## 1. Noise Level

Element	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Zn
Absorbance	0.0006	0.0004	-0.0003	0.0001	-0.0011	-0.0005	0.0008	0.0004
	0.001	0.0017	-0.0009	0.0008	0.0001	0.0002	-0.0003	0.0007
	0.0006	0.0017	-0.0020	0.0005	0.0005	0.0004	0.0013	0.0014
	0.0001	0.0018	-0.0007	0.0005	0.0004	-0.0003	-0.0001	0.0010
	-0.0001	0.0019	-0.0014	0.0003	0.0010	0.0000	0.0002	-0.0001
	0.0011	0.0014	-0.0017	0.0009	-0.0008	0.0004	0.0006	0.0010
	-0.0002	0.0015	-0.0015	0.0003	0.0002	-0.0008	0.0009	0.0013
	0.0006	0.0012	-0.0001	0.0006	0.0008	0.0001	-0.0002	0.0013
	0.0008	0.0009	-0.0003	0.0003	0.0005	0.0002	0.0001	0.0007
	0.0012	0.0011	-0.0012	0.0008	0.0003	0.0004	0.0004	0.0013
	0.0003	0.0015	-0.0019	0.0001	-0.0002	0.0000	-0.0003	0.0003
	0.0005	0.0017	-0.0019	-0.0007	0.0000	-0.0007	0.0005	0.0005
	-0.0006	0.0016	0.0000	0.0006	-0.0001	0.0013	0.0006	0.0010
	0.0003	0.0011	-0.0002	0.0001	-0.0007	0.0009	0.0009	0.0002
	0.0003	0.0012	-0.0011	0.0007	-0.0003	-0.0003	0.0010	0.0009
	0.0004	0.0018	-0.0016	-0.0004	-0.0006	0.0008	0.0007	0.0007
	-0.0001	0.0018	-0.0018	0.0013	-0.0006	-0.0001	0.0014	0.0006
	0.0003	0.0017	-0.0001	0.0001	-0.0012	-0.0004	0.0001	0.0002
	0.0010	0.0018	-0.0007	0.0003	-0.0005	-0.0002	0.001	0.0003
	0.0004	0.0019	-0.0008	-0.0001	-0.0004	0.0003	0.0002	0.0008
Average Absorbance	0.000	0.001	-0.001	0.000	0.000	0.000	0.000	0.001

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## 2. Precision

Element	Conc. (mg/l)	Absorbance										Ave. Abs.	SD	%RSD
Cd	0.02	0.0078	0.0076	0.0069	0.0075	0.0071	0.0070	0.0076	0.0074	0.0077	0.0067	0.007	0.0004	5.15
	0.30	0.1008	0.1007	0.0999	0.0997	0.1000	0.0996	0.1008	0.1002	0.1005	0.0999	0.100	0.0005	0.46
	0.70	0.2301	0.2306	0.2277	0.2305	0.2310	0.2295	0.2290	0.2293	0.2305	0.2296	0.230	0.0010	0.42
Cr	0.10	0.0094	0.0093	0.0093	0.0098	0.0094	0.0095	0.0090	0.0094	0.0090	0.0090	0.009	0.0003	2.75
	0.30	0.0241	0.0236	0.0221	0.0238	0.0231	0.0226	0.0231	0.0223	0.0230	0.0231	0.023	0.0006	2.75
	0.70	0.0500	0.0500	0.0500	0.0524	0.0499	0.0511	0.0509	0.0512	0.0515	0.0504	0.051	0.0008	1.63
Cu	0.05	0.0061	0.0062	0.0064	0.0061	0.0069	0.0069	0.0061	0.0062	0.0064	0.0061	0.006	0.0003	5.00
	0.30	0.0419	0.0411	0.0402	0.0407	0.0405	0.0404	0.0399	0.0400	0.0399	0.0400	0.040	0.0006	1.58
	0.70	0.0960	0.0960	0.0960	0.0959	0.0947	0.0955	0.0952	0.0952	0.0951	0.0955	0.096	0.0005	0.48
Fe	0.10	0.0096	0.0101	0.0103	0.0100	0.0099	0.0096	0.0106	0.0099	0.0105	0.0102	0.010	0.0003	3.38
	0.50	0.0424	0.0415	0.0428	0.0427	0.0421	0.0426	0.0413	0.0430	0.0421	0.0419	0.042	0.0006	1.33
	1.00	0.0830	0.0839	0.0847	0.0834	0.0832	0.0820	0.0839	0.0838	0.0837	0.0845	0.084	0.0008	0.92
Pb	0.20	0.0078	0.0074	0.0078	0.0078	0.0076	0.0078	0.0077	0.0078	0.0077	0.0078	0.008	0.0001	1.71
	0.70	0.0278	0.0273	0.0271	0.0267	0.0270	0.0264	0.0274	0.0273	0.0269	0.0269	0.027	0.0004	1.45
	1.50	0.0551	0.0548	0.0552	0.0555	0.0547	0.0546	0.0544	0.0544	0.0549	0.0547	0.055	0.0004	0.64
Mn	0.05	0.0116	0.0107	0.0110	0.0103	0.0108	0.0108	0.0112	0.0107	0.0109	0.0108	0.011	0.0003	3.15
	0.30	0.0650	0.0649	0.0649	0.0651	0.0646	0.0649	0.0646	0.0640	0.0648	0.065	0.065	0.0003	0.48
	0.70	0.1463	0.1465	0.1459	0.1471	0.1475	0.1474	0.1487	0.1473	0.1462	0.1468	0.147	0.0008	0.56
Ni	0.10	0.0095	0.0100	0.0096	0.0103	0.0102	0.0096	0.0100	0.0095	0.0097	0.0100	0.010	0.0003	3.04
	0.50	0.0493	0.0493	0.0498	0.0494	0.0490	0.0493	0.0494	0.0493	0.0498	0.0494	0.049	0.0005	1.09
	1.00	0.0812	0.0820	0.0834	0.0829	0.0818	0.0829	0.0831	0.0835	0.0816	0.0819	0.082	0.0008	0.99
Zn	0.05	0.0374	0.0377	0.0373	0.0377	0.0374	0.0377	0.0373	0.0371	0.0371	0.0374	0.037	0.0002	0.61
	0.30	0.1985	0.1993	0.1975	0.1992	0.1979	0.1988	0.1995	0.1985	0.1974	0.2004	0.199	0.0009	0.47
	0.70	0.4027	0.4031	0.4019	0.4021	0.4023	0.3981	0.4042	0.4025	0.3993	0.3997	0.402	0.0019	0.48

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## 3. Trueness

## 3.1 Reading on wavelength- Cadmium(Cd) at 228.8 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cd	0.020	0.020	0.000	1.10	± 0.005
	0.301	0.301	0.000	0.11	± 0.005
	0.707	0.693	-0.013	1.85	± 0.008

## 3.2 Reading on wavelength- Chromium (Cr) at 357.9 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cr	0.1007	0.104	0.004	3.49	± 0.009
	0.3035	0.297	-0.006	2.11	± 0.012
	0.7071	0.685	-0.023	3.19	± 0.023

## 3.3 Reading on wavelength- Copper (Cu) at 324.7 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cu	0.051	0.047	-0.004	7.58	± 0.003
	0.303	0.296	-0.007	2.19	± 0.009
	0.704	0.698	-0.005	0.74	± 0.020

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MTC. ACL. No. 358 / 67

## 3.4 Reading on wavelength- Iron (Fe) at 248.3 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Fe	0.100	0.104	0.005	4.60	± 0.014
	0.500	0.482	-0.018	3.55	± 0.016
	1.006	0.968	-0.038	3.75	± 0.029

## 3.5 Reading on wavelength- Lead (Pb) at 217.0 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Pb	0.201	0.202	0.001	0.34	± 0.014
	0.706	0.719	0.012	1.73	± 0.030
	1.513	1.459	-0.054	3.57	± 0.061

## 3.6 Reading on wavelength- Manganese (Mn) at 279.5 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Mn	0.0505	0.050	0.000	0.83	± 0.005
	0.3031	0.306	0.003	1.12	± 0.007
	0.7023	0.698	-0.004	0.62	± 0.014

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## Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES  
Preventive Maintenance

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

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides what you need to reduce unplanned downtime and keep your systems operating at their peak performance.

This checklist is used as a guide for completing the preventive maintenance tasks. A signed copy of this checklist is provided for your records.



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MTC. ACL. No. 358 / 67

## 3.7 Reading on wavelength- Nickel (Ni) at 232.0 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Ni	0.101	0.098	-0.003	2.90	± 0.013
	0.508	0.502	-0.006	1.16	± 0.018
	1.012	0.962	-0.051	5.02	± 0.032

## 3.8 Reading on wavelength- Zinc (Zn) at 213.9 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Zn	0.050	0.045	-0.005	9.39	± 0.013
	0.303	0.324	0.021	7.04	± 0.013
	0.707	0.675	-0.032	4.52	± 0.019

Remark : The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 (k = 2)

which gives a level of confidence of approximately 95%

Calibrated by Atipat  
(Mr. Atipat Ratana)

Approved by Suladda  
(Miss Suladda Deawtong)  
Director of Analytical Chemistry Laboratory  
Issued Date : 11 March 2024

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Agilent 5100, 5110 Preventive Maintenance Checklist



## Introduction

## Customer Information

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



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## Important Customer Web Links

- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- To access the **Agilent Resource Center** web page, visit <https://www.agilent.com/en-us/agilentresources>. The following information topics are available:
  - Sample Prep and Containment
  - Chemical Standards
  - Analysis
  - Service and Support
  - Application Workflows
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>
- Need to place a service call?** [Flexible Repair Options](#) | Agilent

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## Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Service not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in the most logical order relevant to the individual system service in the order of the tasks listed.
- Complete the **Service Review** section together with the customer.
- Complete the fields for page numbers at the foot of each selected page.
- Add relevant page numbers to selected pages and complete the total number of pages field in the Service Completion section.
- Ask the customer to sign the Service Verification section including the customer's and your signature.**

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## Instrument Maintenance

### System Information

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

Instrument System Name and ID	๖๓๐ ๖๐๖ ICP-OES
Instrument System Site and Location	UAE

List System Component Product Numbers	List the Serial Numbers of each Component
1. G ๖๐๖๐	๓๗ ๗๖๐๓๐๐๐๑
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

ICP-OES Configuration Table	Circle the type or write in the type if other
Nebulizer Type	SeaSpray   OneNeb   <u>Conikal</u>   Other
Spray Chamber	Cyclonic Single Pass   <u>Cyclonic Double Pass</u>   Other
Torch	Radial   <u>Dual View</u>   Other
Torch Type	One Piece   <u>Semi Dismountable</u>   Fully Dismountable   Other
Injector Diameter	2.4mm   <u>1.8mm</u>   1.4mm   0.8mm   Other
Injector Material	<u>Quartz</u>   Ceramic   Other

เอกสารไม่ควบคุม

### Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components and implementation of Service Notes
- ☒ Check for required firmware/software updates and verify with customers if they would like them installed.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. N/A
- ☒ Ask the customer to remove any samples from the ICP-OES sample introduction area, auto sampler or around the ICP-OES.

เอกสารไม่ควบคุม



## Preventive Maintenance Procedures

### Record Pre-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table – Pre-PM.

### Clean and inspect ICP-OES system

- ☒ Look for any obvious external damage or problems.
- ☒ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☒ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☒ Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- ☒ Record the instrument operating conditions in the ICP-OES Status Results Table.
- ☒ Replace the polychromator purge filter.
- ☒ Replace the radial pre-optics window.
- ☒ Replace the axial pre-optics window for SVDV and VDV instruments.
- ☒ Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- ☒ Replace air inlet dust filter.
- ☐ Replace high capacity air inlet dust filter element if installed. *N/A*
- ☒ Remove and clean instrument water inlet filter.

### Agilent Water Recirculator

- ☐ Service not applicable
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir
- ☒ Remove, clean and reinstall water inlet metal mesh filter if present.
- ☒ Re fill with Agilent Cool Clear cooling fluid.
- ☒ Clean the cooling system Air filter and the condenser.

เอกสารไม่ควบคุม

### SPS 3 Auto Sampler

- ☒ Service not applicable
- ☐ Power cycle the autosampler and verify successful initialization.
- ☐ Inspect X and Z axis belts for wear. Replace is necessary.
- ☐ Clean X and Z axis slide shafts.
- ☐ Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and rinse port, ensure that the probe is approximately centered in the vial.

### SPS 4 Auto sampler

- ☒ Service not applicable
- ☐ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☐ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner.
- ☐ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☐ Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☐ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles
- ☐ Test using customer's tray and move the sample probe to the sample vial 1, wash vial and rinse port and ensure that the probe is centered in the vial. If not use calibration wizard and calibrate the position.

### AVS 4, 6, 7 Advanced Valve System

- ☒ Service not applicable
- ☐ Replace valve rotor seal
- ☐ Check fittings for signs of leaks
- ☐ Check tubing including autosampler tubing for kinks or excessive wear
- ☐ Check high flow pump for signs of leaks

เอกสารไม่ควบคุม

### ICP-OES adjustment

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.

### Record Post-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above, run the following Instrument tests
  - ☒ Subsystem Communications Test
  - ☒ Air Flow
  - ☒ Water Flow
  - ☒ Gas Flows
  - ☒ RF Generator
  - ☒ Camera Test
  - ☒ Optics Test
  - ☒ Nebulizer Test
- ☒ Record the result in the Instrument Test Results Table

เอกสารไม่ควบคุม

### Restore Instrument

- ☐ For HF applications, ask the customer to reinstall their sample introduction system. *N/A*
- ☒ Leave system in an Idle state: on and purging.
- ☒ Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

### Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Record the PM event in the Smart Alerts logbook, if applicable.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review this service, parts replaced, and test results obtained with the customer.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box. Systems in a compliant environment may need additional documentation.
- ☒ Complete the Signature Page with both Service Engineer and Customer signatures.

เอกสารไม่ควบคุม

## Test Results

## Instrument Performance Test Results Table

Note: These measurements do not form part of any specification and are for reference only.

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	4190.5	6649.9	4700.6	7564.2
Mn 257.610 nm SRBR	13681.0	27295.3	14569.1	29992.5
Al 396.152 nm SBR	12.1	14.6	11.5	15.6
K 766.491 nm SBR	8.0	31.2	7.4	39.7

\* Axial result is not applicable for G8016AA, G8012AA Radial View instruments.

## Instrument Test Results Table

Note: The Instrument Test results are for systems using ICP Expert version 7.3 and above only.

Instrument Test	Result
Subsystem Communications Test	Pass
Air Flow	Pass
Water Flow	Pass
Gas Flows	Pass
RF Generator	Pass
Camera Test	Pass
Optics Test	Pass
Nebulizer test	Pass

เอกสารไม่ควบคุม

## ICP-OES Status Results Table

Note: These measurements do not form part of any specification and are for reference only.

Measurement	Standby Mode	Plasma On
Mains Voltage	225.153 VAC	220.613 VAC
Mains Current	0.090 A	0.219 A
Instrument Temperature	24.0 °C	25.1 °C
RF Air Flow (sensor speed)	15.0 Hz	19.0 Hz
Plasma Exhaust Temperature	No measurement	39.2 °C
Water Flow Oscillator	No measurement	1.37 L/min
Water Flow Detector	0.64 L/min	0.81 L/min
Water Inlet Temperature	17.3 °C	17.8 °C
Polychromator Temperature	35.0 °C	35.0 °C
CCD Temperature	-39.8 °C	-39.8 °C
Thermal Stabilizer	35.0 °C	35.0 °C
Argon Supply Pressure	659.52 kPa	608.63 kPa
Purge Gas Supply Pressure*1	656.41 kPa	627.71 kPa
Option Gas Supply Pressure*1	- kPa	- kPa
Nebulizer Flow	No measurement	0.70 L/min
Nebulizer Back Pressure	No measurement	166.30 kPa
Plasma Gas Flow	No measurement	11.98 L/min
Auxiliary Gas Flow	No measurement	1.00 L/min
RF Power	No measurement	1199.5 W
RF Supply Current	No measurement	9.223 A
RF Supply Voltage	No measurement	194.481 V

\*1 If option installed

เอกสารไม่ควบคุม

## Consumed PM Parts

Part Description	Part Number	Product or Model# where used	Quantity consumed
Axial Pre-Optic Window	G8010-G8014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-G8015	All	1
Agilent Cool Clear Coolant Fluid	5799-0037	Agilent Water Recirculator	-
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	-
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	-
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	-
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	-
Barb connector 2.5mm-1.5mm id	G8410-80124	SPS 4	-
PVC waste tubing, 8mm od x 5mm id, 2m	G8410-80122	SPS 4	-
Additional Parts may be required from engineer's stock:			
X axis drive belt	5410047500	SPS 3	-
Z axis drive belt	5410047400	SPS 3	-
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	-

## Consumed Parts Reference

(Purchased by customer, not included as part of PM)

☐ Section Not Applicable

Part Description	Part Number	Product or Model# where used	Quantity consumed

เอกสารไม่ควบคุม

## Signature Page

## Service Engineer Comments (optional)

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

## Service Verification

Service Request Number:

600637120

Service Engineer Name:

Kanyakorn S.

Service Engineer Signature:

Kanyakorn S.

Total number of pages in this document:

14

Date Service Completed:

13 Nov 2023

Customer Name:

Aphorn Onkong

Customer Signature:

Aphorn Onkong

เอกสารไม่ควบคุม

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Kanyakorn S.
Test Completed On	11/13/2023 9:18:24 AM
Result Summary	
Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Fail
Precision Test	Pass

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เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	6.92	
As (188.980 nm)	≤ 8.20	6.12	
C (193.027 nm)	≤ 11.50	8.31	
Mo (202.032 nm)	≤ 8.20	6.35	
Cr (206.158 nm)	≤ 13.40	8.99	
Zn (213.857 nm)	≤ 8.70	6.64	
Pb (220.353 nm)	≤ 9.50	7.06	
Co (228.615 nm)	≤ 17.20	11.68	
Ba (230.424 nm)	≤ 9.40	7.27	
Mn (257.610 nm)	≤ 13.30	9.46	
Mn (260.568 nm)	≤ 20.30	14.18	
Cr (267.716 nm)	≤ 11.00	8.01	
Cu (324.754 nm)	≤ 25.00	18.89	
Cu (327.395 nm)	≤ 14.20	11.29	
Sr (338.071 nm)	≤ 33.50	24.46	
Ba (455.403 nm)	≤ 44.00	33.62	
Sr (460.733 nm)	≤ 36.00	17.37	
Ba (493.408 nm)	≤ 36.00	25.47	
Ba (614.171 nm)	≤ 42.00	25.43	
Ar (675.283 nm)	≤ 74.00	60.50	
K (766.491 nm)	≤ 80.00	65.33	

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เอกสารไม่ควบคุม

Sensitivity Test			Fail		
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	142.0	958.5	41.7
Se (196.026 nm)	≥ 41.0	SRBR	105.9	937.4	67.5
Zn (213.857 nm)	≥ 1421.0	SRBR	4190.3	44372.5	111.6
Pb (220.353 nm)	≥ 46.0	SRBR	213.9	2521.3	125.4
Mn (257.610 nm)	≥ 3518.0	SRBR	13681.0	279651.7	416.6
Al (396.152 nm)	≥ 3.4	SBR	12.1	52269.7	3994.3
Ba (493.408 nm)	≥ 34.0	SBR	185.8	2294372.8	12280.0
K (766.491 nm)	≥ 1.8	SBR	8.0	107401.4	11876.7
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	189.4	2285.0	129.5
Se (196.026 nm)	≥ 159.0	SRBR	168.7	2813.7	233.8
Zn (206.200 nm)	≥ 234.0	SRBR	905.0	10158.4	123.0
Zn (213.857 nm)	≥ 1743.0	SRBR	6849.9	135760.6	390.5
Cd (214.439 nm)	≥ 4227.0	SRBR	5597.6	92921.3	273.9
Pb (220.353 nm)	≥ 320.0	SRBR	454.8	10111.2	451.1
Mn (257.610 nm)	≥ 10625.0	SRBR	27295.3	1126118.1	1697.0
Cr (267.716 nm)	≥ 1048.0	SRBR	3948.2	144875.3	1322.0
Cu (324.754 nm)	≥ 19.0	SBR	49.2	341489.7	6798.2
Al (396.152 nm)	≥ 6.0	SBR	14.6	235321.6	15043.9
Ba (493.408 nm)	≥ 60.0	SBR	183.3	8393101.3	45538.3
K (766.491 nm)	≥ 24.0	SBR	31.2	1447045.2	44917.1

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เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	1.22	
Se (196.026 nm)	≤ 2.60	0.76	
Zn (213.857 nm)	≤ 1.50	0.33	
Pb (220.353 nm)	≤ 2.60	0.86	
Mn (257.610 nm)	≤ 1.50	0.45	
Al (396.152 nm)	≤ 1.50	0.37	
Ba (493.408 nm)	≤ 1.50	0.68	
K (766.491 nm)	≤ 1.50	0.33	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.63	
Se (196.026 nm)	≤ 1.50	0.87	
Zn (206.200 nm)	≤ 1.50	0.59	
Zn (213.857 nm)	≤ 1.50	0.46	
Cd (214.439 nm)	≤ 1.50	0.70	
Pb (220.353 nm)	≤ 1.50	0.36	
Mn (257.610 nm)	≤ 1.50	0.95	
Cr (267.716 nm)	≤ 1.50	0.56	
Cu (324.754 nm)	≤ 1.50	0.69	
Al (396.152 nm)	≤ 1.50	0.63	
Ba (493.408 nm)	≤ 1.50	0.86	
K (766.491 nm)	≤ 1.50	1.13	

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เอกสารไม่ควบคุม



Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	Kanyakorn S.	
Test Completed On	11/13/2023 11:10:02 AM	
Result Summary		
Subsystem Communications Test	Pass	
Air Flow Test	Skipped	
Water Flow Test	Skipped	
Gas Flows Test	Skipped	
RF Generator Test	Skipped	
Camera Test	Skipped	
Optics Test	Pass	
Advanced Valve System Test	Skipped	
Resolution Test	Pass	
Sensitivity Test	Pass	
Precision Test	Pass	
Subsystem Communications Test	Pass	
Optics Test		
	Radial	Axial
Intensity	3522064	4003312
Wavelength	737.212	737.212

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เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	6.92	
As (188.980 nm)	≤ 8.20	6.08	
C (193.027 nm)	≤ 11.50	8.33	
Mo (202.032 nm)	≤ 8.20	6.31	
Cr (206.158 nm)	≤ 13.40	8.98	
Zn (213.857 nm)	≤ 8.70	6.73	
Pb (220.353 nm)	≤ 9.50	7.02	
Co (228.615 nm)	≤ 17.20	11.65	
Ba (230.424 nm)	≤ 9.40	7.38	
Mn (257.610 nm)	≤ 13.30	9.46	
Mn (260.568 nm)	≤ 20.30	14.05	
Cr (267.716 nm)	≤ 11.00	7.92	
Cu (324.754 nm)	≤ 25.00	18.84	
Cu (327.395 nm)	≤ 14.20	11.31	
Sr (338.071 nm)	≤ 33.50	24.18	
Ba (455.403 nm)	≤ 44.00	33.28	
Sr (460.733 nm)	≤ 36.00	17.41	
Ba (493.408 nm)	≤ 36.00	25.43	
Ba (614.171 nm)	≤ 42.00	25.27	
Ar (675.283 nm)	≤ 74.00	56.87	
K (766.491 nm)	≤ 80.00	65.88	

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เอกสารไม่ควบคุม

Sensitivity Test						Pass
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	168.6	1284.6	53.3	
Se (196.026 nm)	≥ 41.0	SRBR	122.4	1256.0	90.7	
Zn (213.857 nm)	≥ 1421.0	SRBR	4700.8	53870.1	130.7	
Pb (220.353 nm)	≥ 46.0	SRBR	236.0	3100.6	155.7	
Mn (257.610 nm)	≥ 3518.0	SRBR	14569.1	318398.1	476.2	
Al (396.152 nm)	≥ 3.4	SBR	11.5	59510.5	4761.6	
Ba (493.408 nm)	≥ 34.0	SBR	170.6	2490835.6	14514.2	
K (766.491 nm)	≥ 1.8	SBR	7.4	117698.7	14024.1	
Axial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 208.0	SRBR	214.5	2706.2	142.8	
Se (196.026 nm)	≥ 159.0	SRBR	188.0	3262.8	255.9	
Zn (206.200 nm)	≥ 234.0	SRBR	1088.2	12794.8	135.3	
Zn (213.857 nm)	≥ 1743.0	SRBR	7564.2	156883.9	427.8	
Cd (214.439 nm)	≥ 4227.0	SRBR	6647.3	116281.7	304.4	
Pb (220.353 nm)	≥ 320.0	SRBR	519.3	12490.2	530.3	
Mn (257.610 nm)	≥ 10625.0	SRBR	29992.5	1305852.5	1890.2	
Cr (267.716 nm)	≥ 1048.0	SRBR	4366.6	173343.4	1547.9	
Cu (324.754 nm)	≥ 19.0	SBR	46.8	361093.0	7560.5	
Al (396.152 nm)	≥ 6.0	SBR	15.6	274029.5	16498.6	
Ba (493.408 nm)	≥ 60.0	SBR	203.6	9028914.5	44122.1	
K (766.491 nm)	≥ 24.0	SBR	39.7	1701521.4	41771.8	

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เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	0.85	
Se (196.026 nm)	≤ 2.60	1.26	
Zn (213.857 nm)	≤ 1.50	0.42	
Pb (220.353 nm)	≤ 2.60	0.54	
Mn (257.610 nm)	≤ 1.50	0.60	
Al (396.152 nm)	≤ 1.50	0.47	
Ba (493.408 nm)	≤ 1.50	0.68	
K (766.491 nm)	≤ 1.50	0.50	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.42	
Se (196.026 nm)	≤ 1.50	0.66	
Zn (206.200 nm)	≤ 1.50	0.42	
Zn (213.857 nm)	≤ 1.50	0.54	
Cd (214.439 nm)	≤ 1.50	0.42	
Pb (220.353 nm)	≤ 1.50	0.22	
Mn (257.610 nm)	≤ 1.50	0.54	
Cr (267.716 nm)	≤ 1.50	0.49	
Cu (324.754 nm)	≤ 1.50	0.85	
Al (396.152 nm)	≤ 1.50	0.61	
Ba (493.408 nm)	≤ 1.50	0.78	
K (766.491 nm)	≤ 1.50	1.00	

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เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	Kanyakorn S.	
Test Completed On	11/13/2023 11:15:43 AM	
Result Summary		
Subsystem Communications Test	Pass	
Air Flow Test	Pass	
Water Flow Test	Pass	
Gas Flows Test	Pass	
RF Generator Test	Pass	
Camera Test	Pass	
Optics Test	Skipped	
Advanced Valve System Test	Skipped	
Resolution Test	Skipped	
Sensitivity Test	Skipped	
Precision Test	Skipped	
Subsystem Communications Test	Pass	
Air Flow Test	Pass	
30% Air Flow (relative speed)	75% Air Flow (relative speed)	
14.00	20.00	
Water Flow Test	Pass	
RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.27	0.81	20.37

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เอกสารไม่ควบคุม

Gas Flows Test			Pass		
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	271.62	2.00	2.00	111.13
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	116.00	18.00	17.94	23.11
RF Generator Test			Pass		
RF Power Supply Test	Passed				
RF Power Supply (V)	147.380				
RF Oscillator Test	Passed				
RF Oscillator Frequency (MHz)	25.843				
Work Coil Current (A)	44.410				
RF Power Supply Current (A)	1.999				
Camera Test			Pass		
	Integration Time (ms)	Standard Deviation	Status		
Electronic Offset Test	1000	5.361	Passed		
Dark Current Test	6000	0.779	Passed		
Array Test	5	0.025	Passed		
Linearity Test		0.118	Passed		

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เอกสารไม่ควบคุม

# UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY Ltd.

Automatic Mercury Analyzer

Model RA-4500

Preventive Maintenance Report

Serial No. : 17780278

Soft version : Ver 2.0.7

ROM version : Ver 2.0.1

Date : 09 July 2024

PM by : Pradit mayong  
( Pradit M. )

Approved by : Kitichai S.  
( Kitichai S. )



1131/62,64,325-331 Nakornchaisri road,  
Kwang ThanonNakornchaisri, Dusit, Bangkok 10300 Thailand  
Tel. 02-2435263, 02-6682436 Fax. 02-2437386

เอกสารไม่ควบคุม

## Inspection result

ITEM	STANDARD	RESULT	JUDGE
1. Self Check	1.1 Heating	PASS	OK
	1.2 Cooling	PASS	OK
	1.3 Leak	PASS	OK
	1.4 Optical system	PASS	OK
	1.5 Drift	PASS	OK
2. Analytical curve inspection(AREA)			
2.1 No Pretreatment (Low Conc.)	Correlation coefficient ( r ) ≥ 0.9990	0.9999	OK
3. Repeatability(AREA)			
3.1 No Pretreatment 100ppb, n=3		1. 99.60 ppb 2. 101.84 ppb 3. 101.22 ppb	
	C.V. ≤ 5%	1.15%	OK
4. Blank	Below 1.0 (AREA)	0.1002	OK

เอกสารไม่ควบคุม

## Counter

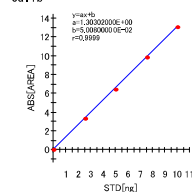
Maintenance

MAIN	IC	Counter	Parameter		
Measurement Count	2027122-05-08	Clear	P1 tube(100000)	0400m(04-02-08)	Clear
Memory Exhaust Filter Amount(mg)(1500mg)	1022-08-08	Clear	P2 tube(100000)	0401m(04-02-08)	Clear
Lamp Active Size(20000)	7415mg(04-02-08)	Clear	P3 tube(100000)	0402m(04-02-08)	Clear
Membrane Filter Usage Time(20000)	0403m(04-02-08)	Clear	P4 tube(100000)	0403m(04-02-08)	Clear
Main Pump tube(7500)	0403m(04-02-08)	Clear	P5 tube(100000)	0404m(04-02-08)	Clear
Heating Lamp Time	18042m(02-05-08)	Clear	P6 tube(100000)	0405m(04-02-08)	Clear
			P7 tube(100000)	0406m(04-02-08)	Clear

Exit

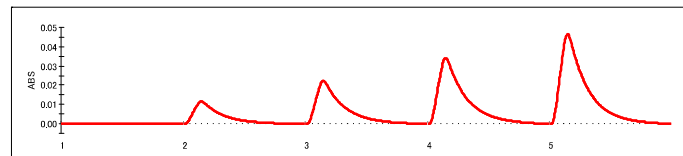
Title : Preventive Maintenance RA-4500 sn:17780278  
Date : 2024-07-09  
Name : Coax Group  
Memo : Calibration Curve 0-10ng

## Calib



## STD

No.	STD [ppb]	SVOL [mL]	CVOL [mL]	DVOL [mL]	STD [ng]	AREA [ON]	MEAS [ng]	Dev [%]	Note
1	100.000	0.000	5.000	5.000	0.000	0.0846	0.0265	-	
2	100.000	0.025	5.000	5.000	2.500	3.3464	2.5298	1.2	
3	100.000	0.050	5.000	5.000	5.000	6.4170	4.8863	2.3	
4	100.000	0.075	5.000	5.000	7.500	9.8647	7.5322	0.4	
5	100.000	0.100	5.000	5.000	10.000	13.1132	10.0253	0.3	



## SMP

No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	AREA [ON]	MEAS [ng]	CONC [ug/L]	Note
1	100ppb	0.050	5.000	5.000	6.5389	4.9798	99.60	
2	100ppb	0.050	5.000	5.000	6.6848	5.0918	101.84	
3	100ppb	0.050	5.000	5.000	6.6446	5.0610	101.22	

## Statistics

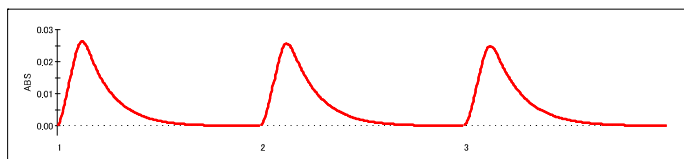
No.	NAME	TRY	AV [ug/L]	SD [ug/L]	Cv [%]
1	100ppb	3	100.887	1.15660	1.15

เอกสารไม่ควบคุม

-1-

เอกสารไม่ควบคุม

NIPPOH INSTRUMENTS CORPORATION



## Self Check

Heat check: PASS!! ( 26.3degC[05:00] -> 30.3degC[02:29])  
Sensor check: PASS!! ( 53- 10= 43)  
Leak check: PASS!! ( 0.19L/min)  
Sig/Ref check: PASS!! ( Sig: 4.00V, Ref: 4.02V)  
Drift check: PASS!! ( 0.000061 - -0.0000179 = 0.0000240)

-2-

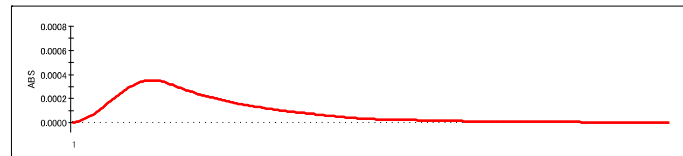
เอกสารไม่ควบคุม

NIPPOH INSTRUMENTS CORPORATION

Title : Preventive Maintenance RA-4500 sn:17780278  
Date : 2024-07-09  
Name : Coax Group  
Memo : Blank

## SMP

No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	AREA [ON]	MEAS [ng]	CONC [ug/L]	Note
1	Blank DI				0.1002	0.0385		



-3-

เอกสารไม่ควบคุม

NIPPOH INSTRUMENTS CORPORATION





## Certificate of Calibration

Cert. No.: 24TM651  
Page : 1 of 3

Equipment : Incubator  
Manufacturer : Memmert  
Model : IPP 260  
Serial No. : V618.0033  
ID No. : UAE.MIC.021/2561  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory (302)  
Received Order : 01 April 2024  
Calibration Date : 02 April 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Man Pattanapongpaiboon

Approved by :   
Approved Signatory

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

Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2404-0003OC-3  
Procedure Used :-

Cert. No.: 24TM651  
Page : 2 of 3

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

### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY49023932	23LM122	TPA	26 Jul 2024

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

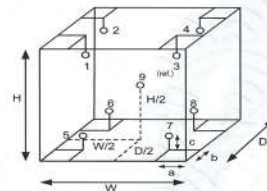
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	25	25
REL Humid. ( % )	54	57
AC Supply ( Volt )	221	224



### Probe Installation Details :

a = 5.0 cm  
b = 5.0 cm  
c = 5.0 cm

### Dimension of Chamber :

D = 0.50 m  
W = 0.64 m  
H = 0.80 m  
Capacity = 0.26 m<sup>3</sup>

Position :	Ref. Std. ID No.:
1	20-16RTD-01
2	20-16RTD-02
3	20-16RTD-03
4	23-16RTD-04
5	22-16RTD-05
6	20-16RTD-06
7	20-16RTD-07
8	22-16RTD-08
9 (ref.)	22-16RTD-09

เอกสารไม่ควบคุม



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2404-0003OC-3  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 24TM651  
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
22.0	22.0	22.0	0.039	0.22	0.42	2
44.0	44.0	44.0	0.048	0.50	0.90	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)	
22.0	22.008	22.034	22.039	22.021	21.746	21.698	21.668	21.668	21.846	0.30
44.0	44.267	44.602	44.293	44.402	44.004	43.961	43.756	44.000	44.205	0.30

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



## Certificate of Calibration

Cert. No.: 24TM650  
Page : 1 of 3

Equipment : Incubator  
Manufacturer : Memmert  
Model : IPP 260  
Serial No. : V616.0066  
ID No. : UAE.MIC.032/2559  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory (302)  
Received Order : 01 April 2024  
Calibration Date : 02 - 03 April 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Man Pattanapongpaiboon

Approved by :   
Approved Signatory

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

Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม





Equipment : Incubator  
 Condition As-Received : Used Item  
 Reference : 2404-0003OC-2  
 Procedure Used :-

Cert. No.: 24TM650  
 Page : 2 of 3

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

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY49023932	23LM122	TPA	26 Jul 2024

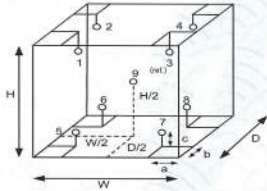
2. This certificate is valid only to the item calibrated on date and place of calibration.  
 3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



Environment during calibration		
	Beginning	Finished
Temp. ( °C )	25	25
REL.Humid. ( % )	57	54
AC Supply ( Volt )	221	222

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

#### Probe Installation Details :

a = 5.0 cm  
 b = 5.0 cm  
 c = 5.0 cm

#### Dimension of Chamber :

D = 0.50 m  
 W = 0.64 m  
 H = 0.80 m  
 Capacity = 0.26 m<sup>3</sup>

เอกสารไม่ควบคุม



Equipment : Incubator  
 Condition As-Received : Used Item  
 Reference : 2404-0003OC-2  
 Result of Calibration :- ( \* ) Without Adjustment  
 Function of UUC\* : Temperature Source  
 Fresh air setting : Close

Cert. No.: 24TM650  
 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
25.0	25.0	25.0	0.053	0.78	1.3	2
36.0	36.0	36.0	0.14	0.57	0.93	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)	
25.0	25.596	25.310	25.439	25.412	24.347	24.332	24.313	24.414	24.875	0.30
36.0	35.843	35.965	35.618	35.701	36.239	36.260	36.343	36.357	36.063	0.31

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
 CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
 5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
 TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 24TM306/1  
 Page : 1 of 3

## Certificate of Calibration

This Certificate was issued to replace to the Certificate No. 24TM306  
 Equipment : Water Bath

Manufacturer : Memmert

Model : WNE 14

Serial No. : L416.0614

ID No. : UAE.MIC.020/2561

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

Location : Microbiology Laboratory

Received Order : 10 February 2024  
 Calibration Date : 10 - 11 February 2024  
 Ambient Temperature : ( 26 ± 10 ) °C  
 Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Krisda Malee

Approved by :   
 Approved Signatory

( ) Pornthippa Tameyakul  
 ( ) Unnopphol Harachai  
 ( ✓ ) Suwit Imjai

Issue Date : 12 February 2024

The Uncertainties are for a confidence probability of approximately 95%

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

A 0064399



Equipment : Water Bath  
 Condition As-Received : Used Item  
 Reference : 2402-0232OC-4  
 Procedure Used :-

Cert. No.: 24TM306/1  
 Page : 2 of 3

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

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY49001451	23LM27	TPA	25 Feb 2024

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

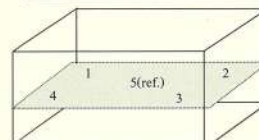
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	24	52	221
Finished of Calibration	23	54	220



Front

Position :	Ref. Std. ID No.:
1	N37P301419
2	N37P300732
3	N37P301420
4	N37P301421
5(ref.)	N37P301425

a 1205493





Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2402-0232OC-4  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 24TM306/1  
Page : 3 of 3

Calibration point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Average* Standard Reading ( °C )					Uncertainty  ( ± °C )
			Position					
			1	2	3	4	5 (ref.)	
44.5	44.5	44.5	44.516	44.483	44.481	44.505	44.504	0.15
50.0	50.0	50.0	50.062	50.016	50.008	50.035	50.044	0.15

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Coverage Factor k
44.5	0.090	0.048	2
50.0	0.11	0.058	2

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

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

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

UUC\* : Unit Under Calibration

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

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

-o0o-

*Signature*

a 1205492



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.: 23TM1078  
Page : 1 of 3

## Certificate of Calibration

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WB 14  
Serial No. : I401.0569  
ID No. : UAE.MIC.004/2544  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory  
Received Order : 10 July 2023  
Calibration Date : 10 July 2023  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Man Pattanapongpaiboon

Approved by : *Signature*  
Approved Signatory

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

Issue Date : 20 July 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.

เอกสารไม่ควบคุม

A 0056395



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2307-0087OC-5  
Procedure Used :-

Cert. No.: 23TM1078  
Page : 2 of 3

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

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY59003411	22LM165	TPA	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.

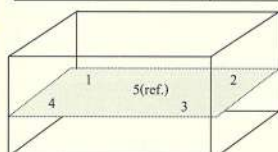
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	( °C )	( %R.H. )	
Beginning of Calibration	25	58	223
Finished of Calibration	25	61	224



Front

Position :	Ref. Std. ID No.:
1	4804539-001
2	4804539-002
3	4804539-003
4	4804539-004
5(ref.)	4804539-005

*Signature*

เอกสารไม่ควบคุม

a 1172089



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2307-0087OC-5  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 23TM1078  
Page : 3 of 3

Calibration point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Average* Standard Reading ( °C )					Uncertainty ( ± °C )
			1	2	3	4	5 (ref.)	
41.5	41.5	41.5	41.438	41.407	41.413	41.331	41.448	0.16

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Coverage Factor k
41.5	0.21	0.082	2

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

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

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

UUC\* : Unit Under Calibration

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

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

-o0o-

*Signature*

เอกสารไม่ควบคุม

a 1172088



## Calibration Certificate

**Certificate No.:** 2304203-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakanong, Bangkok 10260

Page 1 of 3

**Equipment:** Autoclave  
**Manufacturer:** ALP  
**Model:** CL-40L  
**Serial No.:** 807298  
**ID No.:** UAE.MIC.019/2560  
**Order No.:** 2304203  
**Operation No.:** 2304203-001  
**Date of Receipt:** 10 August 2023  
**Date of Calibration:** 10 August 2023

**Calibrated by** Mr. Worapob Sooktong  
Scientist  
**Approved by** (Mr. Pheraphat Tuanjit)  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team  
**Date of Issue:** 15 August 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.

FCS-009 Revision: 01 Date: 20-04-65



## Calibration Report

**Certificate No.:** 2304203-001-01  
**Equipment:** Autoclave  
Model: CL-40L Serial No.: 807298  
Resolution: 1 °C ID No.: UAE.MIC.019/2560  
Manufacturer: ALP  
**Date of Calibration:** 10 August 2023

Page 2 of 3

**Location:** 301, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Environment Condition:** Ambient Temperature ( 28 ± 1 ) °C  
Relative Humidity ( 65 ± 2 ) %  
Line Voltage ( 225 ± 1 ) Volt

### Condition of this results of Calibration:

- This instrument was calibrated by insert 3 standard temperature recorder with RTD into its autoclave and calibration according to W-TE-018 based on BS 2646-1(2021) : Autoclaves for sterilization in laboratories Design, construction, safety and performance Specification.  
- The temperature scale used was based on ITS - 90.  
- All data show below were final values and the initial data may be obtained upon request.
- Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with RTD (Data Logger)	HiTemp140-2	S25601	NC-22-11-22-176	9-Nov-23	MADGETECH INC.
	HiTemp140-2	S25602	NC-22-11-22-175	9-Nov-23	MADGETECH INC.
	HiTemp140-2	R54918	TE 660383-01	8-Apr-24	NATIONAL FOOD INSTITUTE

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- This standard does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical.
- Condition of Calibrated item : Good
- UUC Description : Setting program function sterilization : STERILIZE/NORMAL  
Time of sterilization 15 Minute At 121 °C
- Result of Calibration : ☒ Without adjustment  
☐ After adjustment

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



## Calibration Report

**Certificate No.:** 2304203-001-01  
**Equipment:** Autoclave  
Model: CL-40L Serial No.: 807298  
Resolution: 1 °C ID No.: UAE.MIC.019/2560  
Manufacturer: ALP  
**Date of Calibration:** 10 August 2023

Page 3 of 3

**Calibration point:** 121 °C

**Calibration result:**

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	27.0	63.5	223.3
Max	28.3	67.3	225.9

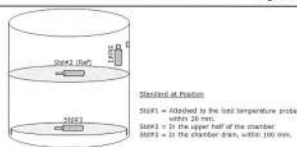


Table 1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.2 is REF)			Uncertainty ± (°C)
	Std.# 1	Std.# 2 (Ref)	Std.# 3	
121	121.68	121.70	121.66	0.66

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading				Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	Min (°C)	Max (°C)	Average (°C)	MPA			
121	121	121	121	0.10	0.11	0.12	0.23

### Note

The quoted uncertainty include " Stability " and " Loading effect ( 20% of Uniformity ) "  
UUC\* = Unit Under Calibration  
Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.  
Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which is observed at the same time.  
Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.  
The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k= 2, providing a level of confidence of approximately 95 %.

----- End -----

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



## Calibration Certificate

**Certificate No.:** 2402420-002-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakanong, Bangkok 10260

Page 1 of 3

**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** XP6  
**Serial No.:** B322373893  
**ID No.:** UAE.AIR.019/2556  
**Order No.:** 2402420  
**Operation No.:** 2402420-002  
**Date of Receipt:** 19 April 2024  
**Date of Calibration:** 19 April 2024

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

The uncertainties are for a confidence probability of approximately 95%

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

FCS-009 Revision: 01 Date: 20-04-65



## Calibration Report

Certificate No.: 2402420-002-01  
Equipment: Electronic Balance  
Model: XP6  
Serial No.: B322373893  
Capacity: 6.1 g  
Manufacturer: METTLER TOLEDO  
Resolution: 0.000001 g  
ID No.: UAE.AIR.019/2556

Date of Calibration: 19 April 2024 Page 2 of 3

Environment Condition: Ambient Temperature: 22.6 ± 1.8 °C Relative Humidity: 48 ± 6.0 %

Place of Calibration: Room 206 Balance Room 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M23111815	28 November 2024
Standard Weight Class E2	1-500g	15882	TCS	M23111825	28 November 2024

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 019/23	Quality Return	QR24-0492	4 March 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

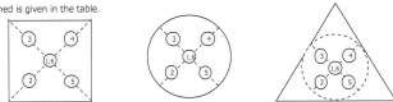
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
3	0.0000057
6	0.0000019

2. Off-Center Error:

A mass of 2 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
1.999981	1.999983	1.999980	1.999984	1.999983	1.999981	0.000003

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

## Calibration Report

Certificate No.: 2402420-002-01  
Equipment: Electronic Balance  
Model: XP6  
Serial No.: B322373893  
Capacity: 6.1 g  
Manufacturer: METTLER TOLEDO  
Resolution: 0.000001 g  
ID No.: UAE.AIR.019/2556

Date of Calibration: 19 April 2024 Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-6 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Uncert	0.0000000	0.000000	0.000000	0.0000032	2.00
0.01	0.0099970	0.009999	-0.000002	0.0000047	2.00
0.05	0.0500010	0.050003	-0.000002	0.0000048	2.00
0.10	0.1000010	0.100001	0.000000	0.0000069	2.00
0.15	0.1500020	0.150002	0.000000	0.0000083	2.00
0.17	0.1700050	0.170006	-0.000001	0.000012	2.00
0.20	0.1999990	0.200002	-0.000003	0.0000083	2.00
1.50	1.4999750	1.499971	0.000004	0.000027	2.00
3.00	2.9999680	2.999959	0.000009	0.000028	2.00
4.50	4.4999810	4.499967	0.000014	0.000022	2.00
6.00	5.9999490	5.999931	0.000018	0.000032	2.00

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

\*\*\*\*\* End \*\*\*\*\*

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

## Calibration Certificate

Certificate No.: 2402420-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AB204-S/FACT

Serial No.: B108115858

ID No.: UAE.AIR.016/2555

Order No.: 2402420

Operation No.: 2402420-001

Date of Receipt: 19 April 2024

Date of Calibration: 19 April 2024

Calibrated by Mr.Pheraphat Tuanjit  
Scientist

Approved by P. Jaengkanrit  
( Miss Preeyaporn Jaengkanrit )  
Vice President, Department of Laboratory Services  
Responsible for the Technical Management Team

Date of Issue: 23 April 2024

The uncertainties are for a confidence probability of approximately 95%

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

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

## Calibration Report

Certificate No.: 2402420-001-01  
Equipment: Electronic Balance  
Model: AB204-S/FACT  
Serial No.: B108115858  
Capacity: 220 g  
Manufacturer: METTLER TOLEDO  
Resolution: 0.0001 g  
ID No.: UAE.AIR.016/2555

Date of Calibration: 19 April 2024 Page 2 of 3

Environment Condition: Ambient Temperature: 22.1 ± 0.6 °C Relative Humidity: 49 ± 1.9 %

Place of Calibration: Room 206 Balance Room 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M23111815	28 November 2024
Standard Weight Class E2	1-500g	15882	TCS	M23111825	28 November 2024

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 019/23	Quality Return	QR24-0492	4 March 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

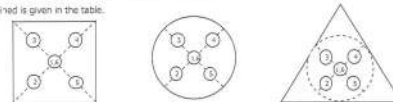
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000057
200	0.000079

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)
99.9999	99.9997	99.9996	99.9998	100.0000	99.9998	0.0003

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



## Calibration Report

**Certificate No.:** 2402420-001-01  
**Equipment:** Electronic Balance  
**Model:** AB204-S/FACT  
**Serial No.:** B108115858  
**Capacity:** 220 g

**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.016/2555

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

**Calibration Results:** (Continued)

**Calibration Range:** 0-200 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:**

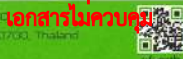
Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor K
Unload	0.0000	0.0000	0.0000	0.000089	2.00
0.1	0.10000	0.10000	0.0000	0.000089	2.00
1	0.99998	1.00000	0.00002	0.000092	2.00
5	4.99997	5.00000	0.00003	0.000091	2.00
10	10.00002	10.00001	-0.00001	0.00012	2.00
20	20.00003	20.00001	-0.00002	0.00014	2.00
50	49.99998	50.00000	0.00002	0.00017	2.00
70	70.00000	69.99999	-0.00001	0.00016	2.00
100	99.99997	100.00000	0.00003	0.00017	2.00
150	149.99994	149.99997	-0.00003	0.00022	2.00
200	200.00001	199.99995	-0.00006	0.00028	2.00

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

----- End -----

F-C5-012 Revision: 01 Date: 20-04-65

2000, Basavanagar, 35, Nuea Road, Bangkok 10700  
 2000, Soi 35, Anant Road, Bang Yai Khan Subdomic, Bang Phai District, Bangkok 10700, Thailand  
 Tel: +66(0) 2142 0608 Fax: +66(0) 2142 0545



nfi.co.th



## Certificate of Calibration

**AquionRFIC : Anion (ID#1047)**

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co.,Ltd.

**AquionRFIC** S/N : 220380031

**AS-DV** S/N : 220360045

for  
**United Analyst and Engineering Consultant Co.,Ltd.**  
 บริษัท อานาลิสต์ วิศวกร และที่ปรึกษา จำกัด  
 ARCHEMICA LAB CO.,LTD

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

(Mr.Channarong Khiao-Un)

Test Engineer

เอกสารไม่ควบคุม

## Qualification Report

PM Check list,CM\_OQ and PQ

AquionRFIC : Anion (ID#1047)

Aquion : Cation (ID#1048)

For

United Analyst Engineering Conslutand Co.,Ltd.

(Validate System 2024)

## PM Anion ID#1047

### Preventive Maintenance Check List

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



Dionex Ion Chromatography  
Preventive Maintenance Report

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

## Instrument Detail

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

## Consumable Detail

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

Perform By Archemica

K.Channarong  
Archemica  
Date 23/Apr/2024



Customer  
Date 23/Apr/2024

เอกสารไม่ควบคุม



## General ICS Maintenance Checklist

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

เอกสารไม่ควบคุม



## AS-DV Autosampler Preventive Maintenance Checklist

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

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

Others / comments

เอกสารไม่ควบคุม

## PM Cation ID#1048

Preventive Maintenance  
Check List

เอกสารไม่ควบคุม

Dionex Ion Chromatography  
Preventive Maintenance Report

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

## Instrument Detail

Instrument Model	Application
Aquion	Cation
Instrument components	Serial Number
Aquion	220340349

## Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
CS12A	CG12A	CDER-600	-	-
Remark: มาตรฐานการติดตั้งเครื่องมือ, System ยังไม่มีการ				

Perform By Archemica

Archemica  
Date 23/Apr/2024



Customer  
Date 23/Apr/2024

เอกสารไม่ควบคุม



## General ICS Maintenance Checklist

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

เอกสารไม่ควบคุม

Seq: ChromeleonLocal\Archemica\Service Contract\Validate 2024\Station Qual 2024-04-23  
Page 1 of 12

CM OQ

Chromeleon  
Operation QualificationThermoFisher  
SCIENTIFIC

## Chromeleon Operational Qualification

## General Information

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

Overall Test Result: Passed

## Comparison Format:

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



Archemica  
Date 23/Apr/2024

Reviewer's Signature // Date

Operator's Signature // Date

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

## ThermoFisher SCIENTIFIC

### Chromeleon Operational Qualification, Part 1 Verification of Selected Results

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

Report Variable	Peak Name	Status
Offset (c0)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Slope (c1)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Correlation Coeff.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Variance	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Std. Deviation	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Rel. Std. Dev.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Variance Coeff.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok

เอกสารไม่ควบคุม

## ThermoFisher SCIENTIFIC

### Chromeleon Operational Qualification, Part 1 Verification of Selected Results

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

Test Result: Passed

เอกสารไม่ควบคุม

## ThermoFisher SCIENTIFIC

### Chromeleon Operational Qualification, Part 1 Verification of Selected Results

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

เอกสารไม่ควบคุม

## ThermoFisher SCIENTIFIC

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

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

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

เอกสารไม่ควบคุม





## Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Abs.Ret.Dev.	Acetanilide	ok
	Ret.Dev.(abs)	Acetophenone	ok
	Ret.Dev.(abs)	Propiophenone	ok
	Rel.Ret.Dev.	Acetanilide	ok
	Ret.Dev.(rel)	Acetophenone	ok
	Ret.Dev.(rel)	Propiophenone	ok
	Area	Acetanilide	ok
	Area	Acetophenone	ok
	Area	Propiophenone	ok
	Rel.Area	Acetanilide	ok
	Rel.Area (Total)	Acetophenone	ok
	Rel.Area (Total)	Propiophenone	ok
	Height	Acetanilide	ok
	Height	Acetophenone	ok
	Height	Propiophenone	ok
	Rel.Height (Total)	Acetanilide	ok
	Rel.Height (Total)	Acetophenone	ok
	Rel.Height (Total)	Propiophenone	ok
	Amount	Acetanilide	ok
	Amount	Acetophenone	ok
	Amount	Propiophenone	ok
	Concentration	Acetanilide	ok
	Concentration	Acetophenone	ok
	Concentration	Propiophenone	ok
	Rel.Amount	Acetanilide	ok
	Rel.Amount	Acetophenone	ok
	Rel.Amount	Propiophenone	ok
	Peak Width (0%)	Acetanilide	ok
	Peak Width (0%)	Acetophenone	ok
	Peak Width (0%)	Propiophenone	ok
	Peak Width (5%)	Acetanilide	ok
	Peak Width (5%)	Acetophenone	ok
	Peak Width (5%)	Propiophenone	ok
	Peak Width (10%)	Acetanilide	ok
	Peak Width (10%)	Acetophenone	ok
	Peak Width (10%)	Propiophenone	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%)	Acetanilide	ok
	Peak Width (50%)	Acetophenone	ok
	Peak Width (50%)	Propiophenone	ok
	Left Width (0%)	Acetanilide	ok
	Left Width (0%)	Acetophenone	ok
	Left Width (0%)	Propiophenone	ok
	Right Width (0%)	Acetanilide	ok
	Right Width (0%)	Acetophenone	ok
	Right Width (0%)	Propiophenone	ok
	Peak Start	Acetanilide	ok
	Peak Start	Acetophenone	ok
	Peak Start	Propiophenone	ok
	Peak Stop	Acetanilide	ok
	Peak Stop	Acetophenone	ok
	Peak Stop	Propiophenone	ok
	Peak Start Value	Acetanilide	ok
	Peak Start Value	Acetophenone	ok
	Peak Start Value	Propiophenone	ok
	Peak Stop Value	Acetanilide	ok
	Peak Stop Value	Acetophenone	ok
	Peak Stop Value	Propiophenone	ok
	BL-Value Peak Start	Acetanilide	ok
	BL-Value Peak Start	Acetophenone	ok
	BL-Value Peak Start	Propiophenone	ok
	BL-Value Peak Stop	Acetanilide	ok
	BL-Value Peak Stop	Acetophenone	ok
	BL-Value Peak Stop	Propiophenone	ok
	Type	Acetanilide	ok
	Type	Acetophenone	ok
	Type	Propiophenone	ok
	Resolution (EP)	Acetanilide	ok
	Resolution(EP)	Acetophenone	ok
	Resolution(USP)	Acetanilide	ok
	Resolution(USP)	Acetophenone	ok
	Resolution(USP)	Acetanilide	ok
	Asymmetry(EP)	Acetanilide	ok
	Asymmetry(EP)	Acetophenone	ok
	Asymmetry(EP)	Propiophenone	ok

เอกสารไม่ควบคุม



## Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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

เอกสารไม่ควบคุม



## 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	Propiophenone	ok
	No. of Points(disabled)	Acetanilide	ok
	No. of Points(disabled)	Acetophenone	ok
	No. of Points(disabled)	Propiophenone	ok
	Variance	Acetanilide	ok
	Variance	Acetophenone	ok
	Variance	Propiophenone	ok
	Var.Coeff	Acetanilide	ok
	Var.Coeff	Acetophenone	ok
	Var.Coeff	Propiophenone	ok
	Std.Dev.	Acetanilide	ok
	Std.Dev.	Acetophenone	ok
	Std.Dev.	Propiophenone	ok
	Rel.Std.Dev.	Acetanilide	ok
	Rel.Std.Dev.	Acetophenone	ok
	Rel.Std.Dev.	Propiophenone	ok
	Corr.Coeff.	Acetanilide	ok
	Corr.Coeff.	Acetophenone	ok
	Corr.Coeff.	Propiophenone	ok
	R-Square	Acetanilide	ok
	R-Square	Acetophenone	ok
	R-Square	Propiophenone	ok
	Adj. R-Square	Acetanilide	ok
	Adj. R-Square	Acetophenone	ok
	Adj. R-Square	Propiophenone	ok
	X	Acetanilide	ok
	X	Acetophenone	ok
	X	Propiophenone	ok
	Y	Acetanilide	ok
	Y	Acetophenone	ok
	Y	Propiophenone	ok
	W	Acetanilide	ok
	W	Acetophenone	ok
	W	Propiophenone	ok
	F(X)	Acetanilide	ok
	F(X)	Acetophenone	ok
	F(X)	Propiophenone	ok

เอกสารไม่ควบคุม



## Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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



## Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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

Test Result: Passed

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เอกสารไม่ควบคุม



## Chromeleon Operational Qualification, Part 3

System Suitability Test: Comparison with Expected Results

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

Test Result: Passed

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## SOFTWARE OQ



### Chromeleon

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

OVERALL TEST RESULT: PASS



Field Service Representative Signature:	Customer Signature:
<i>[Signature]</i>	<i>[Signature]</i>
Date: 27/Apr/2024	Date: 22/Apr/2024

เอกสารไม่ควบคุม

PQ Anion ID#1047

Performance Qualification

TEST EQUIPMENT AND STANDARDS

ThermoFisher  
SCIENTIFIC

Test Equipment

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

Standards/Chemicals

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



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

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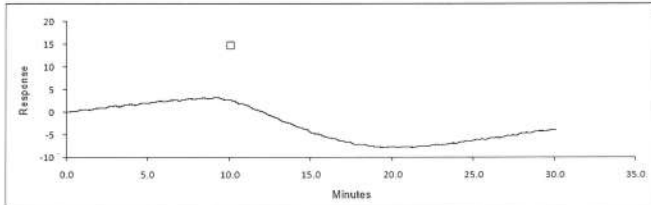
23-Apr-2024  
Test Equipment and Standards Report Page 1 of 1

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

NOISE AND DRIFT (CD)

ThermoFisher  
SCIENTIFIC



Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	chrom://desktop-c4fs3i7/ChromleonLocal/Archimica/Service Contract/Validate 2024/1PM1PQ 23-04-24/Anion/IC_OQ.seq/278.smp/ECD_1.channel

Noise and Drift

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

OVERALL TEST RESULT: PASS



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

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23-Apr-2024  
Noise and Drift (CD) Report Page 1 of 1

เอกสารไม่ควบคุม

REPEATABILITY (CD)

ThermoFisher  
SCIENTIFIC

Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	ChromleonLocal://Archimica/Service Contract/Validate 2024/1PM1PQ 23-04-24/Anion/IC_OQ

Peak Results

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

Repeatability

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

OVERALL TEST RESULT: PASS



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

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23-Apr-2024  
Repeatability (CD) Report Page 1 of 1

เอกสารไม่ควบคุม



Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	ChromeleonLocal://Archemica/Service Contract/Validate 2024/1PM1PQ 23-04-24/Anion/IC OQ

Peak Results

Sample Name	Injection Volume (µL)	Retention Time (min)	Area
Reference Blank	25	0.265	0.053
High Standard	25	0.265	49.734
Carryover	25	0.265	0.051

Results

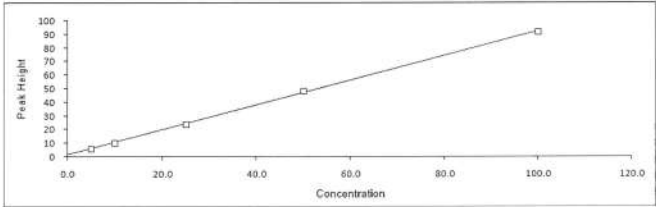
Test	Observed (%)	OQ Limit (%)	Result
AREA	0.00	≤ 0.10	PASS



OVERALL TEST RESULT: PASS

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

เอกสารไม่ควบคุม



Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	ChromeleonLocal://Archemica/Service Contract/Validate 2024/1PM1PQ 23-04-24/Anion/IC OQ

Peak Results

Sample Name	Concentration	Peak Height	Calculated
Detector Linearity 01	5	5.872	4.82
Detector Linearity 02	10	10.299	9.68
Detector Linearity 03	25	23.794	24.52
Detector Linearity 04	50	48.473	51.65
Detector Linearity 05	100	91.855	99.34

Linearity

Test	Observed	OQ Limit	Result
r <sup>2</sup>	0.999	≥ 0.999	PASS



OVERALL TEST RESULT: PASS

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

เอกสารไม่ควบคุม

ELUENT GENERATOR TEST

EG Current Test

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



OVERALL TEST RESULT: PASS

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

เอกสารไม่ควบคุม

IC PUMP FLOW RATE ACCURACY

IC Pump Flow Rate

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



OVERALL TEST RESULT: PASS

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

เอกสารไม่ควบคุม

Column Compartment

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

OVERALL TEST RESULT: PASS



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

เอกสารไม่ควบคุม

N/A
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Field Service Representative Signature:	Customer Signature:
<i>K. Khamwong</i>	<i>Simon</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

เอกสารไม่ควบคุม

OQ REVIEW AND COMPLETION

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

OPERATIONAL QUALIFICATION RESULTS

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

Service Representative

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

Customer

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



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

เอกสารไม่ควบคุม