

ภาคผนวก ค

เอกสารสอบเทียบเครื่องมือ

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Andersen Instruments, Inc.	G25A 11MX	Jiranatee Associates Co., Ltd.	CO-005-66	12 Jun 23	11 Jun 25	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	24P1250	10 Apr 24	9 Apr 25	-
3	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24P1367	22 Apr 24	21 Apr 25	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24H752	10 Apr 24	9 Apr 25	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM08130002	UAE Consultant Co.,Ltd.	01112023	1 Nov 23	31 Oct 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050148	UAE Consultant Co.,Ltd.	13112023	13 Nov 23	12 Nov 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050149	UAE Consultant Co.,Ltd.	01112023	1 Nov 23	31 Oct 24	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050150	UAE Consultant Co.,Ltd.	01112023	1 Nov 23	31 Oct 24	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM22177051	UAE Consultant Co.,Ltd.	21112023	21 Nov 23	20 Nov 24	-
10	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05N91E15A0014	6 Jul 23	6 Jul 31	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387065	UAE Consultant Co.,Ltd.	03112023	3 Nov 23	2 Nov 24	-
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387066	UAE Consultant Co.,Ltd.	03112023	3 Nov 23	2 Nov 24	-
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1200906875	UAE Consultant Co.,Ltd.	03112023	3 Nov 23	2 Nov 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
Ambient									
14	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1200906876	UAE Consultant Co.,Ltd.	09112023	9 Nov 23	8 Nov 24	-
15	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920012	UAE Consultant Co.,Ltd.	03112023	3 Nov 23	2 Nov 24	-
16	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2311DR0037	Thai Meteorological Department	123/24	13 Mar 24	12 Mar 25	-
17	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	SvanteK	SV36 107224	Innovative Instrument Co.,Ltd.	24-ACT-091	26 Jun 24	25 Jun 25	-
18	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Adm} , L_{A90} , L_{Amax}	Larson Davis	LxT2 0005372	Innovative Instrument Co.,Ltd.	24-SLM-229	9 Jul 24	8 Jul 25	-
19	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Adm} , L_{A90} , L_{Amax}	Larson Davis	LxT2 0005341	Innovative Instrument Co.,Ltd.	24-SLM-232	10 Jul 24	9 Jul 25	-
20	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Adm} , L_{A90} , L_{Amax}	Larson Davis	LxT2 0005346	Innovative Instrument Co.,Ltd.	24-SLM-235	10 Jul 24	9 Jul 25	-
21	Sound Level Meter	ระดับเสียงรบกวน	Larson Davis	LxT1 0007305	Electrical And Electronics Institute Foundation For Industrial Development	CP20240323EA	22 Aug 24	21 Aug 25	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Workplace									
1	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6306	Innovative Instrument Co.,Ltd.	23-ACT-066	12 May 23	11 May 24	-
2	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35A 73249	Innovative Instrument Co.,Ltd.	23-ACT-111	23 Jun 23	22 Jun 24	-
3	Sound Level Meter	$L_{Aeq} 5 min$ L_{Amax}	Rion, Japan	NL-43 00430305	Sithiporn Associates Co., Ltd.	ACL23289	27 Sep 23	26 Sep 24	-
4	Sound Level Meter	$L_{Aeq} 5 min$ L_{Amax}	Rion, Japan	NL-43 00430300	Sithiporn Associates Co., Ltd.	ACL23277	15 Sep 23	14 Sep 24	-
5	Sound Level Meter	$L_{Aeq} 5 min$ L_{Amax}	Rion, Japan	NL-43 00730426	Sithiporn Associates Co., Ltd.	ACL23290	27 Sep 23	26 Sep 24	-

CERTIFICATE OF CALIBRATION

Certificate No. : CO-005-66

Page 1 of 2 Pages

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

: Top Load Orifice
: Andersen Instruments
: 625A
: 11MX
: UAE ANV.008/2543
: Used Item
: United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong,
Bangkok 10260

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

: 02 Jun 2023
: 12 Jun 2023
: 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 24.0 °C and 56.4 %RH.

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

TABULATION OF RESULTS:

The table on next page give the measured values.



Calibrated by:

- ☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol

Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

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

Continuation of Certificate of Calibration Number CO-005-66

Page 2 of 2 Pages

MEASUREMENT RESULTS:

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

Table 1: The results of Q Standard calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _a] °C	Temperature [T _m] °C	Ap_meter mmHg	Ap_Orifice inH ₂ O	γ	Standard Flow [Q _s] m ³ /min
1	0.705	754.535	24.09	23.49	51.470	1.745	1.318	0.656
2	0.998	754.592	24.01	23.68	55.777	3.453	1.855	0.922
3	1.124	754.473	23.93	23.53	37.502	4.619	2.145	1.066
4	1.172	754.436	23.39	23.00	27.960	5.187	2.275	1.128
5	1.418	754.502	23.52	23.02	28.014	7.616	2.756	1.365

Slope (m): 2.02897
Intercept (b): -0.01391
Correlation coefficient (r): 0.99986
Uncertainty (k=2): 0.015 m³/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _a] °C	Temperature [T _m] °C	Ap_meter mmHg	Ap_Orifice inH ₂ O	γ	Standard Flow [Q _s] m ³ /min
1	0.705	754.535	24.09	23.49	51.470	1.745	0.829	0.658
2	0.998	754.592	24.01	23.68	55.777	3.453	1.166	0.925
3	1.124	754.473	23.93	23.53	37.502	4.619	1.349	1.070
4	1.172	754.436	23.39	23.00	27.960	5.187	1.428	1.130
5	1.418	754.502	23.52	23.02	28.014	7.616	1.730	1.368

Slope (m): 1.27084
Intercept (b): -0.00875
Correlation coefficient (r): 0.99986
Uncertainty (k=2): 0.015 m³/min

End of Certificate of Calibration



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Certificate of Calibration

Certificate No.: 24P1250
Page: 1 of 2

Equipment : U Tube Manometer
Manufacturer: Dwyer
Model : 1221-36-W/M
Serial No.: -
ID No.: UAE.EFM.076/2566
Condition As-Received: Used Item
Received Date: 03 April 2024
Calibration Date: 10 April 2024
Reference: 2404-0118WSC
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-P04, using " DKD-R 6-1 ; Calibration of Pressure Gauges " as a guidelines.

Condition of this result of calibration

1.Reference standards instruments :

- | Instrument | Model | Serial No. | Certificate No. | Due Date |
|------------------------|--------|------------|-----------------|-------------|
| 1) Pressure Calibrator | PC106P | 1189 | MP-0176-23 | 12 Sep 2024 |
- 2.This result of calibration was made on requested at the point specified by customer.
3.Scale and conversion factor is 1 kPa = 4.0146293 inH₂O
4.This instrument was used clean air as pressure media.
5.This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.
6.This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.
7.The certificate is valid only to the item calibrated on date and place of calibration.
8.This Certification is traceable to the International System of Unit maintained through:-
-National Institute of Metrology (Thailand), NSC-ONSC Accredited No. Calibration 0144

Calibrated by : Suksan Khankaew
Issue Date : 17 April 2024

Approved Signatory :

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

Result of calibration:- Without adjustment
Function:- Pressure Measurement
Increasing Pressure

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

UUC Indication		ΔP	Error
Low-port side	High-port side		
0.00	0.00	0.00	0.00
2.00	1.00	-1.00	0.00
4.00	2.00	-2.00	0.00
6.00	3.00	-3.00	0.00
8.00	4.00	-4.00	0.00
10.00	5.05	-4.95	0.00
12.00	6.05	-5.95	0.00
14.00	7.05	-6.95	0.00
16.00	8.10	-7.95	0.05
18.00	9.10	-8.95	0.05
20.00	10.10	-9.95	0.05
22.00	11.10	-10.95	0.05
24.00	12.10	-11.95	0.05
26.00	13.15	-12.95	0.10
28.00	14.15	-13.95	0.10
30.00	15.20	-14.95	0.15
32.00	16.20	-15.95	0.15
34.00	17.20	-16.95	0.15
35.50	18.00	-17.70	0.20

The uncertainty of measurement was ± 0.11 inH₂O

* ΔP = High-port side - Low-port side

* UUC = Unit Under Calibration

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

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



Certificate of Calibration

Certificate No.: 24P1367
Page : 1 of 2

Equipment : Aneroid Barometer
Manufacturer: Barigo
Model : -
Serial No.: -
ID No.: UAE.ANV.152/2550
Condition As-Received: Used Item
Received Date: 05 April 2024
Calibration Date: 22 April 2024
Reference: 2404-0243/WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1007 mbar

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

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

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 | DP1142 | 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.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 : 23 April 2024

Approved Signatory :

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

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Result of calibration:- Without adjustment											
Function:- Absolute Pressure Measurement											
Scale Interval : 1 hPa (The Fifth Estimate)											
Range : 960 hPa to 1030 hPa											
Increasing Pressure											
Applied Pressure (hPa)	957.13	968.77	980.13	990.56	1001.26	1011.35	1022.10	1032.61			
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0			
Error (hPa)	2.87	1.23	-0.13	-0.56	-1.26	-1.35	-2.10	-2.61			
Decreasing Pressure											
Applied Pressure (hPa)	1032.61	1021.84	1010.88	1000.82	990.20	979.52	968.48	957.17			
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0			
Error (hPa)	-2.61	-1.84	-0.88	-0.82	-0.20	0.48	1.52	2.83			

The uncertainty of measurement was ± 0.25 hPa

* UUC = Unit Under Calibration

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

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Certificate of Calibration

Certificate No.: 24H752
Page : 1 of 2

Cert. No.: 24H752
Page.: 2 of 2

Equipment : Dial Thermo-Hygrometer
Manufacturer: Barigo
Model : -
Serial No.: -
ID No.: UAE.ANV.004/2548
Condition As-Received: Used Item
Received Date: 05 April 2024
Calibration Date: 10 April 2024
to 18 April 2024
Reference: 2404-0247WSC
Ambient Temperature: (25 ± 3) °C
Relative Humidity: (50 ± 20) %

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

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

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

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Chilled Mirror Hygrometer	Dew Master	44730	21656	02 Aug 2024
2) Handheld Thermometer With Sensor	1521	A5A339	2311238	16 Oct 2024

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

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

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

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

Result of Calibration:-

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	41	0.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	78	-2.0	1.8

Result of Calibration:-

Temperature Measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.014	20.5	0.486	0.72
25.033	25.0	-0.033	0.72
30.010	30.0	-0.010	0.72
35.027	34.5	-0.527	0.72
40.013	39.5	-0.513	0.72

UUC* : Unit Under Calibration

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

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Calibrated by : Chakrit Waewwanjua
Issue Date : 18 April 2024

Approved Signatory :

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

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MULTI-POINT GAS TEST REPORT

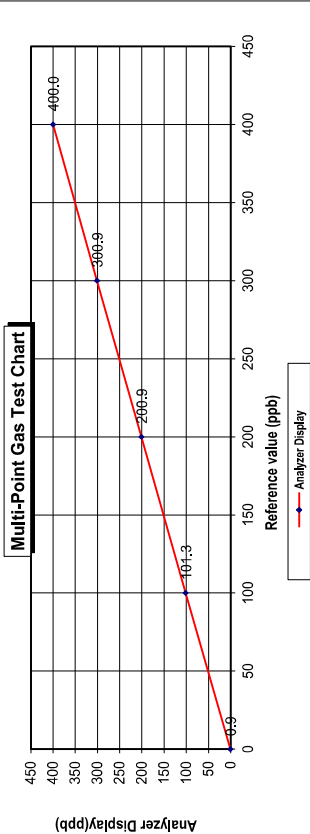
Test Date : Nov 1, 2023

Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : CM08130002

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68	PPM	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	146i
Methane (CH ₄)	-	PPM	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%	101.3	1.30	1.28	1.28
Level 3 40.00%	200.9	0.90	0.45	0.45
Level 4 60.00%	300.9	0.90	0.30	0.30
Level 5 80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb		Average Difference (%)		0.59
		: Acceptable Limit \pm 5%		



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Approve by

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MULTI-POINT GAS TEST REPORT

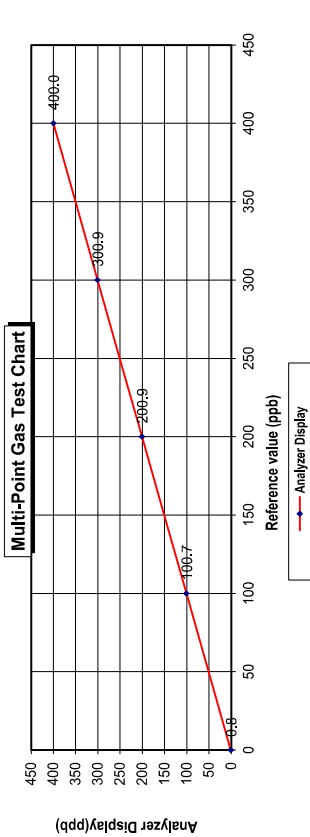
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Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : CM19050148

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68	PPM	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	146i
Methane (CH ₄)	-	PPM	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	0.8	0.80	0.80	0.80
Level 2 20.00%	100.7	0.70	0.70	0.70
Level 3 40.00%	200.9	0.90	0.45	0.45
Level 4 60.00%	300.9	0.90	0.30	0.30
Level 5 80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb		Average Difference (%)		0.45
		: Acceptable Limit \pm 5%		



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MULTI-POINT GAS TEST REPORT

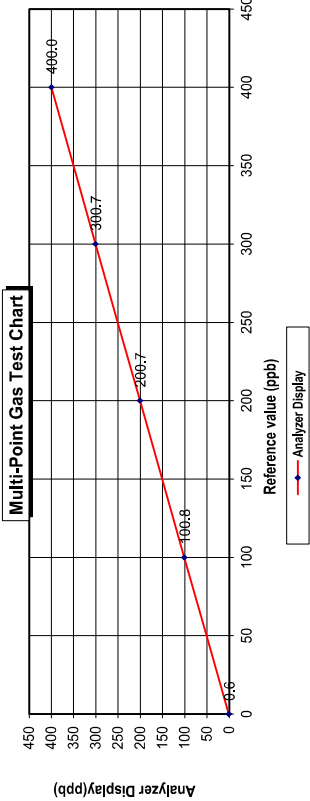
Test Date : Nov 1, 2023

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

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68	PPM	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	146i
Methane (CH ₄)	-	PPM	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			
Level 2	20.00%	100.0	0.60	0.60	0.60
Level 3	40.00%	200.0	100.8	0.80	0.79
Level 4	60.00%	300.0	200.7	0.70	0.35
Level 5	80.00%	400.0	300.7	0.70	0.23
		400.0	0.00	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)		0.40



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MULTI-POINT GAS TEST REPORT

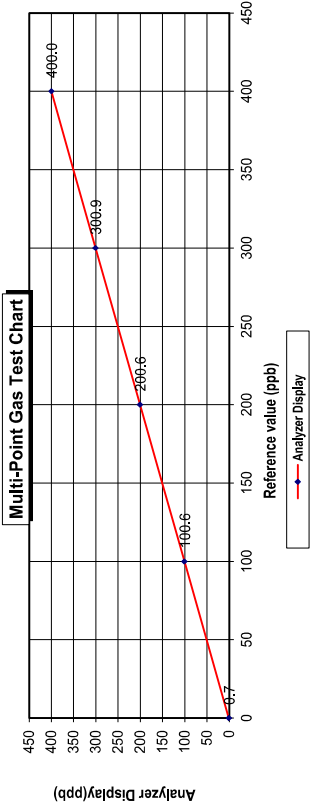
Test Date : Nov 1, 2023

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

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68	PPM	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	146i
Methane (CH ₄)	-	PPM	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			
Level 2	20.00%	100.0	0.7	0.70	0.70
Level 3	40.00%	200.0	100.6	0.60	0.60
Level 4	60.00%	300.0	200.6	0.60	0.30
Level 5	80.00%	400.0	300.9	0.90	0.30
		400.0	0.00	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)		0.38



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MULTI-POINT GAS TEST REPORT

Test Date : Nov 21, 2023

Equipment : Gas Analyzer (NO₂)
Manufacturer : Thermo Scientific

Model : 42i
Serial Number : CM22177051

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.68
Nitric Oxide (NO) 45.94
Methane (CH₄) -
Carbon Monoxide (CO) 984.8
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

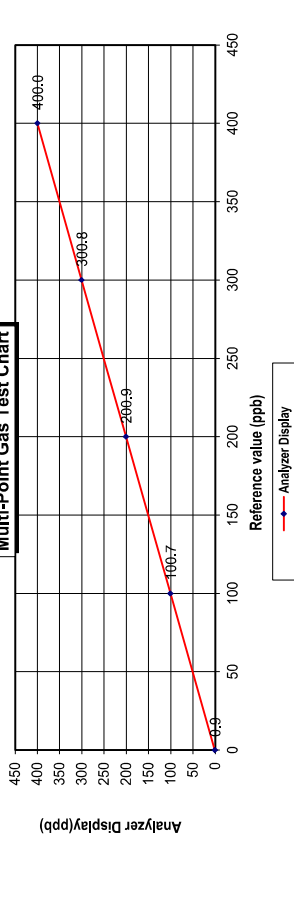
Dilutor Detail

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

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error]
Level 1 Zero	0.0	0.9	0.90	0.90
Level 2 20.00%	100.0	100.7	0.70	0.70
Level 3 40.00%	200.0	200.9	0.45	0.45
Level 4 60.00%	300.0	300.8	0.27	0.27
Level 5 80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range : 500.0 ppb				
: Acceptable Limit $\pm 5\%$				

Multi-Point Gas Test Chart



Calculate by

21 Nov 2023
/ /

Approve by

22 Nov 2023
/ /

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)

LTD--

Part Number: E05N191E15A0014
Cylinder Number: EB0162121
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12023
Gas Code: CO, CO₂, NO, NO₂, SO₂, BALN

Reference Number: 160-402772205-1
Cylinder Volume: 144.0 CF
Cylinder Pressure: 2016 PSIG
Valve Outlet: 560
Certification Date: Jul 06, 2023

Expiration Date: Jul 06, 2031

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards" (May 2012) document EPA 800R-12/ES31, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

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

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	104202308	CC754364	98.35 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Jan 04, 2031
PRM	C2219101	AP1514048	100.19 PPM NITRIC OXIDE/NITROGEN	+/- 0.3%	Feb 28, 2025
GMIS	2023042525	CC754381	98.52 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Apr 25, 2031
PRM	12409	D913660	15.01 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Feb 17, 2023
GMIS	15340020202	EB0130037	9.693 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%	Sep 29, 2025
NTRM	160102-22	KAL003820	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Nov 01, 2027
CO	230601	CC745902	249.47 PPM CARBON MONOXIDE/NITROGEN	+/- 0.3%	Dec 09, 2028
NTRM	130606-02	CC411730	13.359 % CARBON DIOXIDE/NITROGEN	+/- 0.5%	May 14, 2025

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

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet IS50 FTIR AUP2010245 CO2	FTIR	Jun 15, 2023
SIEMENS ULTRAMATE6E N1-C8-180	NDIR	Jun 14, 2023
Nicolet IS50 FTIR AUP2010245 NO	FTIR	Jun 29, 2023
Nicolet IS50 FTIR AUP2010245 NO2	FTIR	Jun 15, 2023
Nicolet IS50 FTIR AUP2010245 SO2	FTIR	Jun 08, 2023

Approved for Release

MULTI-POINT GAS TEST REPORT

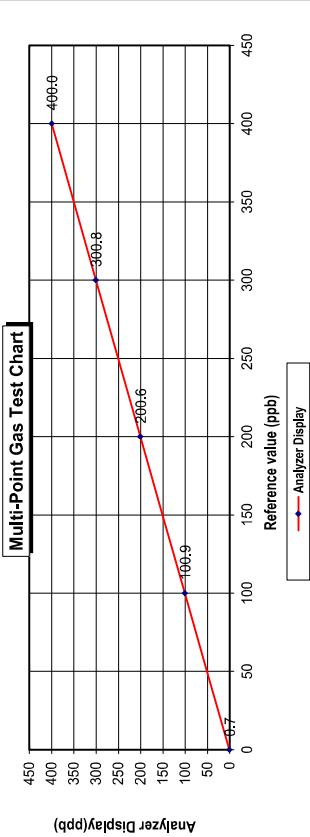
Test Date : Nov 3, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387065

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

Multi-point gas test data

Reference Value (ppb)		Analyzer Display (ppb)		Difference Error		Percent Error		[% Error]	
Level 1	Zero	0.0	0.7	0.70	0.70	0.70	0.70	0.70	0.70
Level 2	20.00%	100.0	100.9	0.90	0.89	0.89	0.89	0.89	0.89
Level 3	40.00%	200.0	200.6	0.60	0.30	0.30	0.30	0.30	0.30
Level 4	60.00%	300.0	300.8	0.80	0.27	0.27	0.27	0.27	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00	0.00	0.00	0.00
Remark : Measuring Range		500.0 ppb		Average Difference (%)		0.43		0.43	
				: Acceptable Limit ± 5%					



Calculate by

Approve by

03...../.....Nov.../.....2023.

03...../.....Nov.../.....2023.

MULTI-POINT GAS TEST REPORT

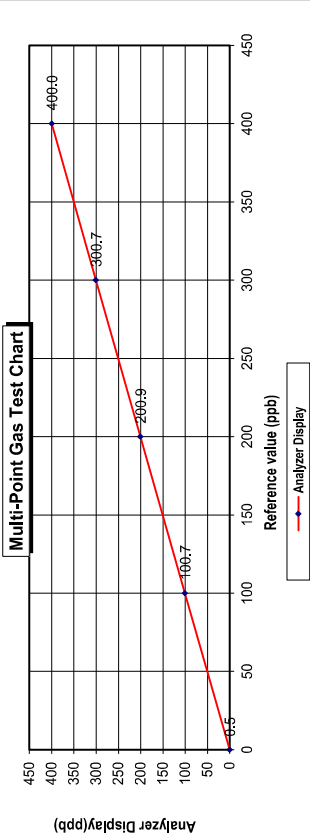
Test Date : Nov 3, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387066

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

Multi-point gas test data

Reference Value (ppb)		Analyzer Display (ppb)		Difference Error		Percent Error		[% Error]	
Level 1	Zero	0.0	0.5	0.50	0.50	0.50	0.50	0.50	0.50
Level 2	20.00%	100.0	100.7	0.70	0.70	0.70	0.70	0.70	0.70
Level 3	40.00%	200.0	200.9	0.90	0.45	0.45	0.45	0.45	0.45
Level 4	60.00%	300.0	300.7	0.70	0.23	0.23	0.23	0.23	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00	0.00	0.00	0.00
Remark : Measuring Range		500.0 ppb		Average Difference (%)		0.38		0.38	
				: Acceptable Limit ± 5%					



Calculate by

Approve by

03...../.....Nov.../.....2023.

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MULTI-POINT GAS TEST REPORT

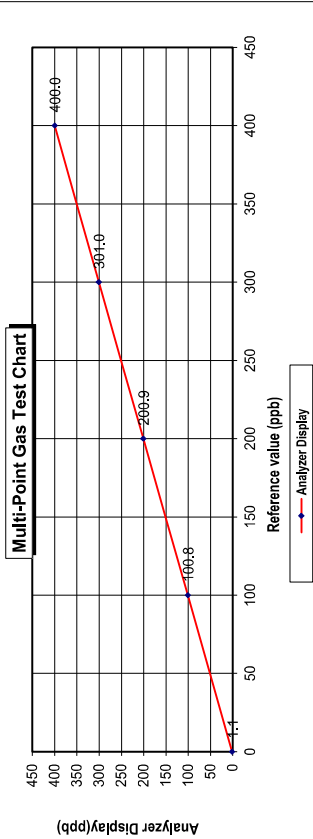
Test Date : Nov 3, 2023

Equipment :	Gas Analyzer (SO ₂)	Model :	43i
Manufacturer :	Thermo SCIENTIFIC	Serial Number :	1200906875

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

Multi-point gas test data

Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0			
Level 2	20.00%	100.0	1.1	1.10	1.10
Level 3	40.00%	200.0	100.8	0.80	0.79
Level 4	60.00%	300.0	200.9	0.90	0.45
Level 5	80.00%	400.0	301.0	1.00	0.33
Level 5		400.0	400.0	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)	0.53	



Calculate by

Approve by

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MULTI-POINT GAS TEST REPORT

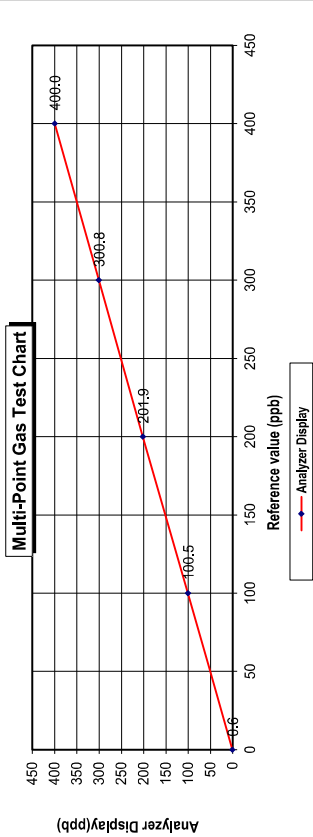
Test Date : Nov 9, 2023

Equipment :	Gas Analyzer (SO ₂)	Model :	43i
Manufacturer :	Thermo SCIENTIFIC	Serial Number :	1200906876

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

Multi-point gas test data

Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0			
Level 2	20.00%	100.0	0.6	0.60	0.60
Level 3	40.00%	200.0	0.50	0.50	0.50
Level 4	60.00%	300.0	1.90	0.94	0.94
Level 5	80.00%	400.0	0.80	0.27	0.27
Remark : Measuring Range		500.0 ppb	0.00	0.00	0.00
			Average Difference (%)	0.46	



Calculate by

Approve by

.....9...../.....11...../.....66.....

.....9...../.....Nov...../.....2023.....

Test Date : Nov 3, 2023

Equipment : Gas Analyzer (SO₂)
Manufacturer : Thermo SCIENTIFIC

Model : 43i
Serial Number : 1182920012

Standard Gas Concentration

Sulphur Dioxide (SO₂)
Nitric Oxide (NO)
Methane (CH₄)
Carbon Monoxide (CO)
Cylinder No. :
Expiration Date :

44.68
45.94
-
984.8
EB0143262
Jun 24, 2024

PPM
PPM
PPM
PPM
PPM
PPM

Thermo SCIENTIFIC
146i
1180540071

Multi-point gas test data					
Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.7	0.70	0.70
Level 2	20.00%	100.0	100.6	0.60	0.60
Level 3	40.00%	200.0	200.5	0.50	0.25
Level 4	60.00%	300.0	300.9	0.90	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range : 500.0 ppb		Average Difference (%)		0.37	
: Acceptable Limit ± 5%					

Multi-Point Gas Test Chart

Reference value (ppb)	Analyzer Display (ppb)
0	0.7
100	100.6
200	200.5
300	300.9
400	400.0

Calculate by
Siri Chai S.

03...../.....Nov./.....2023

Approve by
Siri Chai S.

03...../.....Nov./.....2023



THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau
Date of Issue 13 March, 2024 Certification No. 123/24
Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger
Manufacturer : SCARLET/TECH
Type : WL-21
Mfg Code : Wireless Receiver 2311DR0037
Wind Sensor 2112DT0102
Customer : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road,

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1013.1 hPa
Bangchak, Prakanong, Bangkok 10260.

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board
: Micromanometer Theodor Friedrichs FC014 Serial No. 8310119 : HOOK GAGE NO 1425
N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629586)
JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec
STANDARD THERMOMETER : Theodor Friedrich : Dry No. 8390/94 Wet No. 8389/94

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

Calibrated by : Nattapong
Mr. Watchampol Subwat
Mechanical Engineer
Signed :
Mr. Pisoot Promsut
(Authorized Signatory)
for the Chief
Sub-Standard Instrument





The Result of Calibration

13 March, 2024

Certification No. 123/24

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		1011		0.46
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
1013.81		1014		-0.19
1014.19		1014		0.19
1015.96		1016		-0.04
1016.23		1016		0.23
1015.64		1016		-0.36
1015.23		1015		0.23
1012.87		1013		-0.13
1013.63		1013		0.63
		Average		0.09

Calibrated by :

Wattapol

Mr. Watchapol Subwat
Mechanical Engineer



เอกสารไม่ควบคุม



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

The Result of Calibration

13 March, 2024

Certification No. 123/24

Page : 2 of 5

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H ₂ O	Vacuum inches H ₂ O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	6.9	0.14
9.02	-	-	-	9.0	0.02
11.02	-	-	-	10.9	0.12
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

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

Calibrated by :

Wattapol

Mr. Watchapol Subwat
Mechanical Engineer



เอกสารไม่ควบคุม



The Result of Calibration

13 March, 2024
Certification No. 123/24
Page : 4 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mmHg
757.25	757	0.25
757.15	757	0.15
757.64	758	-0.36
758.27	758	0.27
758.66	759	-0.34
758.94	759	-0.06
759.11	759	0.11
759.84	760	-0.16
759.95	760	-0.05
759.73	760	-0.27
759.96	760	-0.04
760.14	760	0.14
760.42	760	0.42
760.70	761	-0.30
762.03	762	0.03
762.24	762	0.24
761.79	762	-0.21
761.48	761	0.48
759.71	760	-0.29
760.28	760	0.28
Average		0.02

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



เอกสารไม่ควบคุม



The Result of Calibration

13 March, 2024
Certification No. 123/24
Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.1	45	0.1
30.2	30	0.2
15.4	15	0.4

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



เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name

Address

: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

: 24-SLM-229

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

Request No :

Certificate No :

Req-2024-1448

24-SLM-229

Unit Under Calibration Details

Measurement item :

Manufacturer

Model

Serial Number

ID

Resolution

: Sound Level Meter

: Larson Davis

: LX12

: 0005372

: UAEFFM0372563

: 0.1 dB

Microphone Class : 2

Microphone Model : 375B02

Microphone S/N : 11792

Preamplifier Model : PRMLX12B

Preamplifier S/N : 056132

Instrument Status : Used

Calibration Environment and Details

Temperature

Humidity

Barometric Pressure

Received Date

Calibrated Date

: 23 °C ± 2 °C

: 50 %RH ± 20 %RH

: 1013 hPa ± 10 hPa

: 1 July 2024

: 9 July 2024

Calibration Procedure

Location of Calibration

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

: Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	Svanick	Svan401	131	8 October 2024	WK Electric

Note

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

Calibrated By :

Mr. Noppadon Luangart

Service Calibration Engineer

Approved By :

Mr. Pait Madaavorn

Calibration Engineer Supervisor

Issue Date :

9 July 2024

Certificate No : 24-ACT-091

Request No : Req-2024-1380

Decision Rule for Statements of Conformity

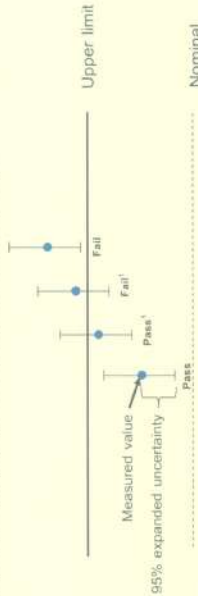
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09-2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements:

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

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

Fail¹ - The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

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



End of Calibration



Certificate No : 24-SLM-229

Request No : Req-2024-1448

1. Indication at the calibration check frequency

	UUC Setting		Nominal Level (dB)	Before Adjust		After Adjust		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)	Result
		Calibrator Setting		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)			
			113.76	114.7	0.94	113.8	+0.04	0.30	Pass	

Note:

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

2. Self-generated noise. Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(\pm dB)
A	32.0	0.10

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

UUC Setting	Measured (dB)	UNCERTAINTY (\pm dB)
FAST / 37-139		
UUC Weighting		
A	31.8	0.10
C	31.7	0.10
Z	35.0	0.10

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

UUC Setting	Deviation from various Frequency				UNCERTAINTY	Acceptance Limit	Result
	Weighting Response curve						
	A	C	Z				
FAST / 37-139	(dB)	(dB)	(dB)	(dB)	(\pm dB)		
STD Setting							
125 Hz	0.1	0.2	0.1	0.60	1.5	Pass	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass	Pass
4000 Hz	0.3	0.3	0.4	0.60	3.0	Pass	Pass
8000 Hz	0.3	0.3	0.5	0.70	\pm 0	Pass	Pass

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

UIC Setting		Deviation from various Frequency				UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)	Result
FAST / 37-139		Weighting Response curve						
STD Setting		A (dB)	C (dB)	Z (dB)				
63 Hz		-0.1	0.0	0.0			2.0	Pass
125 Hz		-0.1	0.0	0.0			1.5	Pass
250 Hz		-0.1	0.0	0.0			1.5	Pass
500 Hz		0.0	0.0	0.0			1.5	Pass
1000 Hz		0.0	0.0	0.0		0.20	1.0	Pass
2000 Hz		0.0	0.1	0.0			2.0	Pass
4000 Hz		0.0	0.0	0.0			3.0	Pass
8000 Hz		0.0	0.0	0.1			5.0	Pass
16000 Hz		0.0	0.0	0.0			∞ -INF	Pass

6. Frequency and time weightings at 1kHz

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

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)	Result
		UUC (dB)	ERR (dB)			
UUC Time Response						
Fast	114.00	114.0	0.0		0.10	Pass!
Slow	114.00	114.0	0.0	0.20	0.10	Pass!
Leq	114.00	114.0	0.0		0.10	Pass!

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting	REF (dB)	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		UUC (dB)	ERR (dB)			
FAST / A / 37-139						
STD dB						
139.00	139	139.0	0.0		1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
129.00	129	129.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	93.6	-0.4		1.1	Pass
89.00	89	88.6	-0.4		1.1	Pass
84.00	84	83.6	-0.4	0.30	1.1	Pass
79.00	79	78.6	-0.4		1.1	Pass
74.00	74	73.6	-0.4		1.1	Pass
69.00	69	68.6	-0.4		1.1	Pass
64.00	64	63.6	-0.4		1.1	Pass
59.00	59	58.6	-0.4		1.1	Pass
54.00	54	53.6	-0.4		1.1	Pass
49.00	49	48.7	-0.3		1.1	Pass
44.00	44	43.9	-0.1		1.1	Pass
39.00	39	39.5	0.5		1.1	Pass
34.00	34	34.9	0.9		1.1	Pass

Certificate No : 24-SLM-229

Request No : Req-2024-1448

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9. Level linearity including the level range control

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		UUC (dB)	ERR (dB)			
FAST / A						
UUC Range	39.10	39.6	0.5		1.1	Pass
37-139	114	114.0	0.0	0.30	1.1	Pass

10. Tone burst response

UUC Setting	STD Toneburst (ms)	Anticipated Ref (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
			UUC (dB)	ERR (dB)			
A / 37-139							
UUC Time Response	200	135.0	135.0	0.0		1.0	Pass
Fast	2	118.0	117.9	-0.1		+1.0, -2.5	Pass
	0.25	109.0	108.8	-0.2		+1.5, -5.0	Pass
Slow	200	128.6	128.5	-0.1	0.20	1.0	Pass
	2	109.0	108.9	-0.1		+1.0, -5.0	Pass
	200	129.0	129.0	0.0		1.0	Pass
SEL	2	109.0	109.1	+0.1		+1.0, -2.5	Pass
	0.25	100.0	100.0	0.0		+1.5, -5.0	Pass

11. Peak C Sound level

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

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

12. Overload indication

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

13. High Level Stability

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

Note :

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

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

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

Decision Rule for Statements of Conformity

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

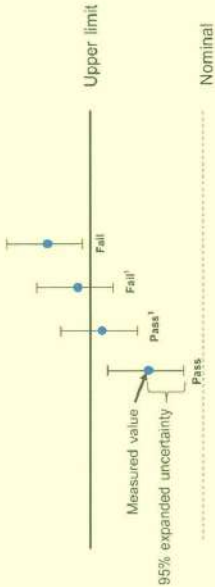
Reporting of Compliance with Specification as following Fig. and statements

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

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

Fail = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

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



End of Certificate

Certificate of Calibration

Customer

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

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

Certificate No : 24-SLM-232

Request No : Req-2024-1451

Unit Under Calibration Details

Measurement item : Sound Level Meter

Manufacturer : Larson Davis

Model : LxT2

Serial Number : 0005341

ID : UAE-EFM.03822563

Resolution : 0.1 dB

Calibration Environment and Details

Temperature : 23 °C ± 2 °C

Humidity : 50 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 1 July 2024

Calibrated Date : 10 July 2024

Microphone Class : 2

Microphone Model : 375B02

Microphone S/N : 11793

Preamplifier Model : PRMLxT2B

Preamplifier S/N : 056133

Instrument Status : Used

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

Location of Calibration : Lab Acoustic

Reference Standard

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

Note

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

Calibrated By :

Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :

Mr. Pacit Mahavorn
Calibration Engineer Supervisor

Issue Date :

10 July 2024

1. Indication at the calibration check frequency

UUC Setting FAST / A / 37-139 Calibrator Setting 1000 Hz 114 dB	Nominal Level (dB)	Before Adjust		After Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)			
	113.76	114.3	0.54	113.8	+0.04	0.20	0.30	Pass

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

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	29.7	0.10

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

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

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

UUC Setting	Deviation from various Frequency Weighting Response curve				UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A	C	Z				
FAST / 37-139							
STD Setting	(dB)	(dB)	(dB)		(± dB)		
125 Hz	0.0	0.1	0.1	0.60	1.5	Pass	
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass	
4000 Hz	0.6	0.5	0.6	0.60	3.0	Pass	
8000 Hz	1.0	0.9	1.0	0.70	5.0	Pass	

Certificate No : 24-SLM-232

Request No : Req-2024-1451

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

UUC Setting	Deviation from various Frequency				UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)	Result
	Weighting Response curve						
STD Setting	A (dB)	C (dB)	Z (dB)				
FAST / 37-139							
63 Hz	-0.2	-0.1	-0.1			2.0	Pass
125 Hz	-0.1	0.0	-0.1			1.5	Pass
250 Hz	-0.1	0.0	-0.1			1.5	Pass
500 Hz	-0.1	0.0	-0.1			1.5	Pass
1000 Hz	0.0	0.0	-0.1		0.20	1.0	Pass
2000 Hz	0.0	0.0	0.0			2.0	Pass
4000 Hz	0.0	0.0	0.0			3.0	Pass
8000 Hz	-0.1	-0.1	0.0			5.0	Pass
16000 Hz	-0.1	-0.1	-0.1			*5, -INF.	Pass

6. Frequency and time weightings at 1kHz

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

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)	Result
		UUC (dB)	ERR (dB)			
UUC Time Response	Fast	114.00	114.0	0.0	0.10	Pass1
	Slow	114.00	114.0	0.0	0.10	Pass1
	Leq	114.00	114.0	0.0	0.10	Pass1

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting			Anticipated		Deviation		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)	Result
FAST / A / 37-139		REF (dB)	UUC (dB)	ERR (dB)					
STD dB							0.30		
139.00		139	139.0	0.0		1.1		Pass	
134.00		134	134.0	0.0		1.1		Pass	
129.00		129	129.0	0.0		1.1		Pass	
124.00		124	124.0	0.0		1.1		Pass	
119.00		119	119.0	0.0		1.1		Pass	
114.00		114	114.0	0.0		1.1		Pass	
109.00		109	109.0	0.0		1.1		Pass	
104.00		104	104.0	0.0		1.1		Pass	
99.00		99	99.0	0.0		1.1		Pass	
94.00		94	94.0	0.0		1.1		Pass	
89.00		89	89.0	0.0		1.1		Pass	
84.00		84	84.0	0.0		1.1		Pass	
79.00		79	79.0	0.0		1.1		Pass	
74.00		74	74.0	0.0		1.1		Pass	
69.00		69	69.0	0.0		1.1		Pass	
64.00		64	64.0	0.0		1.1		Pass	
59.00		59	59.0	0.0		1.1		Pass	
54.00		54	54.0	0.0		1.1		Pass	
49.00		49	49.1	0.1		1.1		Pass	
44.00		44	44.2	0.2		1.1	Pass		
39.00		39	39.5	0.5		1.1	Pass		

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FM-708-SLM-01 Rev. 04 Issue date: 5/6/24

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FM-708-SI M-01 Rev. 04 Issue date 5/6/2014

Certificate No : 24-SLM-232
Request No : Req-20234-1451

Decision Rule for Statements of Conformity

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

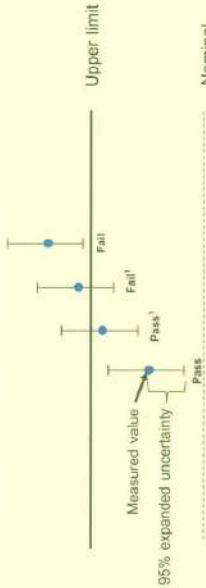
Reporting of Compliance with Specification as following Fig. and statements

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

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

Fail¹ = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

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



End of Certificate

Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Request No : Req-2024-1454
Certificate No : 24-SLM-235

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : Larson Davis
Model : LX12
Serial Number : 0005346
ID : UAE.FFM.043.2563
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375B02
Microphone S/N : 11798
Preamplifier Model : PRMLX12B
Preamplifier S/N : 056138
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 1 July 2024
Calibrated Date : 10 July 2024

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

Reference Standard

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

Note

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

Calibrated By :

Mr. Nopadon Luangart
Service Calibration Engineer

Approved By :

Mr. Pacit Malhavorn
Calibration Engineer Supervisor

Issue Date : 10 July 2024

1. Indication at the calibration check frequency

UUC Setting	Nominal		Before Adjust		After Adjust		Acceptance Limit (± dB)	Result
	FAST / A / 37-139	Level (dB)	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
Calibrator Setting	1000 Hz 114 dB	113.76	115.3	1.54	113.8	+0.04	0.20	Pass

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

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	31.4	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	31.1	0.10
C	30.5	0.10
Z	35.0	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve				Acceptance Limit (± dB)	Result
	A	C	Z	(± dB)		
FAST / 37-139						
STD Setting	(dB)	(dB)	(dB)	(dB)		
125 Hz	0.0	0.1	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	1.1	1.1	1.1	0.60	3.0	Pass
8000 Hz	2.6	2.5	2.6	0.70	5.0	Pass

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Certificate No : 24-SLM-235

Request No : Req-2024-1454

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

UUC Setting	Deviation from various Frequency Weighting Response curve				UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A (dB)	C (dB)	Z (dB)				
FAST / 37-139							
STD Setting							
63 Hz	-0.1	0.0	0.1			2.0	Pass
125 Hz	-0.1	0.0	0.0			1.5	Pass
250 Hz	-0.1	0.0	0.0			1.5	Pass
500 Hz	0.0	0.1	0.0			1.5	Pass
1000 Hz	0.0	0.0	0.0		0.20	1.0	Pass
2000 Hz	0.0	0.1	0.0			2.0	Pass
4000 Hz	0.0	-0.1	0.0			3.0	Pass
8000 Hz	-0.1	-0.1	0.0			5.0	Pass
16000 Hz	-0.1	-0.1	-0.1			+5, -INF	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD REF	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		UUC (dB)	ERR (dB)			
FAST / 37-139						
UUC Weighting	(dB)	(dB)	(dB)			
A	114.00	114.00	0.0		0.20	Pass
C	114.00	114.00	0.0	0.20	0.20	Pass
Z	114.00	114.00	0.0		0.20	Pass

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

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance Limit	Result
		UUC (dB)	ERR (dB)			
FAST / A	REF (dB)					
UUC Range				(± dB)		
		46.40	0.1		1.1	Pass
37-139	114	114.0	0.0	0.30	1.1	Pass

10. Tone burst response

UUC Setting	STD	Toneburst (ms)	Anticipated		Measured	UNCERTAINTY	Acceptance Limit	Result
			Ref (dB)	ERR (dB)	UUC (dB)			
A / 37-139								
UUC Time Response								
		200	135.0		134.9	-0.1		Pass
Fast		2	118.0		117.6	-0.4		Pass
		0.25	109.0		108.5	-0.5		Pass
Slow		200	128.6		128.4	-0.2		Pass
		2	109.0		108.8	-0.2	0.20	Pass
		200	129.0		129.0	0.0		Pass
		2	109.0		108.8	-0.2		Pass
SEL		0.25	100.0		99.7	-0.3		Pass

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance Limit	Result
		REF (dB)	ERR (dB)			
FAST / C / 95-142						
STD Setting				(± dB)		
		137.4	-0.60		3.0	Pass
Complete cycle						
		136.4	-0.20	0.20	2.0	Pass
Positive half cycle						
		136.4	-0.20		2.0	Pass
Negative half cycle						
		136.4	-0.20		2.0	Pass

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7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance Limit	Result
		REF (dB)	UUC (dB)			
FAST / A / 37-139						
STD dB						
		139	139.0	0.0	1.1	Pass
		134	134.0	0.0	1.1	Pass
		129	129.0	0.0	1.1	Pass
		124	124.0	0.0	1.1	Pass
		119	119.0	0.0	1.1	Pass
		114	114.0	0.0	1.1	Pass
		109	109.0	0.0	1.1	Pass
		104	104.0	0.0	1.1	Pass
		99	99.0	0.0	1.1	Pass
		94	94.0	0.0	1.1	Pass
		89	89.0	0.0	1.1	Pass
		84	84.0	0.0	1.1	Pass
		79	79.0	0.0	1.1	Pass
		74	74.0	0.0	1.1	Pass
		69	69.0	0.0	1.1	Pass
		64	64.0	0.0	1.1	Pass
		59	59.0	0.0	1.1	Pass
		54	54.0	0.0	1.1	Pass
		49	49.1	0.1	1.1	Pass
		44	44.2	0.2	1.1	Pass
		43	43.3	0.3	1.1	Pass
		42	42.3	0.3	1.1	Pass
		41	41.4	0.4	1.1	Pass

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

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

Decision Rule for Statements of Conformity

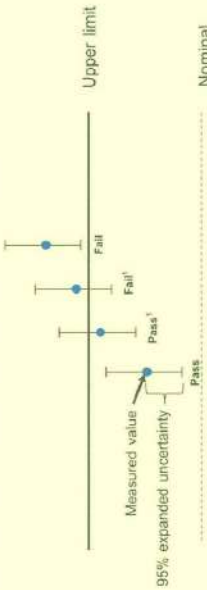
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

Fail – The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

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



End of Certificate

Lower limit

Nominal

Upper limit

12. Overload Indication

UUC Setting	Measured		UNCERTAINTY (\pm dB)	Acceptance		Result
	UUC	(dB)		Limit	(\pm dB)	
FAST / A / 37-139						
STD Setting						
Positive one-half cycle		145.4				
Negative one-half cycle		145.3				
Deviated		0.1	0.20	1.5		Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC	(± dB)	(± dB)	
	(dB)			
STD Setting				
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.20	Pass

Note :

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

- Acceptance limit and Maximum-permitted Uncertainty was IEC 61072-1:2013



**ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT**
975 Moo 4, Bangpoo Industrial Estate, Soi 8, Sukhumvit Road km 37,
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amphawattana
ELECTRICAL AND ELECTRONICS INSTITUTE

NSC-TISI-TIS 17025
CALIBRATION 0110

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

Certificate No.: CP20240323EA

Certificate No.:	CP20240323EA
Operation No.:	CP2024080294

Certificate of Calibration

Equipment:	Sound Level Meter
Manufacturer:	Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)
Model/Type:	LxT1 (Meter), 377B02 (Microphone), PRMLxT1 (Preamplifier)
Serial No.:	0007305 (Meter), 345234 (Microphone), 077640 (Preamplifier)
ID No.:	UAE-EFM.038/2566

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

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

Received Date: 9 August 2024

Calibrated Date: 22 - 27 August 2024

Issued Date: 28 August 2024

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

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

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

Calibration Report

Certificate No.: CP20240323EA

Equipment:	Sound Level Meter
Manufacturer:	Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)
Model/Type:	LxT1 (Meter), 377B02 (Microphone), PRLxT1 (Preamplifier)
Serial No.:	0007305 (Meter), 345234 (Microphone), 077640 (Preamplifier)
ID No.:	UAE.EFM.038/2566
Ambient Temperature:	(23 ± 2) °C
Relative Humidity:	(50 ± 15) %
Pressure:	(101.3 ± 1.5) kPa

Method of Calibration :-

IEC 61672-3:2013

Condition of this result of calibration

1. Reference standards instrument :-

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

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

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

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

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

Certificate No.: CP20240323EA

Calibration Report

Function : 2. Self-generated Noise
2.1 Microphone Installed

Measured value (dB)
30.1

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	29.9
C-weighting	30.0
Z-weighting	35.5

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)
Meter free-field acoustic response at a level of 84 dB.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve		
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)
125	0.2	0.1	0.1
1000	-0.1	-0.1	-0.1
8000	0.6	0.5	0.6

Function : 4. Electrical signal tests of frequency weightings
Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve		
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)
63	0.0	-0.1	0.0
125	0.0	-0.1	0.0
250	0.0	-0.1	0.0
500	0.0	-0.1	0.0
1000	0.0	0.0	0.0
2000	0.0	-0.1	0.0
4000	0.0	-0.1	0.0
8000	-0.1	-0.1	0.0
16000	0.0	0.0	0.0

Certificate No.: CP20240323EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz
5.1 Frequency weighting at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Function : 6. Long-Term Stability
Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

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

Function : 7. Level Linearity on the reference level range
7.1 Level Linearity on the reference level range, Upper

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

Certificate No.: CP20240323EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

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

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	136.0	0.0	±0.5
	2	118.9	-0.1	+1.0 ; -1.5
	0.25	109.7	-0.3	+1.0 ; -3.0
Slow	200	129.5	-0.1	±0.5
	2	109.9	-0.1	+1.0 ; -3.0
	200	130.0	0.0	±0.5
LAE	2	110.0	0.0	+1.0 ; -1.5
	0.25	100.9	-0.1	+1.0 ; -3.0

Function : 9. Peak C sound level

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

Certificate No.: CP20240323EA

Calibration Report

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.5
143.7	143.7		

Function : 11. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	139.0	139.0	0.0	±0.1

Uncertainty of measurement

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

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

2. The acceptance limit is for the deviated value.

3. Acceptance limits was IEC61672-3:2013 Class 1.

4. The coverage factor $k = 2.00$

-- End of Report --

Certificate of Calibration

Customer

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

Certificate No : 23-ACT-066

Request No : Req-2023-0977

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : LARSON DAVIS
Model : CAL150
Serial Number : 6306
ID : UAE.EPM.048/2563

Class : 2

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 : 9 May 2023
Calibration Date : 12 May 2023

Location of Calibration : LAB 1 Acoustic

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

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

Traceability

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

Note

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

Calibrated By :

Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :

Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date :

12 May 2023

Certificate No : 23-ACT-066

Request No : Req-2023-0977

Calibration Results : Without Adjustment

Sound pressure level

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 2 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	94.11	0.11	-	-	0.13	0.40
114 dB / 1000 Hz	114.13	0.13	-	-	0.13	0.40

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 2 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	1000.00	0.00	-	-	0.01	1.7
114 dB / 1000 Hz	1000.00	0.00	-	-	0.01	1.7

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

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 2 (± %)
	Measured (%)	Error (%)	Measured (%)	Error (%)		
94 dB / 1000 Hz	0.04	-	-	-	0.40	3.0
114 dB / 1000 Hz	0.21	-	-	-	0.40	3.0

Note :

- Acceptance limit was IEC 60942:2017 Class 1
- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

Certificate No : 23-ACT-111

Request No : Req-2023-1408

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	93.84	-0.16	-	-	0.14	0.25
114 dB / 1000 Hz	113.79	-0.21	-	-	0.13	0.25

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

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)	Error (%)	Measured (%)	Error (%)		
94 dB / 1000 Hz	0.17	-	-	-	0.40	2.5
114 dB / 1000 Hz	0.04	-	-	-	0.40	2.5

Note :

- Acceptance limit was IEC 60942:2017 Class 1
- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING

Address : CONSULTANT CO.,LTD.

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

Unit Under Calibration Details

Measurement item : Acoustic Calibrator

Manufacturer : SVANTEK

Model : SV 35A

Serial Number : 73249

ID : UAE.EFM.105/2561

Class : 1

Range : 94 , 114 dB / 1000 Hz

Instrument Status : Used

Calibration Environment and Details

Temperature : (23 ±2 °C)

Humidity : (50 ± 20 %RH)

Barometric Pressure : (1013 ±10.0 hPa)

Received Date : 26 June 2023

Calibration Date : 27 June 2023

Location of Calibration : LAB 1 Acoustic

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

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

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

Note

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

Calibrated By :  Mr. Noppadon Luangart

Approved By :  Mr. Pacit Mathavorn

Service Calibration Engineer

Calibration Engineer Supervisor

Issue Date : 27 June 2023

เอกสารไม่ควบคุม

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-43 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00430305 / 202730 / 28155
ID No.: -

Condition As Found : GOOD

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

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

Received Date : 28 AUGUST 2023
Calibration Date : 25 -27 SEPTEMBER 2023
Date of Issue : 27 SEPTEMBER 2023

Calibrated by : Nathakorn Pisuipaisan

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.

Continuation of Calibration Certificate

Calibration Procedure : CP-AC-02

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-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).

Continuation of Calibration Certificate

Cert. No. : ACL23289
Job No. : VC66AC0083
Pages : 3 of 9Cert. No. : ACL23289
Job No. : VC66AC0083
Pages : 4 of 9

Summary of Measurement Result :

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

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

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 microphones of the sound level meter was replaced by electrical signal input device.

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.1	0.1	0.1
1000	-0.1	-0.1	-0.1
8000	-0.3	-0.3	-0.3
Acceptance Limits			± 1.5 ± 1.0 ± 5.0

Continuation of Calibration Certificate

Continuation of Calibration Certificate

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Pages : 5 of 9

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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	0.0	±2.0
125	0.0	0.0	±1.5
250	0.0	0.0	±1.5
500	0.0	0.0	±1.5
1000	0.0	0.0	±1.0
2000	0.0	0.1	±2.0
4000	0.0	0.0	±3.0
8000	0.0	0.0	±5.0

5. Frequen 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

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	38.9	-0.1	±1.1
34.0	33.9	-0.1	±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	25.8	-0.2	±1.1
25.0	24.8	-0.2	±1.1

Continuation of Calibration Certificate

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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)
130	94.0	94.0	0.0	±1.1
120	94.0	94.0	0.0	±1.1
110	94.0	94.0	0.0	±1.1
100	94.0	94.0	0.0	±1.1
90	94.0	94.0	0.0	±1.1
80	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	117.0	117.0	0.0	1.5 ; -5.0
	2	8	134.0	134.0	0.0	1.0 ; -2.5
	200	800	108.0	108.0	0.0	±1.0
Slow	2	8	127.6	127.6	0.0	1.5 ; -5.0
	200	800	99.0	98.9	-0.1	±1.0
	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
SEL	2	8	128.0	128.0	0.0	1.0 ; -2.5
	200	800	0.0	0.0	0.0	±1.0

Continuation of Calibration Certificate

Cert. No. : ACL23289
Job No. : VC66AC0083
Pages : 8 of 9

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	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	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.8	89.6	-0.2	±1.5

Continuation of Calibration Certificate

Cert. No. : ACL23289
Job No. : VC66AC0083
Pages : 9 of 9

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



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

Cert. No. : ACL23277
Pages : 1 of 9

Calibration Certificate

Equipment :	SOUND LEVEL METER
Manufacturer :	RION
Model :	NL-43 / Microphone UC-52 / Preamplifier NH-24
Serial No.:	00430300 / 202723 / 28150
ID No.:	-
Condition As Found :	GOOD
Customer :	UNITED ANALYST AND ENGINEERING CONSULTANT (UAE) 81 SOI UDOMSUK 41, SUKHUMVIT ROAD, BANGCHAK SUB-DISTRICT, PHRAKHANONG DISTRICT, BANGKOK 10260 THAILAND.
Location :	-
Ambient Temperature :	(23.0 ± 3) °C
Pressure :	(101.3 ± 3) kPa
Relative Humidity :	(50.0 ± 20) %
Received Date :	10 AUGUST 2023
Calibration Date :	11 -15 SEPTEMBER 2023
Date of Issue :	15 SEPTEMBER 2023
Calibrated by :	Nathakorn Pisurpaisan

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.

Continuation of Calibration Certificate

Continuation of Calibration Certificate

Cert. No. : ACL23277
Job No. : VC66AC0083
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Cert. No. : ACL23277
Job No. : VC66AC0083
Pages : 3 of 9

Calibration Procedure : CP-AC-02

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-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	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Continuation of Calibration Certificate

Cert. No. : ACL23277
Job No. : VC66AC0083
Pages : 4 of 9

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)
16.1

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

Frequency Weighting	Measured value (dB)
A - weight	13.6
C - weight	18.7
Flat	24.4

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.0	0.1	0.1
1000	-0.1	-0.1	-0.1
8000	0.4	0.4	0.4
			±5.0

Continuation of Calibration Certificate

Cert. No. : ACL23277
Job No. : VC66AC0083
Pages : 5 of 9

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequen 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

Continuation of Calibration Certificate

Cert. No. : ACL23277
Job No. : VC66AC0083
Pages : 6 of 9

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	33.9	-0.1	±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	24.9	-0.1	±1.1

เอกสารไม่ควบคุม
P. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23277
Job No. : VC66AC0083
Pages : 7 of 9

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1
120	94.0	94.0	0.0	±1.1
110	94.0	94.0	0.0	±1.1
100	94.0	94.0	0.0	±1.1
90	94.0	94.0	0.0	±1.1
80	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	117.0	116.9	-0.1	1.5 ; -5.0
	2	8	134.0	134.0	0.0	1.0 ; -2.5
	200	800	108.0	108.0	0.0	±1.0
Slow	2	8	127.6	127.6	0.0	1.5 ; -5.0
	200	800	99.0	98.9	-0.1	±1.0
	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
SEL	2	8	128.0	128.0	0.0	1.0 ; -2.5
	200	800	0.0	0.0	0.0	±1.0

เอกสารไม่ควบคุม
P. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23277
Job No. : VC66AC0083
Pages : 8 of 9

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak Value (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	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

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

Continuation of Calibration Certificate

Cert. No. : ACL23277
Job No. : VC66AC0083
Pages : 9 of 9

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

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-43 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00730426 / 204873 / 32839
ID No.: -

Condition As Found : GOOD

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

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

Received Date : 28 AUGUST 2023
Calibration Date : 25 -27 SEPTEMBER 2023
Date of Issue : 27 SEPTEMBER 2023

Calibrated by : Nathakorn Pisuipaisan

Approved by : 
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Calibration Procedure : CP-AC-02

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-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).

Continuation of Calibration Certificate

Cert. No. : ACL23290
Job No. : VC66AC0083
Pages : 3 of 9

Summary of Measurement Result :

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

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Continuation of Calibration Certificate

Cert. No. : ACL23290
Job No. : VC66AC0083
Pages : 4 of 9

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)
15.5

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

Frequency Weighting	Measured value (dB)
A - weight	13.0
C - weight	17.7
Flat	23.5

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
125	0.0	0.0	0.0
1000	-0.1	-0.1	-0.1
8000	-0.1	0.0	0.0

Continuation of Calibration Certificate

Continuation of Calibration Certificate

Cert. No. : ACL23290
Job No. : VC66AC0083
Pages : 5 of 9

Cert. No. : ACL23290
Job No. : VC66AC0083
Pages : 6 of 9

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

5. Frequen 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	94.1	0.1	± 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

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	25.8	-0.2	±1.1
25.0	24.8	-0.2	±1.1

Continuation of Calibration Certificate

Cert. No. : ACL23290
Job No. : VC66AC0083
Pages : 7 of 9

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1
120	94.0	94.0	0.0	±1.1
110	94.0	94.0	0.0	±1.1
100	94.0	94.0	0.0	±1.1
90	94.0	94.0	0.0	±1.1
80	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	117.0	117.0	0.0	1.5 ; -5.0
	2	8	134.0	134.0	0.0	1.0 ; -2.5
	200	800	108.0	108.0	0.0	±1.0
Slow	2	8	127.6	127.6	0.0	1.5 ; -5.0
	200	800	99.0	98.9	-0.1	±1.0
	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
SEL	2	8	128.0	128.0	0.0	1.0 ; -2.5
	200	800	0.0	0.0	0.0	±1.0

Continuation of Calibration Certificate

Cert. No. : ACL23290
Job No. : VC66AC0083
Pages : 8 of 9

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.2	-0.2	±3.0

11. Overload indication

Measured value (dB)		Deviated Value	Acceptance Limits
Positive one-half cycle	Negative one-half cycle	(dB)	(dB)
89.8	89.7	-0.1	±1.5

Cert. No. : ACL23290

Job No. : VC66AC0083

Pages : 9 of 9

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

รายงานผลการปฏิบัติงานการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม

โครงการปรับปรุงฟาร์ม (ครั้งที่ 2) บริษัท โกลบอล เพาเวอร์ ซินเนอร์ยี จำกัด (มหาชน)

ครั้งที่ 2 ประจำปี พ.ศ. 2567 (กรกฎาคม-ธันวาคม พ.ศ. 2567)

บัญชีรายการเครื่องมือหลักของห้องปฏิบัติการ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม										
No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark	
เครื่องมือหลักวิเคราะห์คุณภาพอากาศ										
1	Analytical Balance (Repeatability 0.001 mg)	ฝุ่นละอองรวม ฝุ่นละอองขนาดเล็กเกิน 10 ไมครอน	Mettler-Toledo	MS6035 /01 B007010311	National Food Institute, Ministry of Industry, Thailand	2402284-001-01	2 Apr 24	1 Apr 25	-	
2	Analytical Balance (Repeatability 0.001 mg)		OHAUS	PX623 C236754745	National Food Institute, Ministry of Industry, Thailand	2402419-001-01	19 Apr 24	18 Apr 25	-	
3	Ion Chromatography (IC)	กรดกำมะถัน โซเดียมไฮโปคลอไรท์	Dionex	AquionRPC / 220380031/220360045	Archemica Lab Co.Ltd.	Qualification Report Anion (IDH1047)	23 Apr 24	22 Apr 25	-	
Laboratory Instrument/Equipments(คุณภาพน้ำ)										
1	pH Meter	ความเป็นกรดและด่าง อุณหภูมิ	Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2401718-001-01	11 Mar 24	10 Mar 25	น้ำดื่ม น้ำดื่ม, น้ำใต้ดิน	
2	BOD Incubator		บีโอดี	Alco	UC4-1320 / (UAE:WAO.006/2553)	Technology Promotion Association (Thailand-Japan)	2467588	1 Apr 24	30 Mar 25	-
3	BOD Incubator			Alco	UC4-1320 / (UAE:WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	2474803	10 Feb 24	9 Feb 25	-
4	Analytical Balance (Repeatability 0.1 mg)	น้ำหนักและไขมัน	Mettler-Toledo	MS6035 / B007010311	National Food Institute, Ministry of Industry, Thailand	2402284-001-01	2 Apr 24	1 Apr 25	-	
5	UV-VIS Spectrophotometer	แอมโมเนีย	Agilent Technologies	Cary60 G6860A / MY15410009	DOE Services Co.,Ltd.	SP24-018	7 May 24	6 May 25	-	
6	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DOE Services Co.,Ltd.	SP24-008	16 Jan 24	15 Jan 25	-	
7	UV-VIS Spectrophotometer		Hitachi	U-2900 / 21E22-009	DOE Services Co.,Ltd.	SP24-001	4 Jan 24	3 Jan 25	-	
8	Analytical Balance (Readability 0.01 mg)	สารที่ละลายได้ทั้งหมด สารแขวนลอย	Mettler-Toledo	XSR205DU / C210685394	National Food Institute, Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25	-	
9	Hot Air Oven		Memmert	UF55 / B216.1666	National Food Institute, Ministry of Industry, Thailand	2400141-001-01	11 Oct 24	10 Oct 25	-	
10	Conductivity Meter	ค่าการนำไฟฟ้า	SI Analytics	Lab955 / 16300356	DKSH Technology Limited	C24240057	14 Mar 24	13 Mar 25	-	

Due Date of Calibration* : กำหนดตามแผนการสอบเทียบประจำปี อย่างน้อยปีละ 1 ครั้ง
บริษัท ยูนิคัต แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์มาตรฐาน ISO/IEC 17025

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: MS603S/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: MS603S/01
Serial No.: B007010311
Capacity: 620
Manufacturer: METTLER TOLEDO
Resolution: 0.001
ID No.: UAE.TOX.008/2553

Page 2 of 3

Date of Calibration: 2 April 2024

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	B505567572	TCS	M23040535	8 April 2024
Standard Weight Class E2	500g	B505567696	TCS	M23040545	8 April 2024

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFLBTH 017723	Quality Reborn	QR24-0344	9 February 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

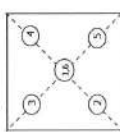
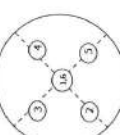
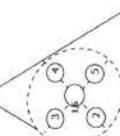
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
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)
200.000	199.997	199.999	199.999	199.998	200.000
					(Maximum Difference) (g)
					0.003

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



Calibration Report

Certificate No.: 2402284-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Resolution: 0.001
Model: MS6035/01
Serial No.: B007010311
ID No.: UAE.TOX.008/2553
Capacity: 620

Page 3 of 3

Date of Calibration: 2 April 2024

Calibration Results: (Continued)

Calibration Range: 0 - 600 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Uncal	0.0000	0.000	0.000	0.00082	2.00
0.1	0.1000	0.100	0.000	0.00082	2.00
0.5	0.5000	0.500	0.000	0.00082	2.00
1	1.0000	1.000	0.000	0.00082	2.00
2	2.0000	2.000	0.000	0.00082	2.00
5	5.0000	5.000	0.000	0.00082	2.00
10	10.0000	10.000	0.000	0.00082	2.00
20	20.0000	20.000	0.000	0.00082	2.00
50	50.0000	50.000	0.000	0.00082	2.00
100	100.0001	100.000	0.000	0.00083	2.00
150	150.0001	150.000	0.000	0.00084	2.00
200	200.0002	200.000	0.000	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 -----

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

Val Value	Standard Value	Average Reading	Error	Correction	Uncertainty (u)	U + Error	Judgement	Result
(g)	(g)	(g)	(g)	(g)	(g)	(g)	(±g)	(Pass / Fail)
0	0.0000	0.000	0.000	0.000	0.00082	0.001	0.005	Pass
0.1	0.1000	0.100	0.000	0.000	0.00082	0.001	0.005	Pass
0.5	0.5000	0.500	0.000	0.000	0.00082	0.001	0.005	Pass
1	1.0000	1.000	0.000	0.000	0.00082	0.001	0.005	Pass
2	2.0000	2.000	0.000	0.000	0.00082	0.001	0.005	Pass
5	5.0000	5.000	0.000	0.000	0.00082	0.001	0.005	Pass
10	10.0000	10.000	0.000	0.000	0.00082	0.001	0.005	Pass
20	20.0000	20.000	0.000	0.000	0.00082	0.001	0.005	Pass
50	50.0000	50.000	0.000	0.000	0.00082	0.001	0.005	Pass
100	100.0001	100.000	0.000	0.000	0.00083	0.001	0.005	Pass
150	150.0001	150.000	0.000	0.000	0.00084	0.001	0.005	Pass
200	200.0002	200.000	0.000	0.000	0.00086	0.001	0.005	Pass
300	300.0002	299.999	0.001	0.001	0.00090	0.002	0.010	Pass
400	400.0003	399.998	0.002	0.002	0.00100	0.003	0.010	Pass
500	500.0003	499.997	0.003	0.003	0.0011	0.004	0.010	Pass
600	600.0004	599.996	0.004	0.004	0.0012	0.006	0.010	Pass

Calibration Certificate

Certificate No.: 2402419-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangchack, Prakhnong, Bangkok 10260

Page 1 of 3

Equipment:	Electronic Balance		
Manufacturer:	OHAUS		
Model:	PX623		
Serial No.:	C236754745		
ID No.:	UAE.MIC.055/2565		
Order No.:	2402419		
Operation No.:	2402419-001		
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.

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



เดอะมอลล์ กรุ๊ป

2008 เดอะสปาร์กยูนิฟर्स 36 ทีมและสปาร์กยูนิฟर्स แชมป์อันดับ แรกจากทีม สปาร์กยูนิฟर्स 10700
2008 โซล 36, Aunt Annam Roadl Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700,
Tel +66(0) 2-422 8698 Fax +66(0) 2-422 8545

Calibration Report

Certificate No.:	2402419-001-01
Equipment:	Electronic Balance
Model:	PX623
Manufacturer:	OHAUS
Resolution:	0.001 g
ID No.:	UAE.NIC.055/2565
Capacity:	620 g

Page 2 of 3

Date of Calibration: 19 April 2024

Environment Condition:	Ambient Temperature:	26.0	+ 0.3	°C	Relative Humidity:	57	+ 8.4	%
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Place of Calibration: Room 301, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

- | | | | | | | | | | | | |
|--|---------------------|-------------------|----------------------|------------------------|--|---------------------------|--------------|-------------------|----------------------|------------------------|-----------------|
| 1. Calibration Method: | NFI Method W-MA-001 | | | | In-House Method based on UKAS Lab 14: 2019 | | | | | | |
| 2. Reference Standards: | | | | | | | | | | | |
| Reference Standard | Model | Serial No. | Calibrated By | Certificate No. | Due Date | Reference Standard | Model | Serial No. | Calibrated By | Certificate No. | Due Date |
| Standard Weight Class E2 | 1-500g | 15882 | TCS | M23111825 | 28 November 2024 | | | | | | |
| Instrument | Model | Serial No. | Calibrated By | Certificate No. | Due Date | Instrument | Model | Serial No. | Calibrated By | Certificate No. | Due Date |
| Thermo-Hygro Meter | 608-H1 | NFLBTH 019/23 | Quality Reform | 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:

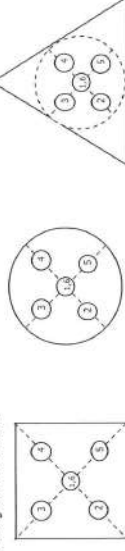
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
300	0.00067
600	0.0010

2. Off-Center Error:

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

The balance reading obtained is given in the table.



	1	2	3	4	5	6	(Maximum Difference)
	(g)	(g)	(g)	(g)	(g)	(g)	(g)
300 000	300 000	300 000	300 000	100 000	200 000	300 000	0.002

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

J. Pengshen
23 April 2024



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



United Analyst and Engineering Consultant Co.,Ltd.

บริษัท อีแอนด์อีเอ็นซี จำกัด
ARCHEMICA LAB CO.,LTD

Operator Signature : K. Khannarong

Date : Apr 23, 2024

(Mr.Channarong Khiao-Un)

Test Engineer

Qualification Report

PM Check list,CM_OQ and PQ

AquionRFIC : Anion (ID#1047)

Aquion : Cation (ID#1048)

For

United Analyst Engineering Consuland Co.,Ltd.
(Validate System 2024)

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

PM Anion ID#1047

Preventive Maintenance Check List



Checklist ICS Preventive Maintenance

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	
AquionRFIC	Serial Number 220380031
AS-DV	220360045

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
AS18	AG18	ADRS-600	-	EGC III KOH
				CR-ATC

Remark: แนะนำเปลี่ยน Column, Guard Column และ Suppressor เนื่องจาก peak shift และ tail

Perform By Archemica


K. Channarong Khiao-Un
Archemica
ARCHERICA LAB
ARCHERICA LAB CO.,LTD
เลขที่ บัญชีภาษี แล่น จักัด
ARCHERICA LAB CO.,LTD


Customer
23/Apr/2024
Date

Date

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



General ICS Maintenance Checklist

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

Others / comments

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PM Cation ID#1048

Preventive Maintenance Check List



Checklist ICS Preventive Maintenance

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: และนำให้เปิดเครื่องใช้งานปกติ, System ข้างไม่ได้ใช้งาน

Perform By Archemica

Archemica
K. Channarong
23/Apr/2024



ARCHEMICA LAB
บริษัท อีทีแอล แล็บ จำกัด
ARCHEMICA LAB CO.,LTD

Customer
Suwan

23/Apr/2024
Date

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General ICS Maintenance Checklist

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

CM OQ

Chromeleon
Operation Qualification

ThermoFisher
S C I E N T I F I C

Chromeleon Operational Qualification

General Information

Instrument Controller: DESKTOP-C4FS3L7 Computer Name Version Number: 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
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K. Channarong 23/Apr/2024

Reviewer's Signature // Date

Operator's Signature // Date

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Chromeleon Operational Qualification, Part 1

Verification of Selected Results

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

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

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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 (AJA)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok

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Chromeleon Operational Qualification, Part 1

Verification of Selected Results

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

Test Result: Passed

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Injection	Detection Algorithm:	Cobra	
	Calibration Type:	Lin. With Offset	
	Evaluation Type:	Area	
	Standard Method:	External	
	Calibration Mode:	Total	
	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

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Abs.Ret.Dev.	Acetanilide	ok
	Ret.Dev.(abs)	Acetophenone	ok
	Ret.Dev.(abs)	Propiophenone	ok
	Ret.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

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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

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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
	Var.Coeff	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	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
W	W	Propiophenone	ok
	W	Acetanilide	ok
	W	Acetophenone	ok
	W	Propiophenone	ok
	F(X)	Acetanilide	ok
	F(X)	Acetophenone	ok
F(X)	F(X)	Propiophenone	ok
	F(X)	Propiophenone	ok

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	Residual for Cal.Point X	Acetanilide	ok
	Residual for Cal.Point X	Acetophenone	ok
	Residual for Cal.Point X	Propiophenone	ok
	Calibration Point Status	Acetanilide	ok
	Calibration Point Status	Acetophenone	ok
	Calibration Point Status	Propiophenone	ok
	Amount	Acetanilide	ok
	Amount	Acetophenone	ok
	Amount	Propiophenone	ok
	Cal.Type	Acetanilide	ok
Component	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

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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

Test Result: Passed

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ThermoFisher
S C I E N T I F I C

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

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

Test Result: Passed

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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

PQ Anion ID#1047

Performance Qualification



OVERALL TEST RESULT: PASS

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

Test Equipment

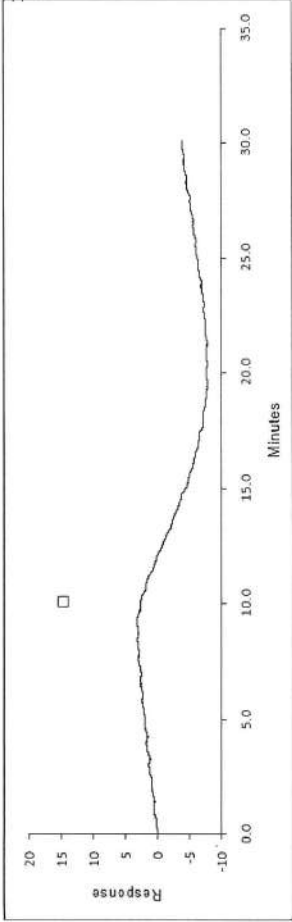
Equipment	Manufacturer	Model	Serial Number	Cal/Ver Date	Good Until
Multimeter	Fluke	289	27970244	N/A	N/A
Thermocouple	Fluke	K-Type	27970244	N/A	N/A
Balance	Mettler Toledo	AB204-S	1129361010	N/A	N/A
IC Qualification	Thermo Scientific	Test Box	21379153	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A

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. Gammakorn</i>	<i>Santana</i>
Date: 23/Apr/2024	Date: 23/Apr/2024



Information

System Name	Aquion RFIC
Detector	220360045
Data Path	chrom://desktop-c4fs37/ChromleonLocal/Archechemical/Service Contract/Validate 2024/1PM1PQ 23-04-24/Aquion/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. Gammakorn</i>	<i>Santana</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

REPEATABILITY (CD)

Information

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

Peak Results

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

Repeatability

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

OVERALL TEST RESULT: PASS



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

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CARRYOVER (CD)

Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	ChromeleonLocal://Archemical/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

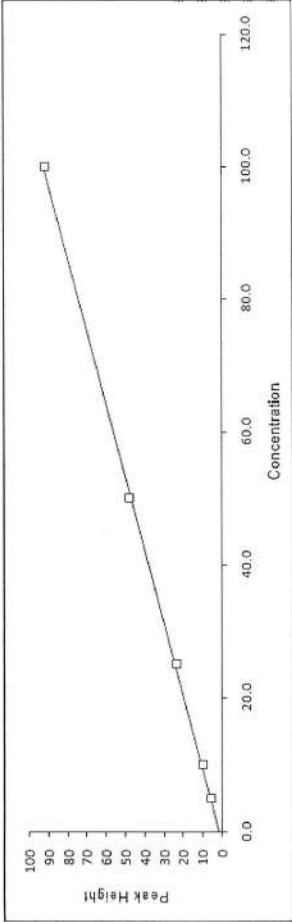
Test	Observed (%)	OQ Limit (%)	Result
AREA	0.00	≤ 0.10	PASS

OVERALL TEST RESULT: PASS



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

เอกสารไม่ควบคุม



Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	ChromeleonLocal://Archemical/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^2	0.999	≥ 0.999	PASS

OVERALL TEST RESULT: PASS



ARCHEMICA LAB
บริษัท อารเคมีคัล แล็บ จำกัด
ARCHEMICA LAB CO.,LTD

Field Service Representative Signature:	Customer Signature:
<i>K. Rattana Rong</i>	<i>Surap</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

เอกสารไม่ควบคุม

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



ARCHEMICA LAB
บริษัท อารเคมีคัล แล็บ จำกัด
ARCHEMICA LAB CO.,LTD

Field Service Representative Signature:	Customer Signature:
<i>K. Rattana Rong</i>	<i>Surap</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. Atcharapong</i>	<i>Sunon</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

เอกสารไม่ควบคุม

TEMPERATURE ACCURACY

Column Compartment

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



OVERALL TEST RESULT: PASS

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

เอกสารไม่ควบคุม

OQ EXCEPTIONS AND COMMENTS

N/A

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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:

K. Khamkhaeng
Date: 23/Apr/2024

Customer Signature:

Simon
Date: 23/Apr/2024

เอกสารไม่ควบคุม



Field Service Representative Signature:

K. Khamkhaeng
Date: 23/Apr/2024

Customer Signature:

Simon
Date: 23/Apr/2024

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2401718-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 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

Date of Issue: 12 March 2024
Responsible for the Technical Management Team

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

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

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

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

Page 2 of 5

Date of Calibration: 11 March 2024

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (23.4 ± 1.5) °C
Condition of Equipment: Good Condition
Condition of this Results of Calibration

1. Calibration Method

W-C-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	NFI.BTH.014/23	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	CPAchem	PH216.L5	13 April 2025
2.5 pH buffer 6.865 (Primary pH buffer Solution)	888843	CPAchem	PH217.L5	13 April 2025
2.6 pH buffer 10.01 (Primary pH buffer Solution)	888844	CPAchem	PH220.L5	13 April 2024
2.7 pH buffer 7.00 (Standard pH buffer Solution)	C03109	HACH LANGE GmbH	S11M004	16 October 2025

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

- 3.1 Instruments Ng.2.1 through
3.2 Instruments Ng.2.2 and 2.3 through
3.3 Certified Reference Material Ng.2.4 to 2.6 traceable to
3.4 Certified Reference Material Ng.2.7 traceable to

NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0008
NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0061
Primary measurement method- Harned cell using calibrated thermometer, barometer and nanovoltmeter The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

PTB Certificate Nr. PTB-PhOA-563/0504/23 and Certificate Nr. PTB-PhOB-555/0802/22 (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



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2404-0004OC-2

Cert. No.: 24TM588
Page : 2 of 3

Procedure Used :-

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

Condition of this result of calibration

1. Reference standard Instrument:-
Instrument **Serial No.** **Cert. No.** **Traceable** **Due Date**
1) Data Acquisition MY57013711 23LM115 TPA 11 Jul 2024

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

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

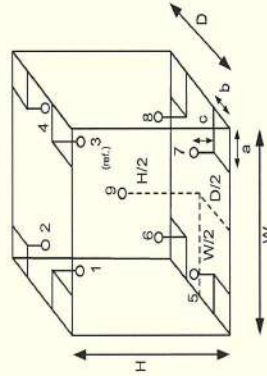
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	27
REL.Humid. (%)	45	47
AC Supply (Volt)	220	221



Probe Installation Details :

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



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2404-0004OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 24TM588
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>	Measured Temperature (°C)									Uncertainty (± °C)
							Position									
	1	2	3	4	5	6	7	8	9 (ref.)							
20.0	20.289	19.835	20.129	19.985	20.190	20.180	20.300	20.457	20.248				0.67			

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 %.

-o00-



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2404-0004OC-2

Cert. No.: 24TM588
Page : 2 of 3

Procedure Used :-

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

Condition of this result of calibration

1. Reference standard Instrument:-
Instrument **Serial No.** **Cert. No.** **Traceable** **Due Date**
1) Data Acquisition MY57013711 23LM115 TPA 11 Jul 2024

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

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

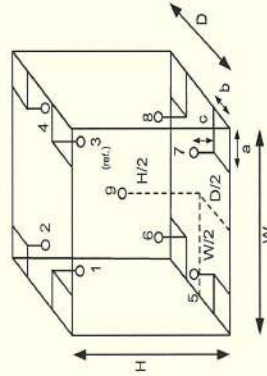
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	27
REL.Humid. (%)	45	47
AC Supply (Volt)	220	221



Probe Installation Details :

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

กำหนดจุดห้ามใช้งาน

References Certificate Number. : 234TM588

Equipment : BOD Incubator

Model : UR-1320

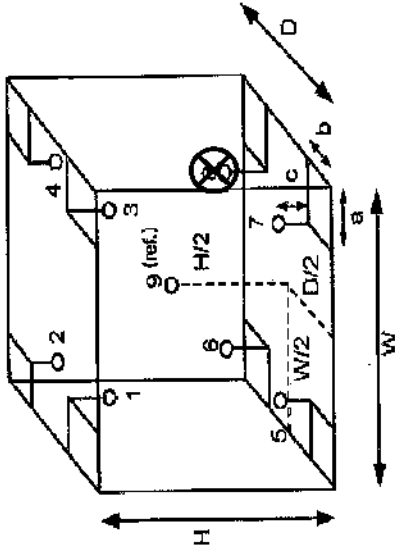
Serial No. : -

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 เก็บใบเพิ่ม.....

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เอกสารไม่ควบคุม



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



ISO 17025
CALIBRATION 0088

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 Sol Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Lab Floor 2

Location :

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 :

() Pornthippa Tameyakul

() Unnophol Harachai

() Suwit Imjai

[Signature]

Approved Signatory

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 <i>k</i>		
20.0	20.1	19.9	0.37	0.72	1.4	2		
Calibration Point (°C)	Measured Temperature (°C)							
	Position							
20.0	1	2	3	4	5	6	7	8
20.0	19.873	19.803	20.322	19.690	19.615	19.585	19.612	19.558

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

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

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

-o0o-

เอกสารไม่ควบคุม



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

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

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY59003411	23LM208	TPA	27 Dec 2024

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

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

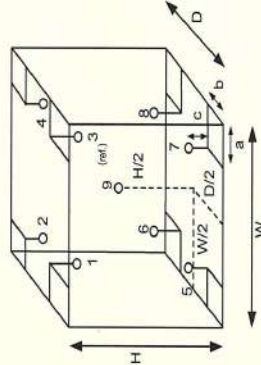
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

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



Probe Installation Details :

a =	10 cm	D =	0.62 m
b =	10 cm	W =	1.2 m
c =	10 cm	H =	1.2 m
		Capacity =	0.89 m³

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.: 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: MS603S/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 **Approved by**  (Mr.Pheraphat Tuanjit)
Scientist
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: MS603S/01
Serial No.: B007010311
Capacity: 620
Manufacturer: METTLER TOLEDO
Resolution: 0.001
ID No.: UAE.TOX.008/2553

Page 2 of 3

Date of Calibration: 2 April 2024
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: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	B505567572	TCS	M23040535	8 April 2024
Standard Weight Class E2	500g	B505567696	TCS	M23040545	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFLBTH 017723	Quality Reborn	QR24-0344	9 February 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

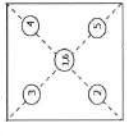
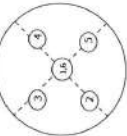
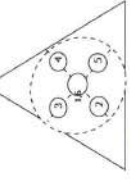
1. Repeatability of Reading:

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

						
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
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-CS-012 Revision: 01 Date: 20-04-65



ศูนย์ปฏิบัติการและมาตรฐานอาหาร

ศูนย์ปฏิบัติการและมาตรฐานอาหาร

Food Inspection Laboratory Service Center



ศูนย์ปฏิบัติการและมาตรฐานอาหาร

ศูนย์ปฏิบัติการและมาตรฐานอาหาร

Food Inspection Laboratory Service Center

Calibration Report

Certificate No.: 2402284-01-01

Equipment: Balance

Model: N2112S

Serial No.: 10010000000000000000

Capacity: 600 g

Date of Calibration: 24 Oct 2023

Calibration Results: (Continued)

Calibration Range: 0 - 600 g

Calibration Adjustment: Internal Calibration

3. Departure From Nominal Value:

Nominal Value	Average Reading			Correction			Uncertainty			Overall Error
	g	g	g	g	g	g	g	g		
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
0.1	0.1000	0.1000	0.1000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
0.5	0.5000	0.5000	0.5000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
1	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
2	2.0000	2.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
5	5.0000	5.0000	5.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
10	10.0000	10.0000	10.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
20	20.0000	20.0000	20.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
50	50.0000	50.0000	50.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
100	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
150	150.0000	150.0000	150.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
200	200.0000	200.0000	200.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
300	300.0000	300.0000	300.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
400	400.0000	400.0000	400.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
500	500.0000	500.0000	500.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
600	600.0000	600.0000	600.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

Unit Under Calibration

g

เอกสารไม่ควบคุม

Equipment : Electronic Balance									
Model: N2112S									
ID No: UAE TOX 0082/2553									
Serial: 8007670311									
Val Value	Standard Value		Average Reading		Error		Correction		Judgment
	g	g	g	g	g	g	g	g	
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Pass
0.1	0.1000	0.1000	0.1000	0.0000	0.0000	0.0000	0.0000	0.0000	Pass
0.5	0.5000	0.5000	0.5000	0.0000	0.0000	0.0000	0.0000	0.0000	Pass
1	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Pass
2	2.0000	2.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Pass
5	5.0000	5.0000	5.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Pass
10	10.0000	10.0000	10.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Pass
20	20.0000	20.0000	20.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Pass
50	50.0000	50.0000	50.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Pass
100	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Pass
150	150.0000	150.0000	150.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Pass
200	200.0000	200.0000	200.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Pass
300	300.0000	300.0000	300.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Pass
400	400.0000	400.0000	400.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Pass
500	500.0000	500.0000	500.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Pass
600	600.0000	600.0000	600.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Pass
Unit Under Calibration									
g									

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เอกสารนี้เป็นทรัพย์สินของกรมการมาตรฐานแห่งชาติและยืมให้คุณเพื่อใช้เท่านั้น ไม่ควรทำซ้ำ เก็บในคลังข้อมูล หรือส่งข้อมูลในรูปแบบใดๆ โดยไม่ได้รับอนุญาตจากกรมการมาตรฐานแห่งชาติ

CERTIFICATE OF CALIBRATION

Certificate No. : SP24-018

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 :  Approved by : 
(Mr.Tanawut Ritidach) (Ms. Chonthicha Sangngern)
Technical Manager Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.
The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

REPORT OF CALIBRATION

Certificate No. : SP24-018

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 Siarna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 60 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 4 of 5

Photometric Accuracy :

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

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 <i>k</i>
420	0.0000 0.5780 1.0484 2.1876	0.0000 0.5747 1.0438 2.1832	0.0000 0.0033 0.0046 0.0044	0.0028 0.0031 0.0029 0.0080	2.00 2.00 2.00 2.00
440	0.0000 0.5595 1.0239 2.1230	0.0000 0.5581 1.0231 2.1219	0.0000 0.0014 0.0008 0.0011	0.0028 0.0034 0.0035 0.0080	2.00 2.00 2.00 2.00
465	0.0000 0.5230 0.9633 1.9753	0.0000 0.5184 0.9614 1.9731	0.0000 0.0046 0.0019 0.0022	0.0028 0.0030 0.0029 0.0070	2.00 2.00 2.00 2.00
546.1	0.0000 0.5181 1.0002 1.9973	0.0000 0.5150 0.9964 1.9914	0.0000 0.0031 0.0038 0.0059	0.0028 0.0031 0.0033 0.0088	2.00 2.00 2.00 2.00
590	0.0000 0.5517 1.0803 2.0373	0.0000 0.5485 1.0772 2.0293	0.0000 0.0032 0.0031 0.0080	0.0028 0.0030 0.0030 0.0080	2.00 2.00 2.00 2.00
635	0.0000 0.5591 1.0518 1.9274	0.0000 0.5565 1.0482 1.9202	0.0000 0.0026 0.0036 0.0072	0.0028 0.0031 0.0030 0.0079	2.00 2.00 2.00 2.00

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 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 -

เอกสารไม่ควบคุม
FM-708-02 R01 1/11/2021

CERTIFICATE OF CALIBRATION

Certificate No. : SP24-008

Page 1 of 5

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

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

Location of calibration : Laboratory 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 :

Technical Manager
(Mr.Tanawat Ritidach)

Approved by :

Quality Manager
(Ms.Chonhicha Sangern)

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

เอกสารไม่ควบคุม
FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

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

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 4 of 5

Photometric Accuracy :

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

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

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k.

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

- * Indicates non TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

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 :

(Mr.Tanawat Ritidach)
Technical Manager

Approved by :

(Ms.Chonthicha Sangngern)
Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and so the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

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FM-708-02 R01 1/11/2021

REPORT OF CALIBRATION

Certificate No. : SP24-001

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 : 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 <i>k</i>
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

เอกสารไม่ควบคุม

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 <i>k</i>
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

REPORT OF CALIBRATION

Certificate No. : SP24-001

Page 5 of 5

Wavelength Accuracy :

CRM 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 -

เอกสารไม่ควบคุม

FM-708-02 R01 1/1/2021

Calibration Certificate

Certificate No.: 2402283-002-01

Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Address: 3 SOI UDOMSUK 41, SUKHUMVIT ROAD,

Bangchack, Prakanong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Serial No.: C210685394

ID No.: UAE.WAO.010/2565

Order No.: 2402283

Operation No.: 2402283-002

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.: 2402283-002-01

Equipment:

Manufacturer: METTLER TOLEDO

Electronic Balance

Resolution: 0.00001 g / 0.0001 g

Model: XSR205DU

TD No.: UAE.WAO.010/2565

Serial No.: C210685394

Capacity: 220 g

Date of Calibration: 2 April 2024

Page 2 of 4

Environment Condition: Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 47.5 ± 2.5 %

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard Model Serial No. Calibrated By Certificate No. Due Date

Standard Weight Class E2 1mg to 200g B505567572 TCS M230405335 8 April 2024

Instrument Model Serial No. Calibrated By Certificate No. Due Date

Thermo-Hygro Meter 608-H1 NFI.BTH 016/23 Quality Reborn QR24-0343 9 February 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

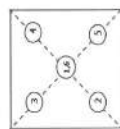
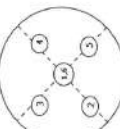
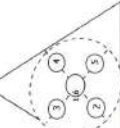
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.0000042
80	0.0000052
100	0.000048
200	0.000048

2. Off-Center Error:

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

The balance reading obtained is given in the table.

		
1 (g) 100.0000	2 (g) 100.0001	3 (g) 99.9999
4 (g) 99.9999	5 (g) 100.0001	6 (g) 100.0000
(Maximum Difference) (g) 0.0001		

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

Calibration Report

Certificate No.: 2402283-002-01

Equipment:

Manufacturer: METTLER TOLEDO

Electronic Balance

Resolution: 0.00001 g / 0.0001 g

Model: XSR205DU

TD No.: UAE.WAO.010/2565

Serial No.: C210685394

Capacity: 220 g

Date of Calibration: 2 April 2024

Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 80 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.000000	0.000000	0.000000	0.0000086	2.00
0.001	0.0010003	0.00101	-0.00001	0.0000089	2.00
0.005	0.0050003	0.00500	0.00000	0.0000092	2.00
0.01	0.0100003	0.01000	0.00000	0.0000089	2.00
0.05	0.049996	0.05000	0.00000	0.0000096	2.00
0.1	0.100011	0.10000	0.00001	0.000011	2.00
0.5	0.500016	0.50001	0.00001	0.000014	2.00
1	1.000003	1.00002	-0.00002	0.000016	2.00
2	2.000023	2.00001	0.00001	0.000017	2.00
5	5.000017	5.00002	0.00000	0.000020	2.00
10	10.000009	10.00000	0.00001	0.000026	2.00
20	20.000031	20.00000	0.00003	0.000037	2.00
30	30.000040	30.00001	0.00003	0.000050	2.00
50	50.000028	50.00002	0.00001	0.000068	2.00
80	80.000068	80.00002	0.00005	0.00011	2.00

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

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.
- 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	CH#201-209/ RTD#201-209			

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

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

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

6. Condition of Calibrated Item : Good

UUC Description :

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

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

F-C5-012 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

Page 3 of 3

Calibration point: 104.0, 140.0 and 180.0 °C

Calibration result:

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

Table1 : Reporting of Temperature



Table2 : Reporting of Characterization Result

Calibration point (°C)	Measured Temperature (°C) @ Sensor No.										Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	# 10	
104.0	104.05	103.98	104.02	104.08	104.00	104.05	103.99	104.17	104.00	104.00	0.53
140.0	140.09	139.99	139.91	140.05	139.99	139.91	139.97	140.26	139.97	140.00	0.73
180.0	180.46	180.33	180.25	180.28	180.33	179.96	180.31	180.64	180.16	180.16	0.90

Table2 : 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-C5-012 Revision: 01 Date: 20-04-65



Certificate of Calibration

Equipment: CONDUCTIVITY METER
Model: Lab 955
Serial No. (or ID.): 18300356
Manufacturer: SI Analytic
Electrode Serial No.: 16070067
Condition: In Condition

Certificate No.: C24240057
Issued Date: 11 March 2024
Job No.: WO-00020309
Page: 1 of 2
Brand : SI Analytic
Model : LF413T

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)

Person in charge

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

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เอกสารไม่ควบคุม

CAL-FM-C24-09; 12 Sep 2022

Certificate No.: C24240057

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Calibration Results: Before Adjustment

Standard	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
Conductivity Solution				
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 (k)	Uncertainty (±)
Conductivity Solution				
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


(Mr. Nitinun Srihawan)

Authorized signatory

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DKSH Technology Limited
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CAL-FM-C24-09; 12 Sep 2022