

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือ

ภาคผนวก จ-1

บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

รายการสอบเทียบเครื่องมือตรวจวัด

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	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6171	Innovative Instrument Co.,Ltd.	24-ACT-086	25 Jun 24	24 Jun 25	-
2	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Adm} , L_{A90} , L_{Amax}	Larson Davis	LxT2 0005396	Electrical And Electronics Institute Foundation For Industrial Development	CP20240291EA	5 Aug 24	4 Aug 25	-

Certificate of Calibration

Customer

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

Certificate No : 24-ACT-086
Request No : Req-2024-1364

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 2
Manufacturer : LARSON DAVIS Range : 94 , 114 dB / 1000 Hz
Model : CAL150 Instrument Status : Used
Serial Number : 6171
ID : UAE-EFM117/2562

Calibration Environment and Details


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


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

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

Note

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

Calibrated By : 
Mr. Noppodon Luangrit
Service Calibration Engineer

Approved By : 
Mr. Pacht Mathavorn
Calibration Engineer Supervisor

Issue Date : 25 June 2024

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

เอกสารไม่ควบคุม
FM-708-ACT-02 Rev.03 Issue date 5/6/24

Certificate No : 24-ACT-086

Request No : Req-2024-1364

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (\pm dB)	Acceptance limit Class 2 (\pm dB)	Result
	Measured	Deviated value	Measured	Deviated value			
94 dB / 1000 Hz	93.99	-0.01	-	-	0.13	0.40	Pass
114 dB / 1000 Hz	114.02	0.02	-	-	0.14	0.40	Pass

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (\pm %)	Acceptance limit Class 2 (\pm %)	Result
	Measured (Hz)	Deviated	Measured (Hz)	Deviated			
94 dB / 1000 Hz	1000.00	0.00	-	-	0.01	1.7	Pass
114 dB / 1000 Hz	1000.00	0.00	-	-	0.01	1.7	Pass

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

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (\pm %)	Acceptance limit Class 2 (\pm %)	Result
	Measured (%)	Measured (%)			
94 dB / 1000 Hz	0.05	-	0.40	3.0	Pass
114 dB / 1000 Hz	0.30	-	0.40	3.0	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
Sound pressure level	0.35 dB
Frequency	0.20%
Total distortion+noise	1.00%

- Acceptance limit was IEC60942:2017 Class 1

- The calibration results exclude the calibrator pressure correction

- The calibration results exclude the microphone volume correction

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

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FM-708-ACT-02 Rev.03 Issue date 5/6/24

Certificate No : 24-ACT-086

Request No : Req-2024-1364

Decision Rule for Statements of Conformity

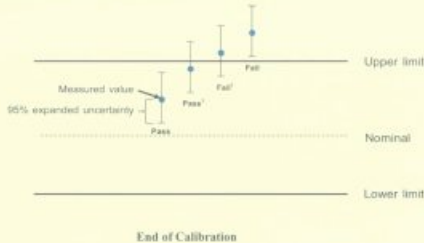
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements:

Pass¹ - The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass² - 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.

Fail² - The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Calibration

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

เอกสารไม่ควบคุม
FM-708-ACT-02 Rev.03 Issue date 5/6/24



Certificate No.: CP20240291EA
Operation No.: CP2024070254

Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)

Model/Type: LxT2 (Meter), 375A04B02 (Microphone), PRLxT2C (Preamplifier)

Serial No.: 0005396 (Meter), 329350 (Microphone), 073805 (Preamplifier)

ID No.: UAE.EFM.033/2564

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

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

Received Date: 25 July 2024

Calibrated Date: 5 - 6 August 2024

Issued Date: 7 August 2024

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.
The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k)
providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except
with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

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F-CAL-004 Ed.1



Certificate No.: CP20240291EA

Calibration Report

Equipment: Sound Level Meter

Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)

Model/Type: LxT2 (Meter), 375A04B02 (Microphone), PRLxT2C (Preamplifier)

Serial No.: 0005396 (Meter), 329350 (Microphone), 073805 (Preamplifier)

ID No.: UAE.EFM.033/2564

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-
IEC 61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5) Pressure humidity and Temperature Transmitter	PTU301	L3950483	CL1-P240023 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.01119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

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

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F-CAL-005 Ed.1

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Certificate No.: CP20240291EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
29.3

2.2 Microphone replaced by the electrical input signal device

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

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

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

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

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

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

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Certificate No.: CP20240291EA

Calibration Report

5.2 Time weighting at 1 kHz

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

Function : 6. Long-Term Stability

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

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

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

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

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Certificate No.: CP20240291EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

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

Function : 8. Tone burst response

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

Function : 9. Peak C sound level

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

Function : 10. Overload indication

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

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Certificate No.: CP20240291EA

Calibration Report

Function : 11. High-Level Stability

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

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

Uncertainty of measurement

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

Remarks:

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

-- End of Report --

เอกสารไม่ควบคุม

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	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 32 TPT030008	Innovative Instrument Co.,Ltd.	24-TPM-395	3 Sep 24	2 Sep 25	-
2	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 34 TEX040017	Innovative Instrument Co.,Ltd.	24-TPM-319	16 Jul 24	15 Jul 25	-
3	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 34 TEX040019	Innovative Instrument Co.,Ltd.	24-TPM-320	16 Jul 24	15 Jul 25	-
4	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 32 TPT030007	Innovative Instrument Co.,Ltd.	25-TPM-056	28 Jan 25	27 Jan 26	-
5	Air Flow Meter	Calibrate personal pump	TSI.Inc	4146 41461813030	Innovative Instrument Co., Ltd.	24-AFM-223	8 Nov 24	7 Nov 25	-
6	Air Sampling Pump	Zinc Oxide (Zinc Fume) Total Dust Respirable Dust Total Dust (Calcium Hydroxide) Respirable Dust (Calcium Hydroxide) Oxalic acid Methyl Ethyl Ketone Borates,tetra,sodium salts pentahydrate Sodium Hydroxide Total Dust (Aluminium Metal,AS AL) Respirable Dust (Aluminium Metal,AS AL) Hydrogen Chloride	Sensidyne	Gi/Air Plus 20240610103	Innovative Instrument Co., Ltd.	24-ASP-130	28 Aug 24	27 Aug 25	-
7	Air Sampling Pump	Zinc Oxide (Zinc Fume) Total Dust Respirable Dust Total Dust (Calcium Hydroxide) Respirable Dust (Calcium Hydroxide) Oxalic acid	Sensidyne	Gi/Air Plus 20230610199	Innovative Instrument Co., Ltd.	24-ASP-124	26 Aug 24	25 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									
		Methyl Ethyl Ketone Borates,tetra,sodium salts pentahydrate Sodium Hydroxide Total Dust (Aluminium Meta,AS AL) Respirable Dust (Aluminium Metal,AS AL) Hydrogen Chloride							
8	Air Sampling Pump	Zinc Oxide (Zinc Fume) Total Dust Respirable Dust Total Dust (Calcium Hydroxide) Respirable Dust (Calcium Hydroxide) Oxalic acid Methyl Ethyl Ketone Borates,tetra,sodium salts pentahydrate Sodium Hydroxide Total Dust (Aluminium Metal,AS AL) Respirable Dust (Aluminium Metal,AS AL) Hydrogen Chloride	Sensidyne	Gi/Air Plus 20240610094	Innovative Instrument Co., Ltd.	24-ASP-135	29 Aug 24	28 Aug 25	-
9	Air Sampling Pump	Zinc Oxide (Zinc Fume) Total Dust Respirable Dust Total Dust (Calcium Hydroxide) Respirable Dust (Calcium Hydroxide) Oxalic acid Methyl Ethyl Ketone Borates,tetra,sodium salts pentahydrate Sodium Hydroxide Total Dust (Aluminium Metal,AS AL)	Sensidyne	Gi/Air Plus 20240610102	Innovative Instrument Co., Ltd.	24-ASP-138	30 Aug 24	29 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									
		Respirable Dust (Aluminium Metal,AS AL) Hydrogen Chloride							
10	Air Sampling Pump	Zinc Oxide (Zinc Fume) Total Dust Respirable Dust Total Dust (Calcium Hydroxide) Respirable Dust (Calcium Hydroxide) Oxalic acid Methyl Ethyl Ketone Borates,tetra,sodium salts pentahydrate Sodium Hydroxide Total Dust (Aluminium Metal,AS AL) Respirable Dust (Aluminium Metal,AS AL) Hydrogen Chloride	Sensidyne	Gi/Air Plus 20240610101	Innovative Instrument Co., Ltd.	24-ASP-142	30 Aug 24	29 Aug 25	-
11	Air Sampling Pump	Zinc Oxide (Zinc Fume) Total Dust Respirable Dust Total Dust (Calcium Hydroxide) Respirable Dust (Calcium Hydroxide) Oxalic acid Methyl Ethyl Ketone Borates,tetra,sodium salts pentahydrate Sodium Hydroxide Total Dust (Aluminium Metal,AS AL) Respirable Dust (Aluminium Metal,AS AL) Hydrogen Chloride	Sensidyne	Gi/Air Plus 20240610100	Innovative Instrument Co., Ltd.	24-ASP-141	30 Aug 24	29 Aug 25	-
12	Air Sampling Pump	Zinc Oxide (Zinc Fume) Total Dust	Sensidyne	Gi/Air Plus 20240610104	Innovative Instrument Co., Ltd.	24-ASP-128	28 Aug 24	27 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									
		Respirable Dust Total Dust (Calcium Hydroxide) Respirable Dust (Calcium Hydroxide) Oxalic acid Methyl Ethyl Ketone Borates,tetra,sodium salts pentahydrate Sodium Hydroxide Total Dust (Aluminium Metal,AS AL) Respirable Dust (Aluminium Metal,AS AL) Hydrogen Chloride							
13	Aneroid Barometer	Zinc Oxide (Zinc Fume) Total Dust Respirable Dust Total Dust (Calcium Hydroxide) Respirable Dust (Calcium Hydroxide) Oxalic acid Methyl Ethyl Ketone Borates,tetra,sodium salts pentahydrate Sodium Hydroxide Total Dust (Aluminium Metal,AS AL) Respirable Dust (Aluminium Metal,AS AL) Hydrogen Chloride	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	25P1359	17 Apr 25	16 Apr 26	-
14	Digital Thermo - Hygrometer	Zinc Oxide (Zinc Fume) Total Dust Respirable Dust Total Dust (Calcium Hydroxide) Respirable Dust (Calcium Hydroxide) Oxalic acid	Digicon	TH-02 435031148	Technology Promotion Association (Thailand-Japan)	24H1487	15 Jul 24	14 Jul 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									
		Methyl Ethyl Ketone Borates,tetra,sodium salts pentahydrate Sodium Hydroxide Total Dust (Aluminium Meta,AS AL) Respirable Dust (Aluminium Meta,AS AL) Hydrogen Chloride							
15	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6307	Innovative Instrument Co.,Ltd.	24-ACT-120	10 Sep 24	9 Sep 25	-
16	Sound Level Meter	L_{Aeq} 8 hours, L_{Amax}	Rion, Japan	NL-42 00409175	Sithiporn Associates Co., Ltd.	ACL25023	13 Jan 25	12 Jan 26	-
17	Sound Level Meter	L_{Aeq} 8 hours, L_{Amax}	Rion, Japan	NL-42 01010781	Sithiporn Associates Co., Ltd.	ACL24158	30 May 24	29 May 25	-
18	Sound Level Meter	L_{Aeq} 8 hours, L_{Amax}	Rion, Japan	NL-62 00130355	Innovative Instrument Co.,Ltd.	24-SLM-203	25 Jun 24	24 Jun 25	-
19	Sound Level Meter	L_{Aeq} 8 hours, L_{Amax}	Rion, Japan	NL-62 00130357	Electrical And Electronics Institute Foundation For Industrial Development	CP20240342EA	22 Sep 24	21 Sep 25	-
20	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 67627	Innovative Instrument Co.,Ltd.	24-NDM-226	12 Sep 24	11 Sep 25	-
21	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 117696	Innovative Instrument Co.,Ltd.	25-NDM-089	30 Apr 25	29 Apr 26	-
22	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 143224	Innovative Instrument Co.,Ltd.	24-NDM-172	15 Jul 24	14 Jul 25	-
23	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 143232	Innovative Instrument Co.,Ltd.	24-NDM-171	15 Jul 24	14 Jul 25	-
24	Light Meter	Lux	Extech Instrument, Taiwan	407026 A 062335	Innovative Instrument Co., Ltd.	24-LXM-199	1 Aug 24	31 Jul 25	-



Certificate of Calibration

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

Certificate No : 24-TPM-395
Request No : Req-2024-1949
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-32
Serial Number : TPT030008
Resolution : 0.1 °C
ID Number : UAE.EFM.219/2562

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

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 28 August 2024
Calibrated Date : 3 September 2024
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard

Digital Thermometer with Sensor, Manufacturer: GINGO/INGO, Model: GT11/RTD100, SN:
08000057, ID: 02-TPM Which was calibrated on 1 March 2024, Calibration Certificate No. : QR24-0478

Traceability

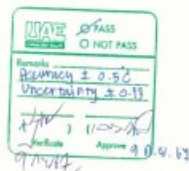
This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSAC Accreditation No.:
Calibration 0292

Note

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

Approved By :
Mr. Noppadol Luangput
Technical Manager
Issue Date : 3 September 2024

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เอกสารไม่ควบคุม



Calibration Note
UUC Adjustment : Not Adjust

Certificate No : 24-TPM-395
Request No : Req-2024-1949
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.031	20.0	0.0	0.13
	23.033	23.0	0.0	0.13
	30.034	30.0	0.0	0.13
	35.036	35.0	0.0	0.13
	40.039	40.0	0.0	0.13
	45.042	45.0	0.0	0.13
	50.042	50.0	0.0	0.13
	60.047	60.0	0.0	0.13
DRY	20.031	20.1	-0.1	0.13
	25.033	25.1	-0.1	0.13
	30.035	30.1	-0.1	0.13
	35.037	35.1	-0.1	0.13
	40.038	40.1	-0.1	0.13
	45.040	45.1	-0.1	0.13
	50.042	50.1	-0.1	0.13
	60.047	60.1	-0.1	0.13
GLOBE	20.030	20.0	0.0	0.13
	25.034	25.0	0.0	0.13
	30.036	30.0	0.0	0.13
	35.039	35.0	0.0	0.13
	40.038	39.9	+0.1	0.13
	45.039	44.9	+0.1	0.13
	50.043	49.9	+0.1	0.13
	60.043	59.9	+0.1	0.13

End of Certificate

Calibrated By :
Mr. Sirichok Jongsakulchai

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Party. (Page 2 of 2)
เอกสารไม่ควบคุม



Certificate of Calibration

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

Certificate No : 24-TPM-319
Request No : Req-2024-1558
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-34
Serial Number : TEX040017
Resolution : 0.1 °C
ID Number : UAE.EFM.121/2566

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

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 10 July 2024
Calibrated Date : 16 July 2024
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard

Digital Thermometer with Sensor, Manufacturer: GINGO/INGO, Model: GT11/RTD100, SN:
08000057, ID: 02-TPM Which was calibrated on 1 March 2024, Calibration Certificate No. : QR24-0478

Traceability

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

Note

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

Approved By :
Mr. Noppadol Luangput
Technical Manager
Issue Date : 16 July 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Party. (Page 1 of 1)
เอกสารไม่ควบคุม



Calibration Note
UUC Adjustment : Not Adjust
Certificate No : 24-TPM-319
Request No : Req-2024-1558
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (K ¹)
WET	20.030	20.1	-0.1	0.13
	25.032	25.0	0.0	0.13
	30.034	30.0	0.0	0.13
	35.037	35.0	0.0	0.13
	40.039	40.0	0.0	0.13
	45.040	45.0	0.0	0.13
	50.043	50.0	0.0	0.13
	60.047	60.0	0.0	0.13
DRY	20.032	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.034	30.0	0.0	0.13
	35.036	35.0	0.0	0.13
	40.039	40.0	0.0	0.13
	45.040	45.0	0.0	0.13
	50.042	50.0	0.0	0.13
	60.046	60.0	0.0	0.13
GLOBE	20.030	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.035	30.0	0.0	0.13
	35.037	35.0	0.0	0.13
	40.039	40.0	0.0	0.13
	45.039	45.0	0.0	0.13
	50.042	50.0	0.0	0.13
	60.047	60.0	0.0	0.13

End of Certificate

Calibrated By :
Mr. Sirichok Jitpakdiwongkol

Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING
CONSULTANT CO.,LTD.
Address : 81 Soi Udomak 41, Sukhumvit Road, Bangkok,
Prakanong, Bangkok 10260
Certificate No : 24-TPM-320
Request No : Req-2024-1559
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-34
Serial Number : TENO40019
Resolution : 0.1 °C
ID Number : UAE.FPM.123/2566
Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 10 July 2024
Calibrated Date : 16 July 2024
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/RTD100, SN: 0808057, ID: 02-TPM Which was calibrated on 1 March 2024, Calibration Certificate No.: QR24-0478

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

Note

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

Approved By :
Mr. Nopadon Luangart
Technical Manager
Issue Date : 16 July 2024



Calibration Note
UUC Adjustment : Not Adjust
Certificate No : 24-TPM-320
Request No : Req-2024-1559
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (K ¹)
WET	20.030	20.0	0.0	0.13
	25.032	25.0	0.0	0.13
	30.034	30.0	0.0	0.13
	35.037	35.0	0.0	0.13
	40.039	40.0	0.0	0.13
	45.040	45.1	-0.1	0.13
	50.043	50.1	-0.1	0.13
	60.047	60.1	-0.1	0.13
DRY	20.032	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.034	29.9	+ 0.1	0.13
	35.036	34.9	+ 0.1	0.13
	40.039	39.9	+ 0.1	0.13
	45.040	45.0	0.0	0.13
	50.042	50.0	0.0	0.13
	60.046	60.0	0.0	0.13
GLOBE	20.030	19.9	+ 0.1	0.13
	25.033	24.9	+ 0.1	0.13
	30.035	29.9	+ 0.1	0.13
	35.037	34.9	+ 0.1	0.13
	40.039	39.9	+ 0.1	0.13
	45.039	45.0	0.0	0.13
	50.042	50.0	0.0	0.13
	60.047	60.0	0.0	0.13

End of Certificate

Calibrated By :
Mr. Sirichok Jitpakdiwongkol



Certificate of Calibration

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

Certificate No : 25-TPM-056
Request No : Req-2024-2854
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-32
Serial Number : TPT030007
Resolution : 0.1 °C
ID Number : UAE.EFM.218/2562

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

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 20 December 2024
Calibrated Date : 28 January 2025
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard :
Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/RTD100, SN:
08000057, ID: 02-TPM Which was calibrated on 1 March 2024, Calibration Certificate No.: QR24-0478

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

Note

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

Approved By :
Mr. Noppadon Luangart
Technical Manager
Issue Date : 28 January 2025

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-TPM-01 Rev.01 Issue date 13/02/20

Calibration Note
UUC Adjustment : Not Adjust

Certificate No : 25-TPM-056
Request No : Req-2024-2854
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.030	20.2	-0.2	0.13
	25.032	25.2	-0.2	0.13
	30.034	30.2	-0.2	0.13
	35.037	35.2	-0.2	0.13
	40.037	40.2	-0.2	0.13
	45.040	45.2	-0.2	0.13
	50.042	50.2	-0.2	0.13
DRY	60.045	60.2	-0.2	0.13
	20.032	20.2	-0.2	0.13
	25.032	25.2	-0.2	0.13
	30.036	30.2	-0.2	0.13
	35.036	35.2	-0.2	0.13
	40.038	40.2	-0.2	0.13
	45.040	45.2	-0.2	0.13
GLOBE	50.042	50.2	-0.2	0.13
	60.046	60.2	-0.2	0.13
	20.031	20.2	-0.2	0.13
	25.033	25.2	-0.2	0.13
	30.033	30.2	-0.2	0.13
	35.035	35.2	-0.2	0.13
	40.038	40.2	-0.2	0.13
	45.040	45.1	-0.1	0.13
	50.042	50.1	-0.1	0.13
	60.046	60.1	-0.1	0.13

End of Certificate

Calibrated By :
Mr. Sitichok Jirapukdeesul

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-TPM-01 Rev.01 Issue date 13/02/20



Certificate of Calibration

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

Certificate No : 24-AFM-223
Request No : Req-2024-1952

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : TSI
Model : 4146
Serial Number : 41461813030
ID : UAE.EFM.102/2561

Accuracy : 2% or 0.005 lpm, whichever is greater
Sensor Model : -
Sensor Serial Number : -
Instrument Status : Used

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 28 August 2024
Calibration Date : 8 November 2024

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18591010906	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	2 August 2025
Temperature meter	GT 11	08000057	Qreborn	1 March 2025
Pressure meter	CPG2400	410008DU/651882	TPA	21 October 2025

Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

Note :

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

Calibration By :
Mr. Noppadon Luangart
Service Calibration Engineer
Approved By :
Mr. Pacin Muthavara
Calibration Engineer Supervisor
Issue Date : 8 November 2024

เอกสารไม่ควบคุม

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-AFM-01 Rev.04 Issue date 17/0/24



Certificate No : 24-AFM-223
Request No : Req-2024-1952

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (hPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Uncertainty (l/min)	MPE (l/min)	Result
23.30	101.30	0.022	0.020	-0.002	0.0013	0.005	N/A
23.50	101.30	0.051	0.050	-0.001	0.0033	0.005	N/A
23.53	101.30	0.102	0.100	-0.002	0.0028	0.005	N/A
23.30	100.68	0.202	0.200	-0.002	0.0056	0.005	N/A
23.50	101.30	0.508	0.500	-0.008	0.0073	0.010	N/A
23.60	101.30	1.016	1.000	-0.010	0.014	0.020	N/A
23.30	101.40	1.717	1.702	-0.015	0.025	0.034	N/A
23.10	101.40	2.026	2.000	-0.026	0.029	0.040	N/A
23.60	101.61	3.014	3.000	-0.014	0.043	0.060	N/A
23.70	101.72	4.023	4.000	-0.023	0.056	0.080	N/A
23.90	101.93	5.025	5.001	-0.024	0.072	0.100	N/A

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

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

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

* Indicates non accredited

MPE = Maximum Permissible Error (Specified in Manufacturer's Specifications)

N/A = Not Available, Customer does not require a statement of conformity.

เอกสารไม่ควบคุม

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-AFM-01 Rev.04 Issue date 17/0/24

Certificate No : 24-AFM-223

Request No : Req-2024-1952

Decision Rule for Statements of Conformity

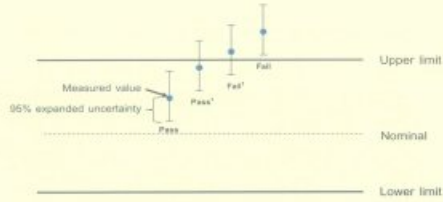
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09-2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements.

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

เอกสารไม่ควบคุม

Certificate of Calibration

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

Certificate No : 24-ASP-130
Request No : Req-2024-1863

Unit Under Calibration Details

Measurement Item : Air Sampling Pump
Manufacturer : SENSIDYNE
Model : GilAir Plus
Serial Number : 20240610103
ID : -
Location of Calibration : LAB 4 AIR VELOCITY METER

Instrument Status : New

Calibration Environment and Details

Temperature : 25 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 kPa ± 10 hPa
Received Date : 22 August 2024
Calibration Date : 28 August 2024
Calibration Procedure : In-house method CP-ASP-01 based on ISO 13137 by Comparison With Standard Air Flow Meter


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	2 August 2025
Digital Thermometer with Probe	GT11	08000057	Q.Reborn	1 March 2025
Barometer	CPG2400	41000KDU/651882	TPA	9 November 2024


Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

Note :

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

Calibration By : 
Mr. Nippon Luang
Service Calibration Engineer

Approved By : 
Mr. Pachi Mahavorn
Calibration Engineer Supervisor
Issue Date : 28 August 2024

เอกสารไม่ควบคุม

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate No : 24-ASP-130

Request No : Req-2024-1863

Result of Calibration : High(Without Adjustment)

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	MPE (l/min, %)	**Back Pressure (inH ₂ O)	Uncertainty (l/min)	Result
23.90	99.11	0.503	0.500	-0.003	-0.6 %	5 (%)	5	0.0080	Pass
23.90	95.44	0.506	0.500	-0.006	-1.2 %	5 (%)	20	0.0081	Pass
23.90	91.54	0.502	0.500	-0.002	-0.4 %	5 (%)	40	0.0080	Pass
23.90	99.12	1.004	1.000	-0.004	-0.4 (%)	5 (%)	5	0.016	Pass
23.90	95.43	0.996	1.000	0.004	0.4 (%)	5 (%)	20	0.016	Pass
23.90	91.68	0.993	1.000	0.007	0.7 (%)	5 (%)	35	0.016	Pass
23.90	99.06	1.711	1.700	-0.011	-0.6 (%)	5 (%)	5	0.027	Pass
23.90	95.08	1.699	1.700	0.001	0.1 (%)	5 (%)	20	0.027	Pass
23.90	92.72	1.691	1.700	0.009	0.5 (%)	5 (%)	30	0.027	Pass
23.90	99.09	2.005	2.000	-0.005	-0.2 (%)	5 (%)	5	0.032	Pass
23.90	95.14	1.985	2.000	0.015	0.8 (%)	5 (%)	20	0.032	Pass
23.90	92.81	1.985	2.000	0.015	0.8 (%)	5 (%)	30	0.032	Pass
23.90	99.05	3.014	3.000	-0.014	-0.5 (%)	5 (%)	5	0.048	Pass
23.90	95.22	3.006	3.000	-0.006	-0.2 (%)	5 (%)	20	0.048	Pass
23.90	92.63	2.985	3.000	0.015	0.5 (%)	5 (%)	30	0.048	Pass
23.90	99.04	4.004	4.000	-0.004	-0.1 (%)	5 (%)	5	0.064	Pass
23.90	97.70	4.007	4.000	-0.007	-0.2 (%)	5 (%)	10	0.064	Pass
23.90	95.20	4.004	4.000	-0.004	-0.1 %	5 (%)	20	0.064	Pass
23.90	99.01	5.005	5.000	-0.005	-0.1 %	5 (%)	5	0.080	Pass
23.90	97.24	5.008	5.000	-0.008	-0.2 %	5 (%)	12	0.080	Pass

Note STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At 25 °C, 101.3 kPa, Air

- Flow Rate was corrected for non-standard operating condition by using equation:

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

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature

meas = Measurement Condition

ref = Standard Condition

เอกสารไม่ควบคุม

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate No : 24-ASP-130

Request No : Req-2024-1863

Result of Calibration : Low (Without Adjustment)

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	MPE (l/min, %)	**Back Pressure (inH ₂ O)	Uncertainty (l/min)	Result
24.00	99.90	0.020	0.020	0.000	0 l/min	0.003 l/min	5	0.0011	Pass
24.00	95.24	0.021	0.020	-0.001	-0.001 l/min	0.003 l/min	20	0.0012	Pass
24.00	89.91	0.019	0.020	0.001	0.001 l/min	0.003 l/min	40	0.0010	Pass
23.90	98.98	0.049	0.050	0.001	0.001 l/min	0.003 l/min	5	0.0027	Pass
23.90	95.09	0.050	0.050	0.000	0 l/min	0.003 l/min	20	0.0028	Pass
23.90	90.58	0.051	0.050	-0.001	-0.001 l/min	0.003 l/min	40	0.0028	Pass
23.90	99.05	0.100	0.100	0.000	0 (%)	5 (%)	5	0.0026	Pass
23.90	95.17	0.098	0.100	0.002	2 (%)	5 (%)	20	0.0025	Pass
23.90	90.17	0.098	0.100	0.002	2 (%)	5 (%)	40	0.0025	Pass
23.90	99.10	0.199	0.200	0.001	0.5 (%)	5 (%)	5	0.0036	Pass
23.90	95.41	0.198	0.200	0.002	1 (%)	5 (%)	20	0.0036	Pass
23.90	90.29	0.197	0.200	0.003	1.5 (%)	5 (%)	40	0.0035	Pass

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate No : 24-ASP-130

Request No : Req-2024-1863

Note

* Indicates non accredited

** Specified in ISO 13137, Back Pressure control ± 1 inH₂O

MPE = Maximum Permissible Error (Specified in Manufacturer's Specification)

Decision Rule for Statements of Conformity

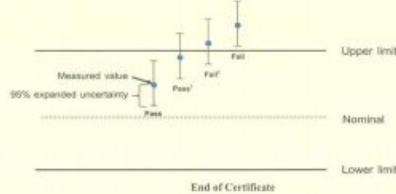
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09:2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements:

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.



เอกสารไม่ควบคุม

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24


Request No : Req-2024-1794

Request No : Rcq-2024-1794

Instrument Status : Used

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilbreth's Standard flow	19031011003	Seasdyne	2 August 2025
Digital Thermometer with Probe	GT11	08000057	Q.Reborn	1 March 2025
Barometer	CPG2400	41000KDU/651882	TPA	9 November 2024

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

Approved By : 
Mr. Pacit Mathaveen
Calibration Engineer Supervisor
Issue Date : 26 August 2024

เอกสารไม่ควบคุม

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

Request No : Req-2024-179

Temperature	Pressure	STD	UUC	Error	Error	MPE	**Back Pressure	Uncertainty	Result
(°C)	(kPa)	(l/min)	(l/min)	(l/min)	(l/min, %)	(l/min, %)	(mH ₂ O)	(l/min)	
23.70	99.07	0.502	0.500	-0.002	-0.4 %	5 (%)	5	0.0080	Pass
23.70	95.37	0.507	0.500	-0.007	-1.4 %	5 (%)	20	0.0081	Pass
23.70	91.68	0.505	0.500	-0.005	-1 %	5 (%)	40	0.0081	Pass
23.60	98.98	1.004	1.000	-0.004	-0.4 (%)	5 (%)	5	0.016	Pass
23.60	95.35	0.996	1.000	0.004	0.4 (%)	5 (%)	20	0.016	Pass
23.60	91.30	0.980	1.000	0.020	2 (%)	5 (%)	35	0.016	Pass
23.70	99.02	1.709	1.700	-0.009	-0.5 (%)	5 (%)	5	0.027	Pass
23.70	95.29	1.670	1.700	0.030	1.8 (%)	5 (%)	20	0.027	Pass
23.70	92.65	1.648	1.700	0.052	3.2 (%)	5 (%)	30	0.027	Pass
23.60	99.04	2.004	2.000	-0.004	-0.2 (%)	5 (%)	5	0.032	Pass
23.60	95.13	1.961	2.000	0.039	2 (%)	5 (%)	20	0.032	Pass
23.60	92.74	1.948	2.000	0.052	2.7 (%)	5 (%)	30	0.031	Pass
23.70	98.98	3.013	3.000	-0.015	-0.5 (%)	5 (%)	5	0.048	Pass
23.70	95.12	2.977	3.000	0.023	0.8 (%)	5 (%)	20	0.048	Pass
23.70	92.68	2.983	3.000	0.017	0.6 (%)	5 (%)	30	0.048	Pass
23.60	98.97	4.005	4.000	-0.005	-0.1 (%)	5 (%)	5	0.064	Pass
23.60	97.68	4.009	4.000	-0.009	-0.2 (%)	5 (%)	10	0.064	Pass
23.50	95.04	4.002	4.000	-0.002	0 %	5 (%)	20	0.064	Pass
23.60	98.98	5.003	5.000	-0.003	-0.1 %	5 (%)	5	0.080	Pass
23.50	97.23	5.007	5.000	-0.007	-0.1 %	5 (%)	12	0.080	Pass

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

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

Certificate of Calibration

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

Unit Under Calibration Details

Measurement Item : Air Sampling Pump
Manufacturer : SENSIDYNE
Model : GilAir Plus
Serial Number : 20240610094
ID : -
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 22 August 2024
Calibration Date : 29 August 2024

Calibration Procedure : In-house method CP-ASP-01 based on ISO 13137 by Comparison With Standard Air Flow Meter


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011005	Sensidyne	2 August 2025
Digital Thermometer with Probe	GT11	08000057	Q.Reborn	1 March 2025
Barometer	CPG2400	41000KDU1651882	TPA	9 November 2024

Traceability :

This Certificate is traceable to SI Unit through Sensidyne A21A Accreditation No. 3943.01

Note :

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

Calibration By : 
Mr. Nippon Luangut
Service Calibration Engineer

Approved By : 
Mr. Patch Mahavorn
Calibration Engineer Supervisor
Issue Date : 29 August 2024

เอกสารไม่ควบคุม

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate No : 24-ASP-135

Request No : Req-2024-1863

Result of Calibration : High(Without Adjustment)

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	MPE (l/min, %)	**Back Pressure (inH ₂ O)	Uncertainty (l/min)	Result
25.20	99.38	0.503	0.500	-0.003	-0.6 %	5 %	5	0.0080	Pass
25.10	95.84	0.509	0.500	-0.009	-1.8 %	5 %	20	0.0081	Pass
25.10	91.92	0.509	0.500	-0.009	-1.8 %	5 %	40	0.0081	Pass
25.20	99.53	1.005	1.000	-0.005	-0.5 %	5 %	5	0.016	Pass
25.20	95.56	1.002	1.000	-0.002	-0.2 %	5 %	20	0.017	Pass
25.20	92.07	0.994	1.000	0.006	0.6 %	5 %	35	0.016	Pass
25.20	99.41	1.710	1.700	-0.010	-0.6 %	5 %	5	0.027	Pass
25.20	95.66	1.699	1.700	0.001	0.1 %	5 %	20	0.027	Pass
25.20	93.02	1.683	1.700	0.017	1 %	5 %	30	0.027	Pass
25.20	99.46	2.004	2.000	-0.004	-0.2 %	5 %	5	0.032	Pass
25.10	95.99	1.995	2.000	0.005	0.3 %	5 %	20	0.032	Pass
25.10	93.18	1.979	2.000	0.021	1.1 %	5 %	30	0.032	Pass
25.00	99.40	3.014	3.000	-0.014	-0.5 %	5 %	5	0.048	Pass
25.00	95.64	3.007	3.000	-0.007	-0.2 %	5 %	20	0.048	Pass
25.00	93.04	3.004	3.000	-0.004	-0.1 %	5 %	30	0.048	Pass
25.00	99.42	4.003	4.000	-0.003	-0.1 %	5 %	5	0.064	Pass
25.00	98.07	4.007	4.000	-0.007	-0.2 %	5 %	10	0.064	Pass
25.00	95.54	3.993	4.000	0.007	0.2 %	5 %	20	0.064	Pass
25.00	99.27	5.005	5.000	-0.005	-0.1 %	5 %	5	0.080	Pass
25.00	97.50	4.998	5.000	0.002	0 %	5 %	12	0.080	Pass

Note STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At 25 °C, 101.3 kPa, Air

- Flow Rate was corrected for non-standard operating condition by using equation :

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

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature

meas = Measurement Condition

ref = Standard Condition

เอกสารไม่ควบคุม

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate No : 24-ASP-135

Request No : Req-2024-1863

Result of Calibration : Low (Without Adjustment)

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	MPE (l/min, %)	**Back Pressure (inH ₂ O)	Uncertainty (l/min)	Result
25.20	99.63	0.021	0.020	-0.001	-0.001 %	0.003 %	5	0.0012	Pass
25.20	95.98	0.020	0.020	0.000	0 %	0.003 %	20	0.0011	Pass
25.20	90.41	0.019	0.020	0.001	0.001 %	0.003 %	40	0.0010	Pass
25.20	99.57	0.050	0.050	0.000	0 %	0.003 %	5	0.0028	Pass
25.20	95.78	0.051	0.050	-0.001	-0.001 %	0.003 %	20	0.0028	Pass
25.20	90.61	0.049	0.050	0.001	0.001 %	0.003 %	40	0.0027	Pass
25.20	99.41	0.100	0.100	0.000	0 %	5 %	5	0.0026	Pass
25.20	95.87	0.100	0.100	0.000	0 %	5 %	20	0.0026	Pass
25.20	90.73	0.097	0.100	0.003	3.1 %	5 %	40	0.0025	Pass
25.20	99.47	0.200	0.200	0.000	0 %	5 %	5	0.0036	Pass
25.20	95.70	0.199	0.200	0.001	0.5 %	5 %	20	0.0036	Pass
25.20	90.77	0.196	0.200	0.004	2 %	5 %	40	0.0035	Pass

เอกสารไม่ควบคุม

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate No : 24-ASP-135

Request No : Req-2024-1863

Note

* Indicates non accredited

** Specified in ISO 13137, Back Pressure control ± 1 inH₂O

MPE = Maximum Permissible Error (Specified in Manufacturer's Specification)

Decision Rule for Statements of Conformity

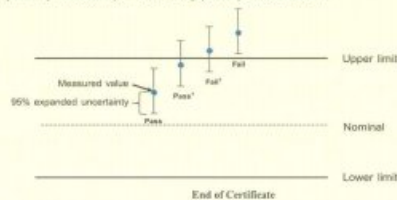
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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.



เอกสารไม่ควบคุม

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate of Calibration

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

Certificate No : 24-ASP-138
Request No : Req-2024-1863

Unit Under Calibration Details

Measurement Item : Air Sampling Pump
Manufacturer : SENSIDYNE
Model : GilAir Plus
Serial Number : 20240610102
ID : -
Location of Calibration : LAB 4 AIR VELOCITY METER

Instrument Status : New

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 kPa ± 10 kPa
Received Date : 22 August 2024
Calibration Date : 30 August 2024

Calibration Procedure : In-house method CP-ASP-01 based on ISO 13137 by Comparison With Standard Air Flow Meter


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011005	Sensidyne	2 August 2025
Digital Thermometer with Probe	GT11	08000057	Q.Reborn	1 March 2025
Barometer	CPO2400	41090KDU651882	TPA	9 November 2024


Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

Note :

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

Calibration By : 
Mr. Noppadon Luangut
Service Calibration Engineer

Approved By : 
Mr. Pachi Mathavorn
Calibration Engineer Supervisor
Issue Date : 30 August 2024

เอกสารไม่ควบคุม

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate No : 24-ASP-138

Request No : Req-2024-1863

Result of Calibration : Low (Without Adjustment)

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	MPE (l/min, %)	**Back Pressure (inH ₂ O)	Uncertainty (l/min)	Result
23.50	99.70	0.019	0.020	0.001	0.001 l/min	0.003 l/min	5	0.0010	Pass
23.50	95.92	0.020	0.020	0.000	0 l/min	0.003 l/min	20	0.0011	Pass
23.50	90.62	0.019	0.020	0.001	0.001 l/min	0.003 l/min	40	0.0010	Pass
23.40	98.58	0.050	0.050	0.000	0 l/min	0.003 l/min	5	0.0028	Pass
23.40	95.09	0.051	0.050	-0.001	-0.001 l/min	0.003 l/min	20	0.0028	Pass
23.40	90.69	0.048	0.050	0.002	0.002 l/min	0.003 l/min	40	0.0026	Pass
23.40	99.58	0.101	0.100	-0.001	-1 (%)	5 (%)	5	0.0026	Pass
23.40	95.91	0.100	0.100	0.000	0 (%)	5 (%)	20	0.0026	Pass
23.40	90.74	0.098	0.100	0.002	2 (%)	5 (%)	40	0.0025	Pass
23.50	99.58	0.201	0.200	-0.001	-0.5 (%)	5 (%)	5	0.0036	Pass
23.50	95.85	0.199	0.200	0.001	0.5 (%)	5 (%)	20	0.0036	Pass
23.50	91.23	0.200	0.200	0.000	0 (%)	5 (%)	40	0.0036	Pass

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate No : 24-ASP-138

Request No : Req-2024-1863

Result of Calibration : High(Without Adjustment)

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	MPE (l/min, %)	**Back Pressure (inH ₂ O)	Uncertainty (l/min)	Result
23.40	99.63	0.501	0.500	-0.001	-0.2 %	5 (%)	5	0.0080	Pass
23.40	95.84	0.504	0.500	-0.004	-0.8 %	5 (%)	20	0.0082	Pass
23.40	91.97	0.503	0.500	-0.003	-0.6 %	5 (%)	40	0.0080	Pass
23.30	99.50	1.003	1.000	-0.003	-0.3 (%)	5 (%)	5	0.016	Pass
23.30	95.65	0.996	1.000	0.004	0.4 (%)	5 (%)	20	0.016	Pass
23.30	91.92	0.987	1.000	0.013	1.3 (%)	5 (%)	35	0.016	Pass
23.30	99.55	1.703	1.700	-0.003	-0.2 (%)	5 (%)	5	0.027	Pass
23.30	95.74	1.671	1.700	0.029	1.7 (%)	5 (%)	20	0.027	Pass
23.30	93.18	1.654	1.700	0.046	2.8 (%)	5 (%)	30	0.027	Pass
23.40	99.61	2.003	2.000	-0.003	-0.1 (%)	5 (%)	5	0.032	Pass
23.40	95.74	1.991	2.000	0.009	0.5 (%)	5 (%)	20	0.032	Pass
23.40	93.08	1.969	2.000	0.031	1.6 (%)	5 (%)	30	0.032	Pass
23.40	99.50	3.005	3.000	-0.005	-0.2 (%)	5 (%)	5	0.048	Pass
23.40	95.60	2.988	3.000	0.012	0.4 (%)	5 (%)	20	0.048	Pass
23.40	93.10	2.974	3.000	0.026	0.9 (%)	5 (%)	30	0.048	Pass
23.40	99.53	4.005	4.000	-0.005	-0.1 (%)	5 (%)	5	0.064	Pass
23.40	98.20	4.005	4.000	-0.005	-0.1 (%)	5 (%)	10	0.064	Pass
23.40	95.66	3.986	4.000	0.014	0.4 (%)	5 (%)	20	0.064	Pass
23.30	99.49	5.004	5.000	-0.004	-0.1 %	5 (%)	5	0.080	Pass
23.30	97.69	5.009	5.000	-0.009	-0.2 %	5 (%)	12	0.080	Pass

Note : STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At 25 °C, 101.3 kPa, Air

- Flow Rate was corrected for non-standard operating condition by using equation :

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

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature

meas = Measurement Condition ref = Standard Condition

เอกสารไม่ควบคุม

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate No : 24-ASP-138

Request No : Req-2024-1863

Note

* Indicates non accredited

** Specified in ISO 13137, Back Pressure control ± 1 inH₂O

MPE = Maximum Permissible Error (Specified in Manufacturer's Specification)

Decision Rule for Statements of Conformity

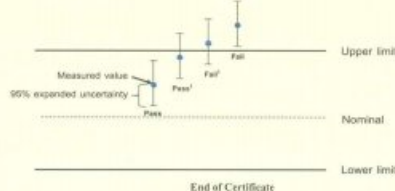
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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.



เอกสารไม่ควบคุม

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FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate of Calibration

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

Certificate No : 24-ASP-142
Request No : Req-2024-1863

Unit Under Calibration Details

Measurement Item : Air Sampling Pump
Manufacturer : SENSIDYNE
Model : GilaAir Plus
Serial Number : 20240610101
ID : *
Location of Calibration : LAB 4 AIR VELOCITY METER

Instrument Status : New

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 kPa ± 10 kPa
Received Date : 22 August 2024
Calibration Date : 30 August 2024
Calibration Procedure : In-house method CP-ASP-01 based on ISO 13137 by Comparison With Standard Air Flow Meter


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	2 August 2025
Digital Thermometer with Probe	GT11	08000057	Q.Robom	1 March 2025
Barometer	CPG2400	41000KDLV651882	TPA	9 November 2024


Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

Note :

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

Calibration By : 
Mr. Nopphadol Luangrat
Service Calibration Engineer

Approved By : 
Mr. Patch Mahavom
Calibration Engineer Supervisor

Issue Date : 30 August 2024

เอกสารไม่ควบคุม

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Result of Calibration : Low (Without Adjustment)

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	MPE (l/min, %)	**Back Pressure (inH ₂ O)	Uncertainty (l/min)	Result
23.30	99.14	0.020	0.020	0.000	0 l/min	0.003 l/min	5	0.0011	Pass
23.30	95.45	0.021	0.020	-0.001	-0.001 l/min	0.003 l/min	20	0.0012	Pass
23.30	91.90	0.021	0.020	-0.001	-0.001 l/min	0.003 l/min	40	0.0012	Pass
23.10	99.29	0.049	0.050	0.001	0.001 l/min	0.003 l/min	5	0.0027	Pass
23.10	95.38	0.050	0.050	0.000	0 l/min	0.003 l/min	20	0.0028	Pass
23.10	90.42	0.049	0.050	0.001	0.001 l/min	0.003 l/min	40	0.0027	Pass
23.10	99.16	0.099	0.100	0.001	1 (%)	5 (%)	5	0.0026	Pass
23.10	95.51	0.099	0.100	0.001	1 (%)	5 (%)	20	0.0026	Pass
23.10	90.78	0.097	0.100	0.003	3.1 (%)	5 (%)	40	0.0025	Pass
23.20	99.19	0.200	0.200	0.000	0 (%)	5 (%)	5	0.0036	Pass
23.20	95.56	0.198	0.200	0.002	1 (%)	5 (%)	20	0.0036	Pass
23.20	90.33	0.196	0.200	0.004	2 (%)	5 (%)	40	0.0035	Pass

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate No : 24-ASP-142

Request No : Req-2024-1863

Result of Calibration : High(Without Adjustment)

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	MPE (l/min, %)	**Back Pressure (inH ₂ O)	Uncertainty (l/min)	Result
23.20	99.35	0.501	0.500	-0.001	-0.2 %	5 (%)	5	0.0080	Pass
23.20	95.45	0.501	0.500	-0.001	-0.2 %	5 (%)	20	0.0080	Pass
23.20	91.45	0.497	0.500	0.003	0.6 %	5 (%)	40	0.0080	Pass
23.30	99.31	1.005	1.000	-0.005	-0.5 (%)	5 (%)	5	0.016	Pass
23.30	95.38	0.997	1.000	0.003	0.3 (%)	5 (%)	20	0.016	Pass
23.40	91.31	0.977	1.000	0.023	2.4 (%)	5 (%)	35	0.016	Pass
23.40	99.29	1.702	1.700	-0.002	-0.1 (%)	5 (%)	5	0.027	Pass
23.40	95.32	1.684	1.700	0.016	1 (%)	5 (%)	20	0.027	Pass
23.40	92.94	1.683	1.700	0.017	1 (%)	5 (%)	30	0.027	Pass
23.30	99.27	2.003	2.000	-0.003	-0.1 (%)	5 (%)	5	0.032	Pass
23.30	95.45	1.979	2.000	0.021	1.1 (%)	5 (%)	20	0.032	Pass
23.30	92.85	1.974	2.000	0.026	1.3 (%)	5 (%)	30	0.032	Pass
23.40	99.19	3.003	3.000	-0.003	-0.1 (%)	5 (%)	5	0.048	Pass
23.40	95.45	2.991	3.000	0.009	0.3 (%)	5 (%)	20	0.048	Pass
23.40	92.88	2.982	3.000	0.018	0.6 (%)	5 (%)	30	0.048	Pass
23.40	99.24	4.005	4.000	-0.005	-0.1 (%)	5 (%)	5	0.064	Pass
23.40	97.96	4.007	4.000	-0.007	-0.2 (%)	5 (%)	10	0.064	Pass
23.40	95.24	4.001	4.000	-0.001	0 %	5 (%)	20	0.064	Pass
23.40	99.19	5.006	5.000	-0.006	-0.1 %	5 (%)	5	0.080	Pass
23.40	97.41	5.004	5.000	-0.004	-0.1 %	5 (%)	12	0.080	Pass

Note : STD : Standard UUC : Unit Under Calibration

UUC Reference Condition : At 25 °C, 101.3 kPa, Air

Flow Rate was corrected for non-standard operating condition by using equation :

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

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature

meas = Measurement Condition

ref = Standard Condition

เอกสารไม่ควบคุม

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Note

* Indicates non accredited

** Specified in ISO 13137, Back Pressure control ± 1 inH₂O

MPE = Maximum Permissible Error (Specified in Manufacturer's Specification)

Decision Rule for Statements of Conformity

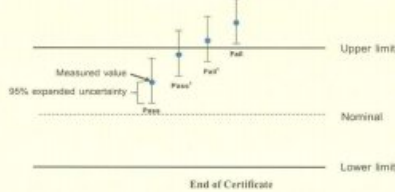
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:08/2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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.



Certificate No : 24-ASP-142

Request No : Req-2024-1863

เอกสารไม่ควบคุม

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate of Calibration

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

Certificate No : 24-ASP-141
Request No : Req-2024-1863

Unit Under Calibration Details

Measurement Item : Air Sampling Pump
Manufacturer : SENSIDYNE
Model : GBAir Plus
Serial Number : 20240610100
ID : -
Location of Calibration : LAB 4 AIR VELOCITY METER

Instrument Status : New

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 kPa ± 10 kPa
Received Date : 22 August 2024
Calibration Date : 30 August 2024
Calibration Procedure : In-house method CP-ASP-01 based on ISO 13137 by Comparison With Standard Air Flow Meter

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	2 August 2025
Digital Thermometer with Probe	GT11	08000057	Q.Reborn	1 March 2025
Barometer	CPG2400	41090KDLV651882	TPA	9 November 2024


Traceability :

This Certificate is traceable to SI Unit through Sensidyne AZLA Accreditation No. 3943.01

Note :

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

Calibration By : 
Mr. Noppadon Luangrat
Service Calibration Engineer

Approved By : 
Mr. Pich Mathavorn
Calibration Engineer Supervisor
Issue Date : 30 August 2024

เอกสารไม่ควบคุม

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate No : 24-ASP-141

Request No : Req-2024-1863

Result of Calibration : Low (Without Adjustment)

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	MPE (l/min, %)	**Back Pressure (inH ₂ O)	Uncertainty (l/min)	Result
23.30	99.20	0.021	0.020	-0.001	-0.001 l/min	0.003 l/min	5	0.0012	Pass
23.30	95.62	0.021	0.020	-0.001	-0.001 l/min	0.003 l/min	20	0.0012	Pass
23.30	91.06	0.020	0.020	0.000	0 l/min	0.003 l/min	40	0.0011	Pass
23.10	99.24	0.051	0.050	-0.001	-0.001 l/min	0.003 l/min	5	0.0028	Pass
23.10	95.35	0.050	0.050	0.000	0 l/min	0.003 l/min	20	0.0028	Pass
23.10	90.56	0.049	0.050	0.001	0.001 l/min	0.003 l/min	40	0.0027	Pass
23.10	99.26	0.100	0.100	0.000	0 (%)	5 (%)	5	0.0026	Pass
23.10	95.36	0.100	0.100	0.000	0 (%)	5 (%)	20	0.0026	Pass
23.10	90.76	0.099	0.100	0.001	1 (%)	5 (%)	40	0.0026	Pass
23.10	99.21	0.200	0.200	0.000	0 (%)	5 (%)	5	0.0036	Pass
23.10	95.40	0.199	0.200	0.001	0.5 (%)	5 (%)	20	0.0036	Pass
23.10	90.36	0.198	0.200	0.002	1 (%)	5 (%)	40	0.0036	Pass

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate No : 24-ASP-141

Request No : Req-2024-1863

Result of Calibration : High(Without Adjustment)

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	MPE (l/min, %)	**Back Pressure (inH ₂ O)	Uncertainty (l/min)	Result
23.20	99.33	0.500	0.500	0.000	0 %	5 (%)	5	0.0080	Pass
23.20	95.41	0.501	0.500	-0.001	-0.2 %	5 (%)	20	0.0080	Pass
23.20	91.75	0.499	0.500	0.001	0.2 %	5 (%)	40	0.0080	Pass
23.40	99.24	1.004	1.000	-0.004	-0.4 (%)	5 (%)	5	0.016	Pass
23.40	95.47	0.993	1.000	0.007	0.7 (%)	5 (%)	20	0.016	Pass
23.40	91.67	0.977	1.000	0.023	2.4 (%)	5 (%)	35	0.016	Pass
23.40	99.23	1.702	1.700	-0.002	-0.1 (%)	5 (%)	5	0.027	Pass
23.40	95.46	1.680	1.700	0.040	2.4 (%)	5 (%)	20	0.027	Pass
23.40	92.87	1.645	1.700	0.055	3.3 (%)	5 (%)	30	0.027	Pass
23.30	99.24	2.003	2.000	-0.003	-0.1 (%)	5 (%)	5	0.032	Pass
23.30	95.35	1.974	2.000	0.026	1.3 (%)	5 (%)	20	0.032	Pass
23.30	92.94	1.945	2.000	0.055	2.8 (%)	5 (%)	30	0.032	Pass
23.40	99.25	3.000	3.000	0.000	0 (%)	5 (%)	5	0.048	Pass
23.40	95.39	2.978	3.000	0.022	0.7 (%)	5 (%)	20	0.048	Pass
23.40	92.96	2.966	3.000	0.034	1.1 (%)	5 (%)	30	0.048	Pass
23.40	99.21	4.003	4.000	-0.003	-0.1 (%)	5 (%)	5	0.064	Pass
23.40	97.96	4.008	4.000	-0.006	-0.1 (%)	5 (%)	10	0.064	Pass
23.40	95.34	3.993	4.000	0.007	0.2 %	5 (%)	20	0.064	Pass
23.30	99.25	5.004	5.000	-0.004	-0.1 %	5 (%)	5	0.080	Pass
23.30	97.45	4.995	5.000	0.005	0.1 %	5 (%)	12	0.080	Pass

Note : STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At 25 °C, 101.3 kPa, Air

- Flow Rate was corrected for non-standard operating condition by using equation :

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

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature

meas = Measurement Condition

ref = Standard Condition

เอกสารไม่ควบคุม

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate No : 24-ASP-141

Request No : Req-2024-1863

Note

* Indicates non accredited

** Specified in ISO 13137, Back Pressure control ± 1 inH₂O

MPE = Maximum Permissible Error (Specified in Manufacturer's Specification)

Decision Rule for Statements of Conformity

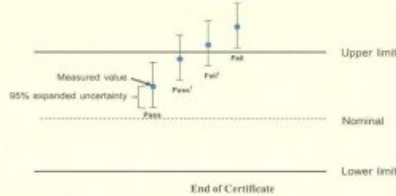
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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.



เอกสารไม่ควบคุม

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FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate of Calibration

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

Unit Under Calibration Details

Measurement Item : Air Sampling Pump
Manufacturer : SENSIDYNE
Model : GilAir Plus
Serial Number : 20240610104
ID : +
Location of Calibration : LAB 4 AIR VELOCITY METER

Certificate No : 24-ASP-128
Request No : Req-2024-1863

Instrument Status : New

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 kPa ± 10 hPa
Received Date : 22 August 2024
Calibration Date : 28 August 2024
Calibration Procedure : In-house method CP-ASP-01 based on ISO 13137 by Comparison With Standard Air Flow Meter


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	2 August 2025
Digital Thermometer with Probe	GT11	08000057	Q.Richom	1 March 2025
Barometer	CPG2400	41090KDU651882	TPA	9 November 2024


Traceability :

This Certificate is traceable to SI Unit through Sensidyne AZLA Accreditation No. 3943.01

Note :

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

Calibration By : 
Mr. Noppadon Lungsart
Service Calibration Engineer

Approved By : 
Mr. Pachi Mathavorn
Calibration Engineer Supervisor

Issue Date : 28 August 2024

เอกสารไม่ควบคุม

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate No : 24-ASP-128
Request No : Req-2024-1863

Result of Calibration : High(Without Adjustment)

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	MPE (l/min, %)	**Back Pressure (lnH ₂ O)	Uncertainty (l/min)	Result
24.80	99.36	0.502	0.500	-0.002	-0.4 %	5 %	5	0.0080	Pass
24.80	95.59	0.503	0.500	-0.003	-0.6 %	5 %	20	0.0080	Pass
24.80	92.09	0.504	0.500	-0.004	-0.8 %	5 %	40	0.0081	Pass
24.60	99.37	1.004	1.000	-0.004	-0.4 %	5 %	5	0.016	Pass
24.60	95.45	1.002	1.000	-0.002	-0.2 %	5 %	20	0.016	Pass
24.60	91.78	0.988	1.000	0.012	1.2 %	5 %	35	0.016	Pass
24.60	99.36	1.707	1.700	-0.007	-0.4 %	5 %	5	0.027	Pass
24.60	95.57	1.682	1.700	0.018	1.1 %	5 %	20	0.027	Pass
24.60	93.16	1.684	1.700	0.016	1 %	5 %	30	0.027	Pass
24.50	99.42	2.004	2.000	-0.004	-0.2 %	5 %	5	0.032	Pass
24.50	95.70	1.994	2.000	0.006	0.3 %	5 %	20	0.032	Pass
24.50	93.06	1.977	2.000	0.023	1.2 %	5 %	30	0.032	Pass
24.50	99.36	3.011	3.000	-0.011	-0.4 %	5 %	5	0.048	Pass
24.50	95.52	3.002	3.000	-0.002	-0.1 %	5 %	20	0.048	Pass
24.50	92.98	2.993	3.000	0.007	0.2 %	5 %	30	0.048	Pass
24.40	99.37	4.003	4.000	-0.003	-0.1 %	5 %	5	0.064	Pass
24.40	96.09	4.006	4.000	-0.006	-0.1 %	5 %	10	0.064	Pass
24.40	95.47	3.993	4.000	0.007	0.2 %	5 %	20	0.064	Pass
24.40	99.33	5.007	5.000	-0.007	-0.1 %	5 %	5	0.080	Pass
24.40	97.53	5.000	5.000	0.000	0 %	5 %	12	0.080	Pass

Note : STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At 25 °C, 101.3 kPa, Air

- Flow Rate was corrected for non-standard operating condition by using equation :

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

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature

meas = Measurement Condition ref = Standard Condition

เอกสารไม่ควบคุม

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate No : 24-ASP-128
Request No : Req-2024-1863

Result of Calibration : Low (Without Adjustment)

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	MPE (l/min, %)	**Back Pressure (lnH ₂ O)	Uncertainty (l/min)	Result
24.70	99.70	0.019	0.020	0.001	0.001 l/min	0.003 l/min	5	0.0010	Pass
24.70	95.26	0.020	0.020	0.000	0 l/min	0.003 l/min	20	0.0011	Pass
24.70	90.25	0.019	0.020	0.001	0.001 l/min	0.003 l/min	40	0.0010	Pass
25.00	99.30	0.050	0.050	0.000	0 l/min	0.003 l/min	5	0.0028	Pass
25.00	95.69	0.051	0.050	-0.001	-0.001 l/min	0.003 l/min	20	0.0028	Pass
25.00	90.31	0.049	0.050	0.001	0.001 l/min	0.003 l/min	40	0.0027	Pass
25.00	99.45	0.100	0.100	0.000	0 %	5 %	5	0.0026	Pass
25.00	95.51	0.099	0.100	0.001	1 %	5 %	20	0.0026	Pass
25.00	90.93	0.098	0.100	0.002	2 %	5 %	40	0.0025	Pass
25.00	99.32	0.200	0.200	0.000	0 %	5 %	5	0.0036	Pass
25.00	95.79	0.200	0.200	0.000	0 %	5 %	20	0.0036	Pass
25.00	90.82	0.199	0.200	0.001	0.5 %	5 %	40	0.0036	Pass

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate No : 24-ASP-128
Request No : Req-2024-1863

Note

* Indicates non accredited

** Specified in ISO 13137, Back Pressure control + 1 lnH₂O

MPE = Maximum Permissible Error (Specified in Manufacturer's Specification)

Decision Rule for Statements of Conformity

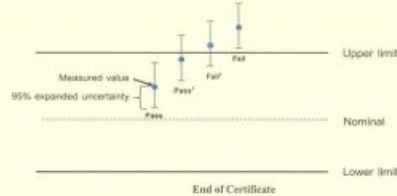
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:89/3019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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.

Fail² = 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 limits.



เอกสารไม่ควบคุม

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

FM-708-AFM-01 Rev.03 Issue date 16/8/24



Certificate of Calibration

Certificate No. : 25P1359
Page : 1 of 2

Equipment : Aneroid Barometer

Manufacturer : Barigo

Model : 111MS

Serial No. : -

ID No. : UAE.EMA2.067/2552

Condition As-Received: Used Item

Received Date: 10 April 2025

Calibration Date: 17 April 2025

Reference: 2504-0315WSC

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

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1009 mbar

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

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

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DP142	1422505046	MP-0133-24	15 May 2025

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

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

4. Scale and conversion factor is 1 kPa = 7.50062 mmHg

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Kaekpon Saivichai
Issue Date : 21 April 2025

Approved Signatory : *Attapol P.*
[] Phalinee Phipphai
[] Sura Suwannarat
[✓] Attapol Panurech

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Result of calibration: Without adjustment

Function: Absolute Pressure Measurement

Range: 720 mmHg to 780 mmHg

Scale Interval: 1 mmHg (The Fifth Estimate)

Increasing Pressure

Applied Pressure (mmHg)	717.92	728.96	739.74	750.28	761.05	773.52	784.47
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0	780.0
Error (mmHg)	2.08	1.05	0.26	-0.28	-1.55	-3.52	-4.47

Decreasing Pressure

Applied Pressure (mmHg)	784.47	773.53	761.51	750.35	739.61	729.05	718.10
UUC* Indication (mmHg)	780.0	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-4.47	-3.53	-1.51	-0.35	0.19	0.95	1.90

The uncertainty of measurement was ± 0.24 mmHg

* UUC = Unit Under Calibration

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

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เอกสารไม่ควบคุม



Certificate of Calibration

Certificate No. : 24H1487
Page : 1 of 2

Equipment : Digital Thermo-Hygrometer

Manufacturer : Digicon

Model : TH-02A

Serial No. : 435031148

ID No. : UAE.EFM.006/2567

Condition As-Received: New Item

Received Date: 10 July 2024

Calibration Date: 15 July 2024

to 17 July 2024

Reference: 2407-0393WSC

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

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

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

Condition of this result of calibration

1. Reference standards instruments :

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

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

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

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

-Technology Promotion Association (Thailand-Japan), NSC-ONS Accredited No. Calibration 0005

Calibrated by : Suresh Phansuol
Issue Date : 17 July 2024

Approved Signatory : *Viporn*
[] Chakrit Waeewarjua
[✓] Viporn Tantiyawutti
[] Uthongphol Harachai

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

Result of Calibration: Without Adjustment
Function: Humidity Measurement.

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

Result of Calibration: Without Adjustment
Function: Temperature Measurement.

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

UUC* : Unit Under Calibration

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

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เอกสารไม่ควบคุม

Certificate of Calibration

Customer

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

Certificate No : 24-ACT-120
Request No : Req-2024-1896

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 2
Manufacturer : LARSON DAVIS Range : 94 , 114 dB / 1000 Hz
Model : CAL150 Instrument Status : Used
Serial Number : 6307
ID : UAE-EFM.049/2563

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 26 August 2024
Calibration Date : 10 September 2024
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators


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

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

Note

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

Calibrated By : 
Mr. Noppodon Luangrat
Service Calibration Engineer

Approved By : 
Mr. Pacit Muthavorn
Calibration Engineer Supervisor
Issue Date : 10 September 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Lab.
FM-708-ACT-02 Rev.03 Issue date 5/6/24

เอกสารไม่ควบคุม

Certificate No : 24-ACT-120

Request No : Req-2024-1896

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 2 (± dB)	Result
	Measured	Deviated value	Measured	Deviated value			
94 dB / 1000 Hz	93.96	-0.04	-	-	0.13	0.40	Pass
114 dB / 1000 Hz	114.04	0.04	-	-	0.13	0.40	Pass

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 2 (± %)	Result
	Measured (Hz)	Deviated	Measured (Hz)	Deviated			
94 dB / 1000 Hz	999.14	0.09	-	-	0.01	1.7	Pass
114 dB / 1000 Hz	999.11	0.09	-	-	0.01	1.7	Pass

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

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)	Acceptance limit Class 2 (± %)	Result
	Measured (%)	Measured (%)			
94 dB / 1000 Hz	0.12	-	0.40	3.0	Pass
114 dB / 1000 Hz	0.23	-	0.40	3.0	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
Sound pressure level	0.35 dB
Frequency	0.20%
Total distortion+noise	1.00%

> Acceptance limit was IEC60942:2017 Class 1

> The calibration results exclude the calibrator pressure correction

> The calibration results exclude the microphone volume correction

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Lab.
FM-708-ACT-02 Rev.03 Issue date 5/6/24

เอกสารไม่ควบคุม

Certificate No : 24-ACT-120

Request No : Req-2024-1896

Decision Rule for Statements of Conformity

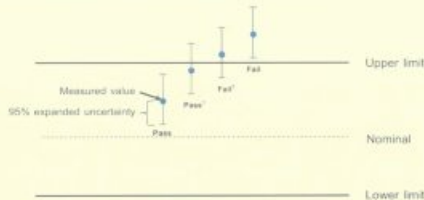
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09:2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass² - 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

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Lab.
FM-708-ACT-02 Rev.03 Issue date 5/6/24

เอกสารไม่ควบคุม

Cert. No. : ACL25023
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00409175 / 185834 / 90621
ID No.: UAE.EFM.014/2564

Condition As Found : GOOD

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

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

Received Date : 03 JANUARY 2025
Calibration Date : 13 - 14 JANUARY 2025
Date of Issue : 15 JANUARY 2025

Calibrated by : Nathakorn Pisutpaisan

Approved by : 
(Thanakul Petchurai)

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

เอกสารไม่ควบคุม

Cert. No. : ACL25023
Job No. : VC68AC0056
Pages : 2 of 8

Calibration Procedure : CP-AC-01

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

Condition of this result of calibration :

1. Reference Standard Instruments :
- | Instrument | Model | Serial No. | Cert. No. | Due Date |
|-------------------------|----------|------------|----------------|-----------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-24 | 05-FEB-25 |
| Waveform Generator | 33511B | MY52302742 | EF-0007-24 | 05-FEB-25 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 21/0267 | 13-FEB-25 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 20/0267 | 15-FEB-25 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 22/0267 | 15-FEB-25 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0008-24 | 05-FEB-25 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-24 | 12-FEB-25 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3001-24 | 05-FEB-25 |
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).

เอกสารไม่ควบคุม

Cert. No. : ACL25023
Job No. : VC68AC0056
Pages : 3 of 8

Summary of Measurement Result :

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

เอกสารไม่ควบคุม

Cert. No. : ACL25023
Job No. : VC68AC0056
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.7

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

Frequency Weighting (dB)	Weighting (dB)
A - weight	11.6
C - weight	17.9
Flat	23.7

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	± 1.5
1000	0.2	0.2	0.2	± 1.0
8000	0.7	0.8	0.8	±5.0

เอกสารไม่ควบคุม

Cert. No. : ACL25023
Job No. : VC68AC0056
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2

เอกสารไม่ควบคุม

Cert. No. : ACL25023
Job No. : VC68AC0056
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	78.9	-0.1	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	63.9	-0.1	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	48.9	-0.1	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

เอกสารไม่ควบคุม

Cert. No. : ACL25023
Job No. : VC68AC0056
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.0	0.0	±1.1

9. Tone burst response

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

เอกสารไม่ควบคุม

Cert. No. : ACL25023
Job No. : VC68AC0056
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-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	89.5	-0.1	±1.5

12. High level stability

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

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

End of Calibration Certificate

เอกสารไม่ควบคุม

Cert. No. : ACL24158
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 01010781 / 194536 / 14659
ID No.: UAE.EFM.084/2565

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 MAY 2024
Calibration Date : 30 - 31 MAY 2024
Date of Issue : 04 JUNE 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : 
(Thanakul Petchurai)

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

เอกสารไม่ควบคุม

Cert. No. : ACL24158
Job No. : VC67AC0071
Pages : 3 of 8

Summary of Measurement Result :

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

เอกสารไม่ควบคุม

Cert. No. : ACL24158
Job No. : VC67AC0071
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL_BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL_BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL_BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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).

เอกสารไม่ควบคุม

Cert. No. : ACL24158
Job No. : VC67AC0071
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	17.2
Flat	22.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.2	0.2	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	0.3	0.4	0.4	±5.0

เอกสารไม่ควบคุม

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.2

เอกสารไม่ควบคุม

T. Kehn

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	135.1	0.1	± 1.1
134.0	134.1	0.1	± 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	119.1	0.1	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.1	0.1	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.2	0.2	± 1.1
27.0	27.2	0.2	± 1.1
26.0	26.4	0.4	± 1.1
25.0	25.5	0.5	± 1.1

เอกสารไม่ควบคุม

T. Kehn

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
SEL	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.3	-0.1	±3.0

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

เอกสารไม่ควบคุม

T. Kehn

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

12. High level stability

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

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

End of Calibration Certificate

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T. Kehn

Certificate of Calibration

Customer

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

Certificate No : 24-SLM-203
Request No : Req-2024-1369

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : RION
Model : NL-92
Serial Number : 00130355
ID : UAE/EMA2.102.2556
Resolution : 0.1 dB
Microphone Class : 1
Microphone Model : UC-59L
Microphone S/N : 02734
Preamplifier Model : NH-26
Preamplifier S/N : 00189
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 : 20 June 2024
Calibrated Date : 25 June 2024
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-1:2013 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	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 Luangant
Service Calibration Engineer

Approved By :
Mr. Pakt Mathavorn
Calibration Engineer Supervisor
Issue Date : 25 June 2024

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

เอกสารไม่ควบคุม

FM-706-SLM-01 Rev.04 Issue date 5/9/24

Certificate No : 24-SLM-203
Request No : Req-2024-1369

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)			
FAST / A / 30-130	Level							
Calibrator Setting								
1000 Hz 114 dB	114.22	114.6	+0.38	114.2	-0.02	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SYANTEK, Model SV 35, SN. 44783

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 30-130		
UUC Weighting	(dB)	(± dB)
A	15.8	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 30-130		
UUC Weighting	(dB)	(± dB)
A	19.2	0.10
C	13.5	0.10
Z	18.7	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A (dB)	C (dB)	Z (dB)			
FAST / 30-130						
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.1	0.2	0.3	0.60	1.0	Pass
1000 Hz	0.0	0.0	0.0	0.60	0.7	Pass
4000 Hz	-0.5	-0.4	-0.2	0.60	1.0	Pass
8000 Hz	-1.2	-1.1	-1.1	0.70	+1.5 -2.5	Pass

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FM-706-SLM-01 Rev.04 Issue date 5/9/24

Certificate No : 24-SLM-203
Request No : Req-2024-1369

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 / 30-130						
STD Setting	(dB)	(dB)	(dB)			
63 Hz	-0.3	-0.2	-0.1	0.20	1.0	Pass
125 Hz	-0.2	0.0	0.0		1.0	Pass
250 Hz	-0.1	0.0	0.0		1.0	Pass
500 Hz	-0.1	0.0	0.0		1.0	Pass
1000 Hz	0.0	0.0	0.0		0.7	Pass
2000 Hz	0.0	0.0	0.0		1.0	Pass
4000 Hz	-0.1	0.0	0.0		1.0	Pass
8000 Hz	0.0	0.0	0.0		+1.5, -2.5	Pass
16000 Hz	-1.4	-1.4	0.0		+2.5, -16.0	Pass

6. Frequency and time weightings at 10Hz

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		UUC (dB)	ERR (dB)			
FAST / 30-130	REF					
UUC Weighting	(dB)	(dB)	(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	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		UUC (dB)	ERR (dB)			
30-130 / A	REF					
UUC Time Response	(dB)	(dB)	(dB)			
Fast	114.00	114.0	0.0	0.20	0.10	Pass
Slow	114.00	114.0	0.0		0.10	Pass
Log	114.00	114.0	0.0		0.10	Pass

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เอกสารไม่ควบคุม

FM-706-SLM-01 Rev.04 Issue date 5/9/24

Certificate No : 24-SLM-203
Request No : Req-2024-1369

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / A / 30-130	UUC (dB)			
STD Setting	(dB)			
Initial	114.0			
Final	114.0			
Deviated	0.0	0.10	0.10	Pass

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		UUC (dB)	ERR (dB)			
FAST / A / 30-130	REF					
STD dB	(dB)	(dB)	(dB)			
130.00	130	130.0	0.0	0.30	0.8	Pass
134.00	134	134.0	0.0		0.8	Pass
128.00	128	128.0	-0.1		0.8	Pass
124.00	124	123.9	-0.1		0.8	Pass
119.00	119	119.0	0.0		0.8	Pass
114.00	114	114.0	0.0		0.8	Pass
109.00	109	109.0	0.0		0.8	Pass
104.00	104	104.0	0.0		0.8	Pass
99.00	99	99.0	0.0		0.8	Pass
94.00	94	94.0	0.0		0.8	Pass
89.00	89	89.0	0.0		0.8	Pass
84.00	84	83.9	-0.1		0.8	Pass
79.00	79	78.9	-0.1		0.8	Pass
74.00	74	73.9	-0.1		0.8	Pass
69.00	69	68.9	-0.1		0.8	Pass
64.00	64	63.9	-0.1		0.8	Pass
59.00	59	58.9	-0.1		0.8	Pass
54.00	54	53.9	-0.1		0.8	Pass
49.00	49	48.9	-0.1		0.8	Pass
44.00	44	43.9	-0.1		0.8	Pass
39.00	39	38.9	-0.1		0.8	Pass
34.00	34	33.9	-0.1		0.8	Pass
29.00	29	28.9	-0.1		0.8	Pass
24.00	24	23.9	-0.1		0.8	Pass

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

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FM-706-SLM-01 Rev.04 Issue date 5/9/24



Certificate No.: CP20240342EA
Operation No.: CP2024090314

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: RION
Model/Type: NL-62 (Meter), UC-59L (Microphone), NH-26 (Preamplifier)
Serial No.: 00130357 (Meter), 02373 (Microphone), 00391 (Preamplifier)
ID No.: UAE.EMA2.104/2556
Customer: United Analyst and Engineering Consultant Co.,Ltd.
Address: 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak
Phrakhanong, Bangkok 10260
Received Date: 3 September 2024
Calibrated Date: 23 - 25 September 2024
Issued Date: 26 September 2024
Calibrated by: Ms. Juntaporn Kunhakom

Approved by:
(Mr. Sittichai Swaksuryawong)
Group Manager

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

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

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F-CAL-004 Ed.1



h.v. 67

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Certificate No.: CP20240342EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: RION
Model/Type: NL-62 (Meter), UC-59L (Microphone), NH-26 (Preamplifier)
Serial No.: 00130357 (Meter), 02373 (Microphone), 00391 (Preamplifier)
ID No.: UAE.EMA2.104/2556
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa
Method of Calibration :-
IEC 61672-3:2013.

Condition of this result of calibration

1. Reference standards Instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P240022	20 March 2025
6) Performance Audio Analyzer	U8903B	MY56510003	CB20240035EB	13 February 2025
			CK20240069EA	19 September 2025

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

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

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

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.7

Note : Absolute sensitivity was established by the use of the Sound Calibrator RION Type NC-74 S/N : 34615278.

เอกสารไม่ควบคุม



Certificate No.: CP20240342EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
15.8

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting (dB)	Measured value (dB)
A-weighting	12.4
C-weighting	17.5
Z-weighting	26.8

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

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.2	0.1	0.2	±1.0
1000	0.0	0.0	0.0	±0.7
8000	1.1	1.1	1.0	+1.5; -2.5

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	-0.1	-0.1	0.0	±1.0
125	0.0	-0.1	-0.1	±1.0
250	0.0	-0.1	0.0	±1.0
500	0.0	-0.1	0.0	±1.0
1000	0.0	0.0	0.0	±0.7
2000	0.0	0.0	0.0	±1.0
4000	0.0	0.0	0.1	±1.0
8000	0.1	0.0	0.0	+1.5; -2.5
16000	-1.4	-1.4	0.1	+2.5; -16.0

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Certificate No.: CP20240342EA

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
130.0	130.0	0.0	±0.8
131.0	131.0	0.0	±0.8
132.0	132.0	0.0	±0.8
133.0	133.0	0.0	±0.8
134.0	134.0	0.0	±0.8
135.0	135.0	0.0	±0.8
136.0	136.0	0.0	±0.8
137.0	137.0	0.0	±0.8

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F-CAL-005 Ed.1

Certificate No.: CP20240342EA

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	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
29.0	29.0	0.0	±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	126.0	0.0	±0.5
	2	109.0	0.0	+1.0 ; -1.5
	0.25	99.9	-0.1	+1.0 ; -3.0
Slow	200	119.6	0.0	±0.5
	2	100.0	0.0	+1.0 ; -3.0
	200	120.0	0.0	±0.5
LAE	2	100.0	0.0	+1.0 ; -1.5
	0.25	90.9	-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	125.4	125.4	0.0	±2.0
Positive half cycle	124.4	124.0	-0.4	±1.0
Negative half cycle	124.4	124.0	-0.4	±1.0

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F-CAL-005 Ed.1

Certificate No.: CP20240342EA

Calibration Report

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
139.4	139.5	0.1	±1.5

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	129.0	129.0	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	0.24	0.25
11) High-Level Stability	0.10	0.10

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

-- End of Report --

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F-CAL-005 Ed.1

Certificate of Calibration

Customer

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

Certificate No : 24-NDM-226
Request No : Req-2024-1956

Unit Under Calibration Details

Measurement Item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 1041S
Serial Number : 67627
ID : UAEEFM1062561
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 270S
Microphone S/N : 68647
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 kPa ± 10 hPa
Received Date : 28 August 2024
Calibrated Date : 12 September 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	Brüel&Kjaer	4192	2294985	25 June 2025	NIMT
Audio Generator	Svanick	SVAN 401	131	9 October 2024	WK Electric
Timer	EXTech	-	05-ACT	14 March 2025	TPA

Note

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

Calibrated By : 
Mr. Noppadol Luangart
Service Calibration Engineer

Approved By : 
Mr. Patch Mathayon
Calibration Engineer Supervisor

Issue Date : 12 September 2024

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INA-708-NDM-01 Rev.05 Issue date 2/9/24

Certificate No : 24-NDM-226

Request No : Req-2024-1956

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error	(%)	Limit	
Calibrator Setting	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)		(%)	
1000 Hz 114 dB	120	120	3.17	3.13	-1.3	3.1	-21, +26	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand Svanick, Model SV35A, SN. 58079

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances	Result
FAST / 60-140	A	C	(± dB)	Limit	
STD Setting	(dB)	(dB)		(± dB)	
563 Hz	0.2	0.1	0.40	2.0	Pass
125 Hz	-0.3	-0.4	0.40	1.5	Pass
250 Hz	-0.3	-0.2	0.40	1.5	Pass
500 Hz	-0.1	-0.1	0.40	1.5	Pass
1000 Hz	0.0	0.0	0.40	-	-
2000 Hz	0.2	0.2	0.40	2.0	Pass
4000 Hz	1.0	0.9	0.40	3.0	Pass
8000 Hz	2.1	1.7	0.40	5.0	Pass

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

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INA-708-NDM-01 Rev.05 Issue date 2/9/24

Certificate No : 24-NDM-226

Request No : Req-2024-1956

3. Linearity of response to steady signals

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

UUC Setting	FAST / A / High											
1000 Hz	Ref	(dB)	80.0	90.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0	
	Level A	(dB)	59.4	80.5	90.2	100.0	110.0	114.0	120.0	130.0	140.0	
	Error	(dB)	-0.6	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	
8000 Hz	Ref	(dB)	88.9	88.9	108.9	112.9	118.9	128.9	138.9			
	Level A	(dB)	88.9	88.9	108.9	112.9	118.9	128.9	138.9			
	Error	(dB)	-0.1	0.1	0.0	0.0	0.0	0.0	0.0	-0.1		
63 Hz	Ref	(dB)	87.8	93.8	103.8	113.8						
	Level A	(dB)	87.8	93.8	103.8	113.8						
	Error	(dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Tolerances Limit		(±dB)	1.0									
UNCERTAINTY		(±dB)	0.3									
Result			Pass									

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error	(%)	Limit	
Calibrator Setting	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)		(%)	
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26	Pass
1000 Hz 110 dB	45	45	0.50	0.50	0.00			Pass
1000 Hz 110 dB	90	90	1.00	1.01	+1.00			Pass
1000 Hz 110 dB	180	180	2.00	2.02	+1.00			Pass
1000 Hz 120 dB	36	36	4.00	3.94	-1.50			Pass
1000 Hz 120 dB	72	72	8.00	8.05	+0.63	5.6	-21, +26	Pass
1000 Hz 120 dB	90	90	10.00	9.90	-1.00			Pass
1000 Hz 120 dB	180	180	20.00	19.76	-1.20			Pass
1000 Hz 120 dB	360	360	40.00	39.42	-1.45			Pass
1000 Hz 120 dB	720	720	80.00	78.66	-1.68			Pass

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INA-708-NDM-01 Rev.05 Issue date 2/9/24

Certificate No : 24-NDM-226

Request No : Req-2024-1956

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error	(%)	Limit	
Calibrator Setting	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(Pa ² ·h)		(Pa ² ·h)	
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.052	-0.29 ~ +0.41	Pass

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error	(%)	Limit	
Calibrator Setting	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)		(%)	
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00	5.6	-21 ~ +26	Pass
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00		-29 ~ +41	Pass
Burst 1 ms, 108 dB	143	143	1.00	1.01	+1.00		-29 ~ +41	Pass

5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 60-140	UUC	UUC	Different			Limit	
Calibrator Setting	(s)	(Pa ³ ·h)	(%)	(%)	(%)		
Continuous Rectangle +	29	10.13	0.00	3.7	-21 ~ +26	Pass	
Continuous Rectangle -		10.13				Pass	

* Indicates non accredited

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

เอกสารไม่ควบคุม

INA-708-NDM-01 Rev.05 Issue date 2/9/24

Certificate No : 24-NDM-226
 Request No : Req-2024-1956

Decision Rule for Statements of Conformity

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

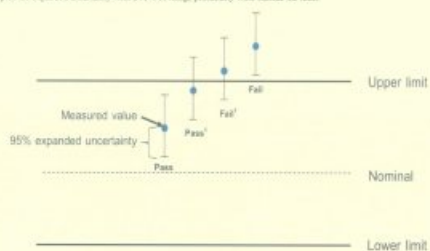
Reporting of Compliance with Specification as Following Fig. and statements

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, Bangkok, Prakanong, Bangkok 10260

Certificate No : 25-NDM-089
Request No : Req-2025-0814

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 117694
ID : UAE.EFM.1172565
Resolution : 0.3 dB
Microphone Class : 2
Microphone Model : SV27
Microphone S/N : 112804
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used


Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 8 April 2025
Calibrated Date : 30 April 2025
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	Briel&Kjaer	4192	2294965	25 June 2025	NIMT
Audio Generator	SvanteK	SVAN 401	131	9 October 2025	WK Electric
Timer	EXTECH	-	05-ACT	11 March 2026	TPA

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

Calibrated By : 
Mr. Noppadol Luangrat
Service Calibration Engineer

Approved By : 
Mr. Paitit Mathavom
Calibration Engineer Supervisor
Issue Date : 30 April 2025

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FSM-708-NDM-01 Rev.06 Issue date 17/02/25

เอกสารไม่ควบคุม

Certificate No : 25-NDM-089
Request No : Req-2025-0814

3. Linearity of response to steady signals

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

UUC Setting		FAST / A / High									
1000 Hz	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
	Level A	(dB)	54.3	80.2	90.2	100.1	110.1	114.0	120.0	130.0	140.0
	Error	(dB)	-0.7	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Level A	(dB)			88.0	98.9	108.9	112.9	118.9	128.9	138.8
	Error	(dB)			0.1	0.0	0.0	0.0	0.0	0.0	-0.1
63 Hz	Ref	(dB)					87.8	93.8	103.8	113.8	
	Level A	(dB)					87.8	93.7	103.7	113.7	
	Error	(dB)						0.0	-0.1	-0.1	-0.1
UNCERTAINTY		(dB)	0.3								

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6
1000 Hz 110 dB	45	45	0.50	0.51	+2.00	
1000 Hz 110 dB	90	90	1.00	1.01	+1.00	
1000 Hz 110 dB	180	180	2.00	2.02	+1.00	
1000 Hz 120 dB	36	36	4.00	4.03	+0.75	
1000 Hz 120 dB	72	72	8.00	8.05	+0.63	5.6
1000 Hz 120 dB	90	90	10.00	9.90	-1.00	
1000 Hz 120 dB	180	180	20.00	19.76	-1.20	
1000 Hz 120 dB	360	360	40.00	40.34	+0.85	
1000 Hz 120 dB	720	720	80.00	80.49	+0.61	

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FSM-708-NDM-01 Rev.06 Issue date 17/02/25

เอกสารไม่ควบคุม

Certificate No : 25-NDM-089
Request No : Req-2025-0814

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)
1000 Hz 114 dB	120	120	3.17	3.13	-1.3	3.1

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SvanteK, Model SV35A, SN. 58079

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY
FAST / 55-140	A	C	
STD Setting	(dB)	(dB)	(± dB)
*63 Hz	-0.1	0.0	0.40
125 Hz	-0.1	0.0	0.40
250 Hz	-0.1	0.0	0.40
500 Hz	0.1	0.2	0.40
1000 Hz	0.0	0.0	0.40
2000 Hz	0.5	0.6	0.40
4000 Hz	1.3	1.3	0.40
8000 Hz	1.6	1.7	0.40

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FSM-708-NDM-01 Rev.06 Issue date 17/02/25

เอกสารไม่ควบคุม

Certificate No : 25-NDM-089
Request No : Req-2025-0814

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(Pa ² h)	(Pa ² h)
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.052

b. Sound exposure meter response for series of toneburst impulses

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

5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement		UNCERTAINTY
FAST / A / 55-140	UUC	UUC	Different	
Calibrator Setting	(s)	(Pa ² h)	(%)	(%)
Continuous Rectangle +	29	10.37	0.00	3.7
Continuous Rectangle -		10.37		

End of Certificate

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FSM-708-NDM-01 Rev.06 Issue date 17/02/25

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

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

Certificate No : 24-NDM-172
Request No : Req-2024-1471

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 143224
ID : UAE.EFM.142-2566
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV27
Microphone S/N : 132054
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 3 July 2024
Calibrated Date : 15 July 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

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

Note

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

Calibrated By :
Mr. Noppadol Lungsri
Service Calibration Engineer

Approved By :
Mr. Puchi Mathavon
Calibration Engineer Supervisor
Issue Date : 15 July 2024

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

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FS4-708-NDM-01 Rev.04 Issue date 5/9/24

Certificate No : 24-NDM-172
Request No : Req-2024-1471

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	(%)	Limit	Result
Calibrator Setting	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(%)			
1000 Hz 114 dB	120	120	3.17	3.13	-1.3	3.1	-21, +26	Pass

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances	Result
FAST / 55-140	A	C	(± dB)	Limit	Result
STD Setting	(dB)	(dB)			
963 Hz	0.1	0.4	0.40	2.0	Pass
125 Hz	0.2	0.4	0.40	1.5	Pass
250 Hz	-0.1	0.0	0.40	1.5	Pass
500 Hz	0.0	0.1	0.40	1.5	Pass
1000 Hz	0.0	0.0	0.40	-	-
2000 Hz	-0.2	-0.1	0.40	2.0	Pass
4000 Hz	2.6	2.6	0.40	3.0	Pass
8000 Hz	1.4	1.7	0.40	5.0	Pass

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

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FS4-708-NDM-01 Rev.04 Issue date 5/9/24

Certificate No : 24-NDM-172
Request No : Req-2024-1471

3. Linearity of response to steady signals

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

UUC Setting	FAST / A / High												
1000 Hz	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0		
	Level A	(dB)	54.9	80.2	90.2	100.1	110.0	114.0	120.0	130.0	140.0		
	Error	(dB)	0.1	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0		
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9		
	Level A	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9		
	Error	(dB)			0.0	0.0	0.0	0.0	0.0	0.0	-0.1		
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8		
	Level A	(dB)						87.8	93.8	103.7	113.7		
	Error	(dB)						0.0	0.0	-0.1	-0.1		
Tolerances Limit		(±dB)	1.0										
UNCERTAINTY		(±dB)	0.3										
Result			Pass										

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	(%)	Limit	Result
Calibrator Setting	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(%)			
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26	Pass
1000 Hz 110 dB	45	45	0.50	0.50	0.00			Pass
1000 Hz 110 dB	90	90	1.00	1.01	+1.00			Pass
1000 Hz 110 dB	180	180	2.00	2.02	+1.00			Pass
1000 Hz 120 dB	36	36	4.00	4.03	+0.75			Pass
1000 Hz 120 dB	72	72	8.00	8.05	+0.63	5.6	-21, +26	Pass
1000 Hz 120 dB	90	90	10.00	9.90	-1.00			Pass
1000 Hz 120 dB	180	180	20.00	19.76	-1.20			Pass
1000 Hz 120 dB	360	360	40.00	40.34	+0.85			Pass
1000 Hz 120 dB	720	720	80.00	80.49	+0.61			Pass

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FS4-708-NDM-01 Rev.04 Issue date 5/9/24

Certificate No : 24-NDM-172
Request No : Req-2024-1471

4. Response to short duration

a. Response for sinusoidal signals - reference level

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

b. Sound exposure meter response for series of toneburst impulses

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

5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 55-140	UUC	UUC	Different	Limit			
Calibrator Setting	(s)	(Pa ² /h)	(%)	(%)	(%)		
Continuous Rectangle +	29	10.37	0.00	3.7	-21 ~ +26	Pass	
Continuous Rectangle -		10.37				Pass	

* Indicates non accredited

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

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FS4-708-NDM-01 Rev.04 Issue date 5/9/24

Certificate No : 24-NDM-172
Request No : Req-2024-1471

Decision Rule for Statements of Conformity

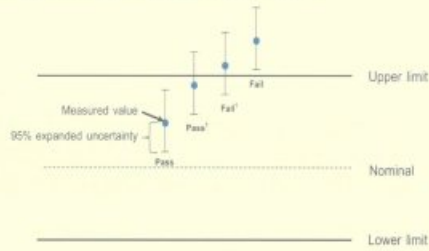
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8-99-2019, Guidelines on the Reporting of Conformity with Specification as following Fig. and statements:

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. : Certificate No : 24-NDM-171
Address : 81 Soi Udomsak 41, Sakhumvit Road, Bangchak, Prakanong, Bangkok 10260 Request No : Req-2024-1470

Unit Under Calibration Details

Measurement item : Noise Dosimeter Microphone Class : 2
Manufacturer : SVANTEK Microphone Model : SV27
Model : SV 104 Microphone S/N : 136150
Serial Number : 143232 Preamplifier Model : -
ID : UAEFEM150/2566 Preamplifier S/N : -
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 kPa ± 10 kPa
Received Date : 3 July 2024
Calibrated Date : 15 July 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

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

Note

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

Calibrated By : 
Mr. Noppadol Lungsri
Service Calibration Engineer

Approved By : 
Mr. Pachi Marthavorn
Calibration Engineer Supervisor

Issue Date : 15 July 2024




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FS4-708-NDM-01 Rev.04 Issue date 5/6/24

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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KAO,
AMPHOE BANG PHU, SAMUT PRAKAN PROVINCE 10140 THAILAND
TEL: 0609-2116-5900-1 FAX: 0609-2116-7140



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Certificate No : 24-NDM-171
Request No : Req-2024-1470

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
	Ref	UUC	Ref	UUC	Error		Limit	
Calibrator Setting	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)	(%)	(%)	
1000 Hz 114 dB	120	120	3.17	3.13	-1.3	3.1	-21, +26	Pass

Note :

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances	Result
	A	C	(± dB)	Limit	
FAST / A / 55-140					
STD Setting	(dB)	(dB)		(± dB)	
963 Hz	0.2	0.5	0.40	2.0	Pass
125 Hz	0.3	0.5	0.40	1.5	Pass
250 Hz	0.1	0.2	0.40	1.5	Pass
500 Hz	0.1	0.2	0.40	1.5	Pass
1000 Hz	0.0	0.0	0.40	-	-
2000 Hz	-0.4	-0.4	0.40	2.0	Pass
4000 Hz	1.8	1.8	0.40	3.0	Pass
8000 Hz	1.2	1.4	0.40	3.0	Pass




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FS4-708-NDM-01 Rev.04 Issue date 5/6/24

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INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
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AC 2001

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Page: 3/5

Certificate No : 24-NDM-171
Request No : Req-2024-1470

3. Linearity of response to steady signals

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

UUC Setting	FAST / A / High											
	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0	
1000 Hz	Level A	(dB)	54.7	80.5	90.2	100.1	110.0	114.0	120.0	130.0	140.0	
	Error	(dB)	0.3	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	
8000 Hz	Level A	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9	
	Error	(dB)			0.0	0.0	0.0	0.0	0.0	0.0	-0.3	
63 Hz	Level A	(dB)						87.8	93.8	103.8	113.8	
	Error	(dB)						0.0	0.0	0.0	0.0	
Tolerances Limit		(±dB)	1.0									
UNCERTAINTY		(±dB)	0.3									
Result			Pass									

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
	Ref	UUC	Ref	UUC	Error	(%)	Limit	
FAST / A / 55-140	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)		(%)	
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26	Pass
1000 Hz 110 dB	45	45	0.50	0.50	0.00			Pass
1000 Hz 110 dB	90	90	1.00	1.01	+1.00			Pass
1000 Hz 110 dB	180	180	2.00	2.02	+1.00			Pass
1000 Hz 120 dB	36	36	4.00	4.03	+0.75			Pass
1000 Hz 120 dB	72	72	8.00	8.05	+0.63	5.6	-21, +26	Pass
1000 Hz 120 dB	90	90	10.00	9.90	-1.00			Pass
1000 Hz 120 dB	180	180	20.00	20.22	+1.10			Pass
1000 Hz 120 dB	360	360	40.00	40.34	+0.85			Pass
1000 Hz 120 dB	720	720	80.00	80.49	+0.61			Pass




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

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FS4-708-NDM-01 Rev.04 Issue date 5/6/24

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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KAO,
AMPHOE BANG PHU, SAMUT PRAKAN PROVINCE 10140 THAILAND
TEL: 0609-2116-5900-1 FAX: 0609-2116-7140



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CALIBRATION LABORATORY
AC 2001

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Certificate No : 24-NDM-171
Request No : Req-2024-1470

4. Response to short duration

a. Response for sinusoidal signals - reference level

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

b. Sound exposure meter response for series of toneburst impulses

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

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
	Ref	UUC	Ref	UUC	Different		Limit	
FAST / A / 55-140	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)	(%)	(%)	
Calibrator Setting								
Continuous Rectangle +	29		10.37		0.00	3.7	-21 - +26	Pass
Continuous Rectangle -			10.37					Pass

* Indicates non accredited

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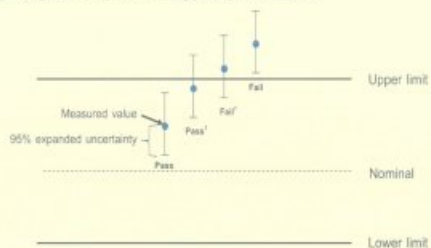
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FS4-708-NDM-01 Rev.04 Issue date 5/6/24

Page: 4/5

Request No : Reg-2024-1470

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 Udornsook 41, Sukhumvit Road, Bangchak, Prakanong,
Bangkok 10260

Certificate No : 24-LXM-199
Request No : Req-2024-1492
Page : 1/3

Unit Under Calibration Details

Instrument Name : Light Meter
Manufacturer : EXTECH
Model : 407026
Serial Number : A062335
Resolution : 1, 10 lx
ID Number : UAEEFM.10K/2566

Range Calibration : 2000, 20000 lx
Accuracy : 4 % of Reading + 2 digits
Instrument Status : Used

Calibration Environment and Details


Temperature : 25 °C ± 2 °C
Humidity : 60 %RH ± 20 %RH
Received Date : 3 July 2024
Calibrated Date : 1 August 2024
Calibration Procedure : The measurement was done in accordance with CP-LXM-01

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

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

Note

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

Approved By : 
Mr. Pachi Mathavorn
Calibration Engineer Supervisor
Issue Date : 1 August 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-LXM-01 Rev.02 Issue date 1/7/24

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Certificate No : 24-LXM-199

Calibration Note
UUC Adjustment : Zero adjustment before use

Request No : Req-2024-1492

Page : 2/3

Result of Calibration :

UUC Range (lx)	Standard (lx)	UUC Reading (lx)	Correction (lx)	Uncertainty (+ lx)	MPE (lx)	Result
2000	* 0	0	0	0.58	2	N/A
	50	50	0	2.5 % of Reading	4	N/A
	100	99	1	2.3 % of Reading	6	N/A
	200	199	1	2.2 % of Reading	10	N/A
	300	302	-2	2.2 % of Reading	14	N/A
	400	403	-3	2.2 % of Reading	18	N/A
	600	604	-4	2.2 % of Reading	26	N/A
	800	803	-3	2.2 % of Reading	34	N/A
	1000	1005	-5	2.2 % of Reading	42	N/A
	1200	1206	-6	2.2 % of Reading	50	N/A
	1400	1409	-9	2.2 % of Reading	58	N/A
	1600	1611	-11	2.2 % of Reading	66	N/A
	1800	1808	-8	2.2 % of Reading	74	N/A
	2000	1990	10	2.2 % of Reading	82	N/A
20000	3000	2970	30	2.2 % of Reading	123	N/A
	4000	3960	40	2.2 % of Reading	160	N/A
	5000	4950	50	2.2 % of Reading	200	N/A

* Indicates non accredited

MPE = Maximum Permissible Error (Specified in Manufacturer's Specification)

N/A = Not Available, Customer does not require a statement of conformity.

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-LXM-01 Rev.02 Issue date 1/7/24

เอกสารไม่ควบคุม

Certificate No : 24-LXM-199
Request No : Req-2024-1492
Page : 3/3

Decision Rule for Statements of Conformity

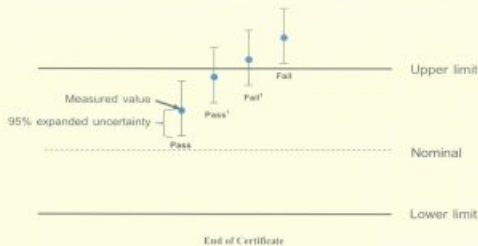
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019:
Guidelines on the Reporting of Compliance with Specification as following Fig. and statements


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.



Calibrated By : 
Mr. Noppakorn Luangart

เอกสารไม่ควบคุม

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-LXM-01 Rev.02 Issue date 1/7/24

รายการสอบเทียบเครื่องมือวิเคราะห์

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Gas Chromatography	METHYL ETHYL KETONE (MEK)	SCION INSTRUMENT, USA	456-GC / GC1802G112	Thai Unique Co., Ltd.	SV0425/23011	26/4/2025	25/4/2026
2	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	ZINC OXIDE	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co., Ltd.	Preventive Maintenance Checklist	4/11/2024	3/11/2025
3	Dionex Aquion RFIC Ion Chromatography	HYDROGEN CHLORIDE OXALIC ACID	Thermo Scientific	Dionex Aquion RFIC / 220380031	ARCHEMICA LAB CO., LTD	ID1047	23/4/2025	22/4/2026
4	Microbalance	RESPIRABLE DUST SODIUM TETRABORATE PENTAHYDRATE TOTAL DUST	Mettler Toledo	XP6 / B322373893	National Food Institute, Ministry of Industry, Thailand	2502228 002 01	20/3/2025	19/3/2026

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

GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0425/23011
Instrument Type : Gas Chromatography
Manufacturer : SCION INSTRUMENT
Model : 456-GC
Serial Number : GC1802G112
Organization : United Analyst and Engineering Consultant Co.,Ltd
Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakhnong, Bangkok 10260
Date : 26/04/2025

ELECTRONIC TEST

CPU	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
LED & DISPLAY TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
VENT TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
KEY ECHO TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
DESTRUCTION RAM TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detectors (Front-FID)
INJECTOR : Split/Split Less Injector (Front-SSL)

GC CONDITION:

Column	80 °C hold 1 min., rate 20 °C/min. to 200 °C hold 1min.
Injector	220 °C
Detector	300 °C
Column flow	5 mL/min
Makeup flow	25 mL/min
Air flow	300 mL/min
Hydrogen flow	30 mL/min

Column: Capillary Column CP sil 5 CB 0.25 ID x 15 M

Sample: 1 µL Injection FID Test Sample 0.218 g/L C14,C15,C16 in hexane Dilute to 30ppm

SENSITIVITY TEST: C15. (Area count $\geq 1,667 \mu V \cdot \text{Min}$) = 14,380.3 $\mu V \cdot \text{Min}$.



VARIAN

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SERVICE DEPARTMENT

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Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (µV)	34.0	≤ 50
Baseline Drift (%)	0.14	≤ 1
Sensitivity (S/N for C15)	23,826	≥ 1,024

Temperature Specification

Temperature	Set	Result	Specification
Column Oven (°C)	80	78.0	± 5
Injector (°C)	220	220	± 5
Detector (°C)	300	299	± 5
Incubator (°C)	60	N/A	± 5

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	0.55	≤ 5
Retention Time C15 (%)	0	≤ 0.5

APPROVAL :

Signature:

Engineer : Somchai Pohtongkam

Date : 26/04/2025



VARIAN

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SERVICE DEPARTMENT

เอกสารไม่ควบคุม

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	SSL Injector
C15 Area 1	14,432.6
C15 Area 2	14,355.2
C15 Area 3	14,296.1
C15 Area 4	14,490.1
C15 Area 5	14,327.5
C15 Area Average	14,380.3
* % RSD (≤ 2 %)	0.55

* The precision specification should be less than 2.0 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 5 % for Manual injections. To calculate the %RSD, select the C15 peak area for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = (\text{std.dev} / \text{avg}) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by		
Date	26/04/2025	



Comments		
Reviewed by		Date 26/04/2025



VARIAN

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Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	SSL Injector
C15 RT 1	3.90
C15 RT 2	3.90
C15 RT 3	3.90
C15 RT 4	3.90
C15 RT 5	3.90
C15 RT Average	3.90
* % RSD (≤ 0.5 %)	0

* The precision specification should be less than 0.5 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 0.5 % for Manual injections. To calculate the %RSD, select the RT C15 peak for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = (\text{std.dev} / \text{avg}) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by		
Date	26/04/2025	



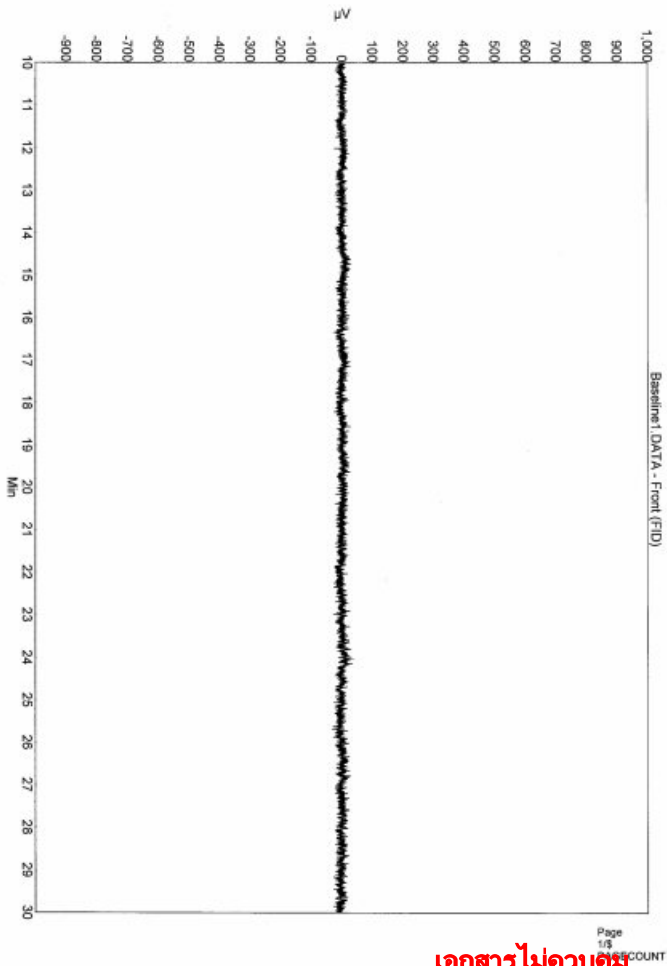
Comments		
Reviewed by		Date 26/04/2025



VARIAN

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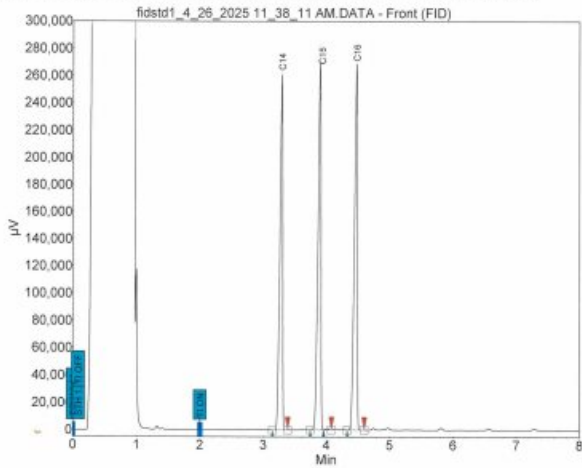
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ANALYSIS / TEST REPORT

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

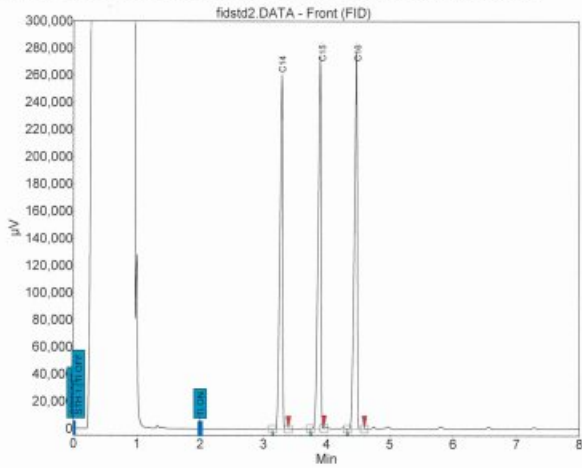


Index	Name	Time (Min)	Quantity (ng/μL)	Height (μV)	Area % (%)	Area (μV Min)	Area (μV Sec)	Width 50% (Min)
1	C14	3.28	30.08	281050.9	31.334	13207.7	752462.3	0.05
2	C15	3.90	30.11	270040.3	34.280	14432.6	865958.5	0.05
4	C16	4.47	30.08	268890.6	34.293	14454.9	867295.1	0.05
Total			90.28	809866.1	100.000	42151.4	2529083.7	

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ANALYSIS / TEST REPORT

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

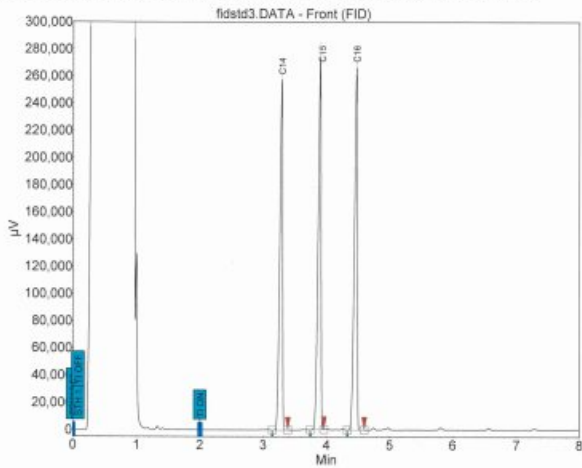


Index	Name	Time (Min)	Quantity (ng/μL)	Height (μV)	Area % (%)	Area (μV Min)	Area (μV Sec)	Width 50% (Min)
1	C14	3.28	29.97	280320.8	31.386	13155.5	789331.9	0.05
2	C15	3.90	29.95	273845.9	34.248	14355.2	861309.7	0.05
3	C16	4.47	29.98	276898.6	34.365	14404.1	864243.3	0.05
Total			89.90	811115.0	100.000	41914.7	2514885.0	

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ANALYSIS / TEST REPORT

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED



Index	Name	Time (Min)	Quantity (ng/μL)	Height (μV)	Area % (%)	Area (μV Min)	Area (μV Sec)	Width 50% (Min)
1	C14	3.28	29.86	257876.7	31.400	13106.6	786393.4	0.05
2	C15	3.90	29.82	273243.5	34.250	14296.1	857767.2	0.05
3	C16	4.47	29.85	266672.1	34.349	14337.3	860240.2	0.05
Total			89.53	797792.3	100.000	41740.0	2504400.7	

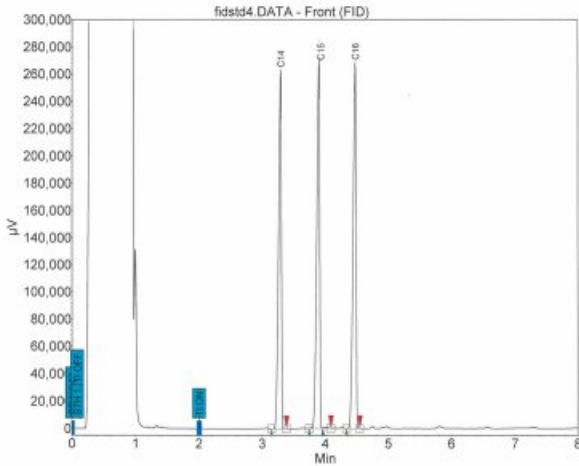
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ANALYSIS / TEST REPORT

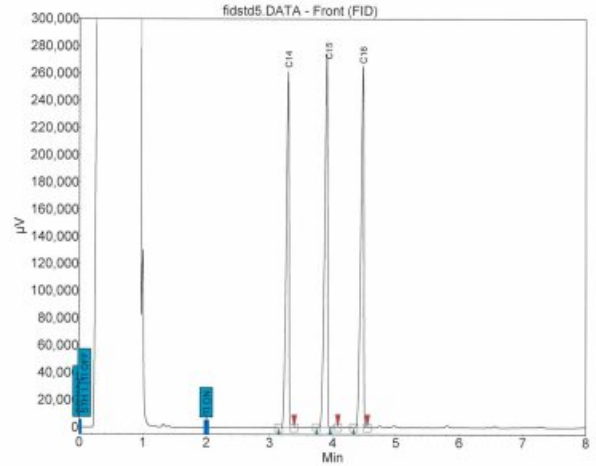
ANALYSIS / TEST REPORT

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED



Index	Name	Time (Min)	Quantity (ng/μL)	Height (μV)	Area % (%)	Area (μV Min)	Area (μV Sec)	Width 50% (Min)
1	C14	3.29	30.23	263354.6	31.347	13268.2	795090.9	0.05
2	C15	3.90	30.23	271861.3	34.234	14490.1	869404.6	0.05
4	C16	4.47	30.21	268560.8	34.288	14513.0	870781.9	0.05
Total			90.67	804857.1	100.000	42326.3	2539580.9	



Index	Name	Time (Min)	Quantity (ng/μL)	Height (μV)	Area % (%)	Area (μV Min)	Area (μV Sec)	Width 50% (Min)
1	C14	3.29	29.86	261391.7	31.330	13107.3	795435.0	0.05
2	C15	3.90	29.89	274115.6	34.246	14327.5	852648.1	0.05
4	C16	4.47	29.87	265568.4	34.294	14347.5	860849.8	0.05
Total			89.62	801922.2	100.000	41836.3	2510190.7	

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Agilent Technologies

Certificate of Analysis

FID-TCD Performance Evaluation Sample Kit

Agilent Part Number: 5080-8842, 18710-60170

Sample Lot Number: 0006750304

This analytical reference material was manufactured and verified in accordance with an ISO 9001 registered quality system, and the analyte concentrations were verified by an ISO 17025 accredited laboratory. The certified value for each analyte was determined gravimetrically.

Concentrations:		
n-tetradecane	0.218 g/L (± 0.5%)	0.033 w/w %
n-pentadecane	0.218 g/L (± 0.5%)	0.033 w/w %
n-hexadecane	0.218 g/L (± 0.5%)	0.033 w/w %

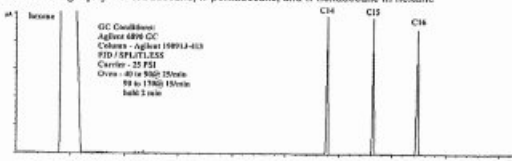
Solvent: hexane

Calibrated Class A glassware and clean bottles were used in the manufacture of this standard. Balances used in the manufacture of this standard are calibrated with weights traceable to NIST in compliance with ANSI/NCSL Z-540-1 and ISO 9001.

Purities:	
n-tetradecane	99.6%
n-pentadecane	99%
n-hexadecane	99.5%
hexane	99%

Typical Analytical Spectrum or Chromatography

GC Chromatography - n-tetradecane, n-pentadecane, and n-hexadecane in hexane



Date of release: 30 June 2023
Date of expiration: 31 July 2025

Monica Bourgeois
Monica Bourgeois
QMS Representative

เอกสารไม่ควบคุม



68/242 Moo 5, Sawalpracharaj Rd., Tumbol Ladsawai, Amphur Lamlukka, Pathumthani 12150
Tel: +66 2993 4773, +66 2153 7132-3 Fax: +66 2994 5509 E-mail: wk.calibrations@gmail.com www.wk-etc.com



Certificate of Calibration

Certificate No.: WK2412-053-1

Page 1 of 2

Customer : THAI UNIQUE CO., LTD.
80-82 Prachathipatani Rd., Bangkokphrom,
Pranakorn, Bangkok 10200

Instrument	: AMD Flow Meter	Ambient Temperature	: (23 ± 2) °C
Manufacturer	: Agilent Technologies	Humidity	: (50 ± 10) %RH
Model	: G6691A	Received Date	: 4-Dec-24
Serial No.	: MY16470347	Calibrated Date	: 11-Dec-24
Identity No.	: SV-DP-001	Issued Date	: 13-Dec-24
Range	: 0 ml/min to 750 ml/min	Calibrated Location	: In Lab
Resolution	: See to Data		
Calibration Method	: CP-WK-M10		

Reference standard instruments:

Instrument	Serial No.	Certificate No.	Due Date	Traceability to
Flow Calibrator	140215-134	L202304114-001	18-Apr-25	MIT
Primary Flow Calibrator	1107-S	WK2405-049-5	22-May-25	WK Electric Co., Ltd.

MIT: Miracle International Technology Co., Ltd.

This result calibrate was found accurate as shown on date place of calibrate only
This certificate is traceability to the International System of Unit (SI)

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

Calibrated by: Mr.Thippatani Mungpungklang

Approved by:

Ms. Budaagorn Patcha
Ms. Budaagorn Patcha
Authorized Signatory

This certificate may not be reproduced except in full unless permission for the reproduction has been obtained in writing from the laboratory.

เอกสารไม่ควบคุม



Measuretronix Limited
2425/2 Lat Phrao Road, Saphan Song
Wangthonglang, Bangkok 10310, Thailand
Phone : 0-2514-1000, 0-2514-1234
Fax : 0-2514-0001, 0-2514-0003
Website : www.measuretronix.com



Certificate of Calibration

Certificate Number : LF24-0278
Equipment : Thermometer
Manufacturer : Fluke
Model : 51
Serial Number : 5910857
Asset Number : 5910857
Customer : Thai Unique Co., Ltd.
80-82 Prachathipatai Road,
Bangkhunphrom, Pranakorn,
Bangkok 10200
Date of Calibrate : 26-Jun-2024
Date of Issue : 27-Jun-2024

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

This calibration certificate applies only to the item identified and shall not be reproduced other than in full, without specific written approval by Measuretronix Cal-Lab. Calibration certificates without signature are not valid.

The measurements marked with an asterisk () in this certificate are outside our range of accreditation. They have been included for completeness.*

The Calibration Interval (Cal.Due) is the responsibility of the end user.

Calibrated by

Nanthiya Ngampring
Mrs. Nanthiya Ngampring
Metrology Technician

Approved by

Arunc Bamrungham
Mrs. Arunc Bamrungham
Cal-Lab Manager

Certificate No. : LF24-0278

Model : 51

Serial No. : 5910857

Page 1 of 3

Form 421 Rev.07 Date : 05-Jun-2024

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CERTIFICATE

This is to certify, that

Somchai Pohthongkham

has participated the course

Basic GC and Sampler training

Date: **24 – 27 May 2004**

Location: **Middelburg**

Instructor: **W.J. Buys**

Signature instructor: *W.J. Buys*



Varian Analytical Instruments
Varian Chrompack International BV
Herselweg 9
P.O. Box 8013
4330 EA Middelburg
The Netherlands
Tel.: +31 118 671000
Fax: +31 118 633118
www.varianinc.com

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Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES Preventive Maintenance



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

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

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

Introduction

Customer Information

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

Important Customer Web Links

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

Service Engineer's Responsibilities

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

Instrument Maintenance

System Information

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

Instrument System Name and ID	5110 VDV ICP-OES
Instrument System Site and Location	United Analyst and Engineering Consultant

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 5058	117 14030001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

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

Preparation

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

Preventive Maintenance Procedures

Record Pre-PM instrument performance

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

Clean and inspect ICP-OES system

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

Agilent Water Recirculator

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

SPS 3 Auto Sampler

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

SPS 4 Auto sampler

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

AVS 4, 6, 7 Advanced Valve System

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

ICP-OES adjustment

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

Record Post-PM instrument performance

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

- ☒ Record the result in the Instrument Test Results Table

Restore Instrument

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

Service Review

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

Test Results

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	1500.9	2219.4	4124.9	6965.9
Mn 257.610 nm SRBR	3915.0	7492.2	13017.9	31121.6
Al 396.152 nm SBR	9.9	10.7	9.9	21.1
K 766.491 nm SBR	5.7	28.1	4.9	45.3

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

Instrument Test Results Table

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

Instrument Test	Result
Subsystem Communications Test	P ₂₅₅
Air Flow	P ₁₉₅₅
Water Flow	P ₁₈₅₅
Gas Flows	P ₂₅₅
RF Generator	P ₂₅₅
Camera Test	P ₂₅₅
Optics Test	P ₁₈₅₅
Nebulizer test	P ₁₈₅₅

ICP-OES Status Results Table

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

Measurement	Standby Mode	Plasma On
Mains Voltage	231.411 VAC	226.971 VAC
Mains Current	0.061 A	0.105 A
Instrument Temperature	22.1 °C	23.5 °C
RF Air Flow (sensor speed)	14.0 Hz	19.0 Hz
Plasma Exhaust Temperature	No measurement	63.9 °C
Water Flow Oscillator	No measurement	1.34 L/min
Water Flow Detector	0.86 L/min	0.81 L/min
Water Inlet Temperature	19.7 °C	19.9 °C
Polychromator Temperature	35.0 °C	35.0 °C
CCD Temperature	-40.1 °C	-39.8 °C
Thermal Stabilizer	35.0 °C	35.0 °C
Argon Supply Pressure	649.92 kPa	391.35 kPa
Purge Gas Supply Pressure*1	646.66 kPa	612.41 kPa
Option Gas Supply Pressure*1	— kPa	— kPa
Nebulizer Flow	No measurement	0.90 L/min
Nebulizer Back Pressure	No measurement	158.43 kPa
Plasma Gas Flow	No measurement	11.91 L/min
Auxiliary Gas Flow	No measurement	1.00 L/min
RF Power	No measurement	1204.7 W
RF Supply Current	No measurement	7.858 A
RF Supply Voltage	No measurement	204.417 V

*1 If option installed

Consumed PM Parts

Part Description	Part Number	Product or Model# where used	Quantity consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Agilent Cool Clear Coolant Fluid	5799-0037	Agilent Water Recirculator	-
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	-
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	-
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	-
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	-
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	-
PVC waste tubing 8mm od x 5mm id, 2m	G8410-80122	SPS 4	-
Additional Parts may be required from engineer's stock:			
X axis drive belt	5410047500	SPS 3	-
Z axis drive belt	5410047400	SPS 3	-
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	-

Consumed Parts Reference
(Purchased by customer, not included as part of PM)☒ Section Not Applicable.

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

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Signature Page

Service Engineer Comments (optional)

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

Service Verification

Service Request Number:

6007197100

Service Engineer Name:

Kanyakorn S.

Service Engineer Signature:

Kanyakorn S.

Total number of pages in this document:

14

Date Service Completed:

04 Nov 2024

Customer Name:

Aphorn Onkong

Customer Signature:

Aphorn Onkong

Revision: A.02, Issued: 21 January 2022
Document Number: G8014-90075
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เอกสารไม่ควบคุม

Report Summary

Instrument Model: Agilent 5100/5110 VDV ICP-OES
Instrument ID: G8011A/G8015A
Instrument Serial Number: MY18030001
Software Version: 7.3.1.9507
Firmware Version: 3442
Tested By: Pre Test_PM_Kanyakorn S.
Test Completed On: 11/4/2024 9:19:10 AM

Result Summary

Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Fail
Precision Test	Pass

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เอกสารไม่ควบคุม

Resolution Test

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.98
As (188.980 nm)	≤ 8.20	6.17
C (193.027 nm)	≤ 11.50	8.30
Mo (202.032 nm)	≤ 8.20	6.38
Cr (206.158 nm)	≤ 13.40	8.98
Zn (213.857 nm)	≤ 8.70	6.80
Pb (220.353 nm)	≤ 9.50	7.09
Co (228.615 nm)	≤ 17.20	11.67
Ba (230.424 nm)	≤ 9.40	7.20
Mn (257.610 nm)	≤ 13.30	9.43
Mn (260.568 nm)	≤ 20.30	14.11
Cr (267.716 nm)	≤ 11.00	8.04
Cu (324.754 nm)	≤ 25.00	18.97
Cu (327.395 nm)	≤ 14.20	11.23
Sr (338.071 nm)	≤ 33.50	24.30
Ba (455.403 nm)	≤ 44.00	33.47
Sr (460.733 nm)	≤ 36.00	17.23
Ba (483.408 nm)	≤ 36.00	25.37
Ba (614.171 nm)	≤ 42.00	25.54
Ar (675.283 nm)	≤ 74.00	56.51
K (766.491 nm)	≤ 80.00	65.86

Pass

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เอกสารไม่ควบคุม

Sensitivity Test					
Fail					
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	104.1	793.0	50.8
Se (196.026 nm)	≥ 41.0	SRBR	87.6	862.0	79.7
Zn (213.857 nm)	≥ 1421.0	SRBR	1500.8	41823.3	749.0
Pb (220.353 nm)	≥ 46.0	SRBR	170.7	2432.0	174.9
Mn (257.610 nm)	≥ 3518.0	SRBR	3915.0	264700.2	4420.0
Al (396.152 nm)	≥ 3.4	SBR	7.7	48454.6	5563.2
Ba (493.408 nm)	≥ 34.0	SBR	45.9	1966719.7	41903.8
K (766.491 nm)	≥ 1.8	SBR	5.7	99038.2	14687.7
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	126.5	1498.8	119.0
Se (196.026 nm)	≥ 159.0	SRBR	112.0	1773.6	197.8
Zn (206.200 nm)	≥ 234.0	SRBR	466.0	6784.2	199.7
Zn (213.857 nm)	≥ 1743.0	SRBR	2217.4	95597.6	1789.7
Cd (214.439 nm)	≥ 4227.0	SRBR	1919.3	68724.6	1236.4
Pb (220.353 nm)	≥ 320.0	SRBR	332.6	7929.5	499.0
Mn (257.610 nm)	≥ 10625.0	SRBR	7492.2	991238.3	18911.7
Cr (267.716 nm)	≥ 1048.0	SRBR	2254.6	129706.6	3150.9
Cu (324.754 nm)	≥ 19.0	SBR	26.9	290746.3	10407.5
Al (396.152 nm)	≥ 6.0	SBR	10.7	211329.2	18005.0
Ba (493.408 nm)	≥ 60.0	SBR	49.3	6956480.4	138336.9
K (766.491 nm)	≥ 24.0	SBR	28.1	1395190.2	47996.2

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เอกสารไม่ควบคุม

Precision Test			
Pass			
Radial			
Element Wavelength	Specification	Measured Value	% RSD
As (188.980 nm)	≤ 2.60	0.73	
Se (196.026 nm)	≤ 2.60	0.95	
Zn (213.857 nm)	≤ 1.50	0.31	
Pb (220.353 nm)	≤ 2.60	0.73	
Mn (257.610 nm)	≤ 1.50	0.39	
Al (396.152 nm)	≤ 1.50	0.39	
Ba (493.408 nm)	≤ 1.50	0.87	
K (766.491 nm)	≤ 1.50	0.32	
Axial			
Element Wavelength	Specification	Measured Value	% RSD
As (188.980 nm)	≤ 1.50	1.21	
Se (196.026 nm)	≤ 1.50	0.84	
Zn (206.200 nm)	≤ 1.50	0.56	
Zn (213.857 nm)	≤ 1.50	0.96	
Cd (214.439 nm)	≤ 1.50	0.26	
Pb (220.353 nm)	≤ 1.50	0.51	
Mn (257.610 nm)	≤ 1.50	0.97	
Cr (267.716 nm)	≤ 1.50	0.22	
Cu (324.754 nm)	≤ 1.50	0.24	
Al (396.152 nm)	≤ 1.50	0.33	
Ba (493.408 nm)	≤ 1.50	0.40	
K (766.491 nm)	≤ 1.50	0.65	

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เอกสารไม่ควบคุม

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Printer	3442
Tested By	Post Test_PM_Kanyakorn S.
Test Completed On	11/4/2024 11:07:24 AM
Result Summary	
Subsystem Communications Test	Pass
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Pass
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Fail
Precision Test	Pass
Subsystem Communications Test	Pass
Optics Test	Pass
Intensity	3184054
Wavelength	737.212

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เอกสารไม่ควบคุม

Resolution Test		
Pass		
Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.97
As (188.980 nm)	≤ 8.20	6.14
C (193.027 nm)	≤ 11.50	8.33
Mo (202.032 nm)	≤ 8.20	6.33
Cr (206.133 nm)	≤ 13.40	9.06
Zn (213.857 nm)	≤ 8.70	6.70
Pb (220.353 nm)	≤ 9.50	7.03
Co (228.615 nm)	≤ 17.20	11.72
Ba (230.424 nm)	≤ 9.40	7.32
Mn (257.610 nm)	≤ 13.30	9.44
Mn (260.568 nm)	≤ 20.30	14.21
Cr (267.716 nm)	≤ 11.00	7.94
Cu (324.754 nm)	≤ 25.00	18.99
Cu (327.395 nm)	≤ 14.20	11.27
Sr (338.071 nm)	≤ 33.50	24.40
Ba (455.403 nm)	≤ 44.00	33.50
Sr (460.733 nm)	≤ 36.00	17.31
Ba (493.408 nm)	≤ 36.00	26.44
Ba (614.171 nm)	≤ 42.00	25.16
Ar (675.283 nm)	≤ 74.00	56.15
K (766.491 nm)	≤ 80.00	65.56

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Sensitivity Test					
Fail					
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	130.6	977.1	50.4
Se (196.026 nm)	≥ 41.0	SRBR	106.0	958.7	70.2
Zn (213.857 nm)	≥ 1421.0	SRBR	4124.8	44037.7	113.4
Pb (220.353 nm)	≥ 46.0	SRBR	207.2	2554.7	136.2
Mn (257.610 nm)	≥ 3518.0	SRBR	13017.8	271846.6	434.7
Al (396.152 nm)	≥ 3.4	SBR	9.7	50615.5	4717.0
Ba (493.408 nm)	≥ 34.0	SBR	133.7	2069203.0	15359.3
K (766.491 nm)	≥ 1.8	SBR	4.8	100199.5	17235.5
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	174.9	1566.7	73.0
Se (196.026 nm)	≥ 159.0	SRBR	167.0	1863.4	110.2
Zn (208.200 nm)	≥ 234.0	SRBR	740.9	6836.0	83.1
Zn (213.857 nm)	≥ 1743.0	SRBR	6965.9	101568.1	211.7
Cd (214.439 nm)	≥ 4227.0	SRBR	5781.0	72852.9	158.1
Pb (220.353 nm)	≥ 320.0	SRBR	501.0	8464.3	267.7
Mn (257.610 nm)	≥ 10625.0	SRBR	31121.6	1006637.8	1044.0
Cr (267.716 nm)	≥ 1048.0	SRBR	4424.8	132202.9	880.8
Cu (324.754 nm)	≥ 19.0	SBR	68.7	302907.8	4345.6
Al (396.152 nm)	≥ 6.0	SBR	21.1	218771.0	9892.3
Ba (493.408 nm)	≥ 60.0	SBR	250.6	7137380.9	28367.3
K (766.491 nm)	≥ 24.0	SBR	45.3	1435050.6	31025.0

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เอกสารไม่ควบคุม

Precision Test		
Pass		
Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.81
Se (196.026 nm)	≤ 2.60	0.98
Zn (213.857 nm)	≤ 1.50	0.22
Pb (220.353 nm)	≤ 2.60	0.37
Mn (257.610 nm)	≤ 1.50	0.27
Al (396.152 nm)	≤ 1.50	0.25
Ba (493.408 nm)	≤ 1.50	0.53
K (766.491 nm)	≤ 1.50	0.15
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.81
Se (196.026 nm)	≤ 1.50	0.65
Zn (208.200 nm)	≤ 1.50	0.79
Zn (213.857 nm)	≤ 1.50	0.81
Cd (214.439 nm)	≤ 1.50	0.36
Pb (220.353 nm)	≤ 1.50	0.33
Mn (257.610 nm)	≤ 1.50	1.02
Cr (267.716 nm)	≤ 1.50	0.32
Cu (324.754 nm)	≤ 1.50	0.51
Al (396.152 nm)	≤ 1.50	0.37
Ba (493.408 nm)	≤ 1.50	0.68
K (766.491 nm)	≤ 1.50	0.74

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เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	Post Test_PM_Kanyakorn S.	
Test Completed On	11/4/2024 11:30:15 AM	
Result Summary		
Subsystem Communications Test		Pass
Air Flow Test		Pass
Water Flow Test		Pass
Gas Flows Test		Pass
RF Generator Test		Pass
Camera Test		Pass
Optics Test		Skipped
Advanced Valve System Test		Skipped
Resolution Test		Skipped
Sensitivity Test		Skipped
Precision Test		Skipped
Subsystem Communications Test		Pass
Air Flow Test		Pass
30% Air Flow (relative speed)	75% Air Flow (relative speed)	
15.00	19.00	
Water Flow Test		Pass
RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.30	0.81	20.55

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เอกสารไม่ควบคุม

Gas Flows Test			Pass		
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	154.65	2.00	2.00	110.92
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	115.38	18.00	17.97	21.48
RF Generator Test			Pass		
RF Power Supply Test	Passed				
RF Power Supply (V)	128.554				
RF Oscillator Test	Passed				
RF Oscillator Frequency (MHz)	25.834				
Work Coil Current (A)	44.660				
RF Power Supply Current (A)	1.999				
Camera Test			Pass		
	Integration Time (ms)	Standard Deviation	Status		
Electronic Offset Test	1000	5.228	Passed		
Dark Current Test	6000	1.168	Passed		
Array Test	5	0.024	Passed		
Linearity Test		0.118	Passed		

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เอกสารไม่ควบคุม

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	change mirror
Test Completed On	11/6/2024 10:35:26 AM
Result Summary	
Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass

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เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	6.79	
As (188.980 nm)	≤ 8.20	5.80	
C (193.027 nm)	≤ 11.50	8.15	
Mo (202.032 nm)	≤ 8.20	5.90	
Cr (206.158 nm)	≤ 13.40	8.85	
Zn (213.857 nm)	≤ 8.70	6.77	
Pb (220.353 nm)	≤ 9.50	6.61	
Co (228.615 nm)	≤ 17.20	11.79	
Ba (230.424 nm)	≤ 9.40	7.25	
Mn (257.610 nm)	≤ 13.30	9.47	
Mn (260.568 nm)	≤ 20.30	14.50	
Cr (267.716 nm)	≤ 11.00	7.91	
Cu (324.754 nm)	≤ 25.00	18.72	
Cu (327.395 nm)	≤ 14.20	11.09	
Sr (338.071 nm)	≤ 33.50	25.39	
Ba (455.403 nm)	≤ 44.00	33.09	
Sr (460.793 nm)	≤ 36.00	18.54	
Ba (493.408 nm)	≤ 36.00	25.74	
Ba (514.171 nm)	≤ 42.00	25.23	
Ar (675.283 nm)	≤ 74.00	58.92	
K (766.491 nm)	≤ 80.00	63.16	

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Sensitivity Test						Pass
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	110.5	868.9	54.3	
Se (196.026 nm)	≥ 41.0	SRBR	88.3	934.7	91.3	
Zn (213.857 nm)	≥ 1421.0	SRBR	3535.4	44017.7	153.9	
Pb (220.353 nm)	≥ 46.0	SRBR	184.5	2492.3	159.8	
Mn (257.610 nm)	≥ 3518.0	SRBR	11099.6	249595.3	503.6	
Al (396.152 nm)	≥ 3.4	SBR	8.7	50274.4	5172.0	
Ba (493.408 nm)	≥ 34.0	SBR	124.5	1903164.1	15166.0	
K (766.491 nm)	≥ 1.8	SBR	6.9	110041.4	13991.2	
Axial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 208.0	SRBR	253.3	3744.3	196.3	
Se (196.026 nm)	≥ 159.0	SRBR	206.7	4199.7	347.2	
Zn (206.200 nm)	≥ 234.0	SRBR	923.0	12282.3	172.1	
Zn (213.857 nm)	≥ 1743.0	SRBR	6396.3	157551.5	601.7	
Cd (214.439 nm)	≥ 4227.0	SRBR	5069.2	99873.7	385.2	
Pb (220.353 nm)	≥ 320.0	SRBR	389.0	10641.1	658.6	
Mn (257.610 nm)	≥ 10625.0	SRBR	21190.4	985528.7	2153.6	
Cr (267.716 nm)	≥ 1048.0	SRBR	3054.1	131797.6	1811.5	
Cu (324.754 nm)	≥ 19.0	SBR	36.3	301401.4	8082.9	
Al (396.152 nm)	≥ 6.0	SBR	10.8	228359.5	19280.5	
Ba (493.408 nm)	≥ 60.0	SBR	106.5	6460421.5	60122.8	
K (766.491 nm)	≥ 24.0	SBR	30.2	1639840.6	52562.1	

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เอกสารไม่ควบคุม

Precision Test				Pass
Radial				
Element Wavelength	Specification	Measured Value % RSD		
As (188.980 nm)	≤ 2.60	1.56		
Se (196.026 nm)	≤ 2.60	1.16		
Zn (213.857 nm)	≤ 1.50	0.50		
Pb (220.353 nm)	≤ 2.60	0.74		
Mn (257.610 nm)	≤ 1.50	0.63		
Al (396.152 nm)	≤ 1.50	0.54		
Ba (493.408 nm)	≤ 1.50	0.78		
K (766.491 nm)	≤ 1.50	0.44		
Axial				
Element Wavelength	Specification	Measured Value % RSD		
As (188.980 nm)	≤ 1.50	0.82		
Se (196.026 nm)	≤ 1.50	0.82		
Zn (206.200 nm)	≤ 1.50	0.35		
Zn (213.857 nm)	≤ 1.50	0.34		
Cd (214.439 nm)	≤ 1.50	0.44		
Pb (220.353 nm)	≤ 1.50	0.48		
Mn (257.610 nm)	≤ 1.50	0.83		
Cr (267.716 nm)	≤ 1.50	0.53		
Cu (324.754 nm)	≤ 1.50	0.69		
Al (396.152 nm)	≤ 1.50	0.56		
Ba (493.408 nm)	≤ 1.50	1.29		
K (766.491 nm)	≤ 1.50	0.74		

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Certificate of Calibration

Aquion: (Anion System ID#1047)

This certificate is to verify that instrument below are calibrated

By Archemica Lab Co., Ltd.

Aquion S/N: 220380031

AS-DV S/N: 2203880133

For

UAE Consultant Co., Ltd.



Operator Signature: Saharat Popayom Date: Apr 23-24, 2025

(Mr.Saharat Popayom)

Test Engineer

เอกสารไม่ควบคุม

Qualification Report

PM Checklist: CM_OQ and PQ
Aquion: Anion (ID#1047)

For
UAE Consultant Co., Ltd.
(1st Contract)

เอกสารไม่ควบคุม

PM

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.	K.Suwanna
Engineer	Date
Mr.Saharat Popayom	23-24/Apr/2025

Instrument Detail

Instrument Model	Application
Aquion (ID#1047, 1st Contract)	Anion
Instrument components	Serial Number
Aquion	220380031
AS-DV Autosampler	2203880133

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
AS18	AG18	ADRS600	-	EGC III KOH
				CR-ATC
Remark: -				



Perform By Archemica

Saharat
Archemica
Date 24/Apr/2025

Simon
Customer
Date 24/Apr/2025

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



General ICS Maintenance Checklist

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

เอกสารไม่ควบคุม



AS-DV Autosampler Preventive Maintenance Checklist

Model	Serial Number	Firmware Version
<input checked="" type="checkbox"/> AS-DV	2203880133	-

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

Others / comments:

เอกสารไม่ควบคุม

CM OQ

Chromeleon
Operation QualificationThermoFisher
SCIENTIFIC

Chromeleon Operational Qualification

General Information

Instrument Controller: DESKTOP-C4FS3L7
Client: DESKTOP-C4FS3L7
Operator: Saharat Popayorn

Computer Name: Version Number:
DESKTOP-C4FS3L7 7.3.1 Build 6535
DESKTOP-C4FS3L7 7.3.1.6535

Overall Test Result: Passed

Comparison Format:

All Parameters:	Significant Digits:	10
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Signature 24/4/2025
Reviewer's Signature // Date

Signature 24 Apr 2025
Operator's Signature // Date

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



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 Coeff.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Variance	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Std. Deviation	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Rel. Std. Dev.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Variance Coeff.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 1

Verification of Selected Results

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

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 1

Verification of Selected Results

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

Test Result: Passed

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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

Variable Category	Report Variable	Peak Name	Status
Injection	No.		ok
	Name		ok
	Type		ok
	Position		ok
	Status		ok
	Volume		ok
	Dilution Factor		ok
	Weight		ok
	IntStd		ok
	InstrumentMethod		ok
Chromatogram	ProcessingMethod		ok
	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		ok

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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

Test Result: Passed

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เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 3

System Suitability Test: Comparison with Expected Results

Variable Category	Report Variable	Status
System Suitability 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

Test Result: Passed

PQ

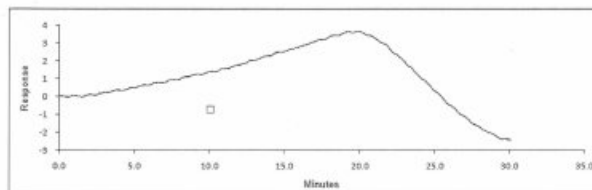
Performance Qualification

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IC Pump Flow Rate

Set Point (mL) (mL/min)	Reading (mL/min)	Deviation (%)	OQ Limit (%)	Result
0.5	0.4964	0.720	± 2.0	PASS
1.0	0.9958	0.42	± 2.0	PASS



Information

System Name	AquionRFIC
Detector SN	220360045
Data Path	chrom://desktop-c4fs3f7/ChromleonLocal/Archemica/Service Contract/2025/1st Con 23-Apr-2025/AquionRFIC %231047/IC OQ seq/884 smp/ECD_1.channel/ECD_1.chm

Noise and Drift

Test	Measured (nS)	OQ Limit (nS)	Result	Conversion Factor
Noise	0.2 nS	≤ 2.0 nS	PASS	1000
Drift	12.9 nS/hr	≤ 20.0 nS/hr	PASS	1000



Field Service Representative Signature:	Customer Signature:
<i>Saharat</i>	<i>Saharat</i>
Date: 24 Apr 2025	Date: 24 Apr 2025

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Field Service Representative Signature:	Customer Signature:
<i>Saharat</i>	<i>Saharat</i>
Date: 24 Apr 2025	Date:

เอกสารไม่ควบคุม

Test Equipment

Equipment	Manufacturer	Model	Serial Number	Cal/Ver Date	Good Until
Multimeter	Fluke	289	59270015	N/A	N/A
Thermocouple	Fluke	K-Type	59270015	N/A	N/A
Balance	MettlerToledo	AB204-S	1129361010	N/A	N/A
IC Qualification	Thermo Scientific	Test Box	24156332	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	241021	Oct-2025
Nitrate	Thermo Scientific	10 ppm	060254	241021	Oct-2025
Nitrate	Thermo Scientific	25 ppm	060254	241021	Oct-2025
Nitrate	Thermo Scientific	50 ppm	060254	241021	Oct-2025
Nitrate	Thermo Scientific	100 ppm	060254	241021	Oct-2025
Nitrate	Thermo Scientific	1000 ppm	060254	241021	Oct-2025
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>Saharat</i>	<i>Saharat</i>
Date: 24 Apr 2025	Date: 24 Apr 2025

เอกสารไม่ควบคุม

Information

System Name	AquionRFIC
Detector SN	220360045
Data Path	ChromleonLocal/Archemica/Service Contract/2025/1st Con 23-Apr-2025/AquionRFIC #1047/IC OQ

Peak Results

Sample Name	Injection Volume (µL)	Retention Time (min)	Area
Repeatability 01	25	0.4467	3.611
Repeatability 02	25	0.4467	3.616
Repeatability 03	25	0.4467	3.607
Repeatability 04	25	0.4467	3.627
Repeatability 05	25	0.4467	3.615
Repeatability 06	25	0.4467	3.571

Repeatability

Test	Measured (% RSD)	OQ Limit (% RSD)	Result
Retention Time	0.0	≤ 5.0	PASS
Area	0.5	≤ 1.0	PASS



Field Service Representative Signature:	Customer Signature:
<i>Saharat</i>	<i>Saharat</i>
Date: 24 Apr 2025	Date: 24 Apr 2025

เอกสารไม่ควบคุม

CARRYOVER (CD)

ThermoFisher
SCIENTIFIC

Information

System Name	Aquion
Detector SN	220360045
Data Path	ChromleonLocal://Archemica/Service Contract/2025/1st Con 23-Apr-2025/AquionRFIC #1047/IC OQ

Peak Results

Sample Name	Injection Volume (µL)	Retention Time (min)	Area
Reference Blank	25	0.4467	0.056
High Standard	25	0.4483	47.903
Carryover	25	0.4467	0.06

Results

Test	Observed (%)	OQ Limit (%)	Result
AREA	0.01	≤ 0.10	PASS



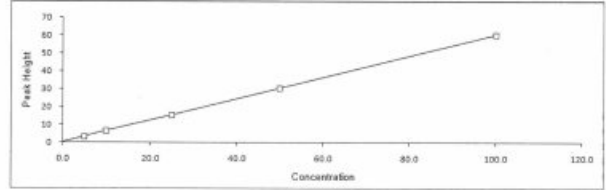
OVERALL TEST RESULT: PASS

Field Service Representative Signature:	Customer Signature:
Sahurath	Sahurath
Date: 24 Apr 2025	Date: 24 Apr 2025

เอกสารไม่ควบคุม

DETECTOR LINEARITY (CD)

ThermoFisher
SCIENTIFIC



Information

System Name	Aquion
Detector SN	220360045
Data Path	ChromleonLocal://Archemica/Service Contract/2025/1st Con 23-Apr-2025/AquionRFIC #1047/IC OQ

Peak Results

Sample Name	Concentration	Peak Height	Calculated
Detector Linearity 01	5	3.478	5.01
Detector Linearity 02	10	6.52	10.08
Detector Linearity 03	25	15.515	25.08
Detector Linearity 04	50	30.296	49.71
Detector Linearity 05	100	60.532	100.11

Linearity

Test	Observed	OQ Limit	Result
r ²	1.000	≥ 0.999	PASS



OVERALL TEST RESULT: PASS

Field Service Representative Signature:	Customer Signature:
Sahurath	Sahurath
Date: 24 Apr 2025	Date: 24 Apr 2025

เอกสารไม่ควบคุม

TEMPERATURE ACCURACY

ThermoFisher
SCIENTIFIC

Column Compartment

Set Point (°C)	Reading (°C)	Deviation (°C)	OQ Limit (°C)	Result
30.0	30.7	0.7	± 2.0	PASS



OVERALL TEST RESULT: PASS

Field Service Representative Signature:	Customer Signature:
Sahurath	Sahurath
Date: 24 Apr 2025	Date: 24 Apr 2025

เอกสารไม่ควบคุม

Certificate

Certificate of Standards and Instruments for Qualification

เอกสารไม่ควบคุม

SYSTRONICS INSLAB COMPANY LIMITED
19/11-12, Sukhumvit Rd., Nongprue, Muang Rayong, Rayong 21150, Thailand
Tel: +66(38) 694 145-8, Email: calibration@systronics.co.th

CERTIFICATE OF CALIBRATION

Certificate No. : EL241787
Job No : 24110052
Page : 1 of 5

Received Date : 14 Nov 2024
Calibrated Date : 18 Nov 2024
Issued Date : 18 Nov 2024

Customer Name : Archchemia Lab Co., Ltd.
Customer Address : 39 Soi Sukhumvit 63 (Ekamai)
Sukhumvit Rd., North Klongton,
Wattana, Bangkok 10110

Instrument Description : TRUE RMS MULTIMETER
Manufacturer : FLUKE
Model No. : 289
Serial Number : 99270015

Tag No : -
Service : -
Condition As Received : Used

Calibration Procedure.
Calibration were conducted using in-house calibration procedure according to direct measurement with reference standard.

Procedure No.
CP-EL-01, 02, 03, 04, 05, 06, 07, 10.

Comment.
Solvent
24 Apr 2025

Reference Standards Instrument	Instrument Name	Model	Serial No.	Cert. No.	Due Date.
Multi-Function Calibrator	Fluke 5522A	2177901	EE-0033-23	03 Apr 2025	

Traceability Information.
- Traceable to the International System of Units (SI) through the National Institute of Metrology (Thailand), NIMT.

Environmental Conditions.
Temperature : (23 +/- 3) °C Relative Humidity : (30 +/- 15) %

Calibration Information.
- The result of calibration was found accurate as shown on date and place of calibration only.
- The reported uncertainty of measurement is based on standard uncertainty multiplied by a coverage factor $k = 2$, providing confidence level of approximately 95%.

Calibrated by : Mr. Suputthana Prapasai
Approved by :
Approved Signatory : Mr. Tanawat Siripakdee

This certificate may not be reproduced, except in full unless permission for the publication of an abstract is obtained in writing from the calibration organisation issuing this report.

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19/11-12, Sukhumvit Rd., Nongprue, Muang Rayong, Rayong 21150, Thailand
Tel: +66(38) 694 145-8, Email: calibration@systronics.co.th

CERTIFICATE OF CALIBRATION

Certificate No. : EL241787
Page : 2 of 5

Range	Standard Value	UUC*Reading	Error	(±) Uncertainty
Function : DC Voltage Measurement (Without Adjustment)				
50 mV	0.0000 mV	0.000 mV	0.000 mV	0.0016 mV
50 mV	5.0000 mV	4.995 mV	-0.005 mV	0.0016 mV
50 mV	45.0000 mV	44.993 mV	-0.007 mV	0.0022 mV
500 mV	50.0000 mV	45.002 mV	-5.000 mV	0.0022 mV
500 mV	450.0000 mV	449.98 mV	-0.02 mV	0.0061 mV
500 mV	450.0000 mV	449.99 mV	-0.01 mV	0.0080 mV
5 V	0.500000 V	0.5000 V	0.0000 V	0.00059 V
5 V	4.500000 V	4.4997 V	-0.0003 V	0.00082 V
5 V	45.00000 V	44.997 V	-0.003 V	0.00059 V
50 V	5.00000 V	5.000 V	0.000 V	0.00059 V
50 V	45.0000 V	44.997 V	-0.003 V	0.00095 V
500 V	50.0000 V	50.00 V	0.00 V	0.0059 V
500 V	450.000 V	449.97 V	-0.03 V	0.0095 V
500 V	450.000 V	449.97 V	-0.03 V	0.0095 V
1000 V	100.0000 V	100.0 V	0.0 V	0.058 V
1000 V	900.000 V	900.0 V	0.0 V	0.060 V
1000 V	900.000 V	900.0 V	0.0 V	0.060 V
Function : DC Voltage Measurement LoZ (Without Adjustment)				
1000 V	0.000000 V	0.0 V	0.0 V	0.058 V
1000 V	100.0000 V	100.1 V	0.1 V	0.058 V
1000 V	900.000 V	900.8 V	0.8 V	0.060 V
1000 V	900.000 V	900.8 V	-0.8 V	0.060 V
Function : AC Voltage Measurement (Without Adjustment)				
50 mV	5.000 mV	50 Hz	4.988 mV	-0.012 mV
50 mV	45.000 mV	50 Hz	45.003 mV	0.003 mV
500 mV	50.000 mV	50 Hz	49.94 mV	-0.06 mV
500 mV	450.00 mV	50 Hz	450.13 mV	0.13 mV
5 V	0.50000 V	50 Hz	0.4986 V	-0.0014 V
5 V	4.50000 V	50 Hz	4.5012 V	0.0012 V
50 V	5.00000 V	50 Hz	4.988 V	-0.012 V
50 V	45.000 V	50 Hz	45.012 V	0.012 V
500 V	50.000 V	50 Hz	49.98 V	-0.02 V
500 V	450.00 V	50 Hz	450.16 V	0.16 V
1000 V	100.000 V	50 Hz	100.0 V	0.0 V
1000 V	900.00 V	50 Hz	900.4 V	0.4 V

Remark : (*) UUC : Unit Under Calibration

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SYSTRONICS INSLAB COMPANY LIMITED
19/11-12, Sukhumvit Rd., Nongprue, Muang Rayong, Rayong 21150, Thailand
Tel: +66(38) 694 145-8, Email: calibration@systronics.co.th

CERTIFICATE OF CALIBRATION

Certificate No. : EL241787
Page : 3 of 5

Range	Standard Value	UUC*Reading	Error	(±) Uncertainty
Function : AC Voltage Measurement LoZ (Without Adjustment)				
1000 V	100.000 V	50 Hz	100.4 V	0.060 V
1000 V	900.00 V	50 Hz	905.7 V	0.23 V
Function : DC Current Measurement (Without Adjustment)				
500 uA	0.000 uA	0.00 uA	0.00 uA	0.017 uA
500 uA	50.000 uA	49.99 uA	-0.01 uA	0.023 uA
500 uA	450.00 uA	449.95 uA	-0.05 uA	0.078 uA
5000 uA	500.00 uA	500.0 uA	0.0 uA	0.097 uA
5000 uA	4500.0 uA	4499.4 uA	-0.6 uA	0.57 uA
50 mA	5.0000 mA	5.001 mA	0.001 mA	0.00082 mA
50 mA	45.0000 mA	44.996 mA	-0.004 mA	0.0058 mA
400 mA	40.000 mA	39.99 mA	-0.01 mA	0.0077 mA
400 mA	360.00 mA	359.93 mA	-0.07 mA	0.090 mA
5 A	0.50000 A	0.5001 A	0.0001 A	0.00013 A
5 A	4.5000 A	4.4991 A	-0.0009 A	0.0022 A
10 A	1.00000 A	1.000 A	0.000 A	0.00061 A
10 A	9.0000 A	8.998 A	-0.002 A	0.0040 A
Function : AC Current Measurement (Without Adjustment)				
500 uA	50.00 uA	50 Hz	49.82 uA	-0.18 uA
500 uA	450.00 uA	50 Hz	449.85 uA	-0.15 uA
5000 uA	500.00 uA	50 Hz	499.8 uA	-0.2 uA
5000 uA	4500.0 uA	50 Hz	4501.0 uA	1.0 uA
50 mA	5.0000 mA	50 Hz	4.988 mA	-0.012 mA
50 mA	45.0000 mA	50 Hz	44.981 mA	-0.019 mA
400 mA	40.000 mA	50 Hz	39.96 mA	-0.04 mA
400 mA	360.00 mA	50 Hz	360.13 mA	0.13 mA
5 A	0.50000 A	50 Hz	0.4990 A	-0.0010 A
5 A	4.5000 A	50 Hz	4.4972 A	-0.0028 A
10 A	1.00000 A	50 Hz	1.000 A	0.000 A
10 A	9.0000 A	50 Hz	8.999 A	-0.001 A

Remark : (*) UUC : Unit Under Calibration

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Tel: +66(38) 694 145-8, Email: calibration@systronics.co.th

CERTIFICATE OF CALIBRATION

Certificate No. : EL241787
Page : 4 of 5

Range	Standard Value	UUC*Reading	Error	(±) Uncertainty
Function : Resistance Measurement (Without Adjustment)				
500 Ω	0.0000 Ω	0.00 Ω	0.00 Ω	0.0075 Ω
500 Ω	50.0000 Ω	49.99 Ω	-0.01 Ω	0.0084 Ω
500 Ω	450.000 Ω	449.93 Ω	-0.07 Ω	0.017 Ω
5 kΩ	0.500000 kΩ	0.4999 kΩ	-0.0001 kΩ	0.00060 kΩ
5 kΩ	4.50000 kΩ	4.4986 kΩ	-0.0014 kΩ	0.00017 kΩ
50 kΩ	5.00000 kΩ	5.000 kΩ	0.000 kΩ	0.00060 kΩ
50 kΩ	45.0000 kΩ	45.001 kΩ	0.001 kΩ	0.0017 kΩ
500 kΩ	50.0000 kΩ	49.99 kΩ	-0.01 kΩ	0.0060 kΩ
500 kΩ	450.000 kΩ	449.87 kΩ	-0.13 kΩ	0.018 kΩ
5 MΩ	0.500000 MΩ	0.4998 MΩ	-0.0002 MΩ	0.00061 MΩ
5 MΩ	4.50000 MΩ	4.4981 MΩ	-0.0019 MΩ	0.00056 MΩ
30 MΩ	3.000000 MΩ	3.000 MΩ	0.000 MΩ	0.00061 MΩ
50 MΩ	5.00000 MΩ	5.00 MΩ	0.00 MΩ	0.00059 MΩ
50 MΩ	45.0000 MΩ	44.97 MΩ	-0.03 MΩ	0.021 MΩ
100 MΩ	10.0000 MΩ	10.0 MΩ	0.0 MΩ	0.058 MΩ
100 MΩ	90.0000 MΩ	89.9 MΩ	-0.1 MΩ	0.069 MΩ
500 MΩ	250.000 MΩ	249.4 MΩ	-0.6 MΩ	0.68 MΩ
500 MΩ	450.000 MΩ	448.0 MΩ	-2.0 MΩ	5.9 MΩ
Function : Resistance Measurement LoZ (Without Adjustment)				
50 Ω	0.0000 Ω	0.00 Ω	0.00 Ω	0.0047 Ω
50 Ω	5.0000 Ω	5.004 Ω	0.004 Ω	0.0049 Ω
50 Ω	25.0000 Ω	24.996 Ω	-0.004 Ω	0.0057 Ω
50 Ω	45.0000 Ω	44.993 Ω	-0.007 Ω	0.0060 Ω
Function : Capacitance Measurement (Without Adjustment)				
1 nF	0.0000 nF	0.000 nF	0.000 nF	0.0078 nF
1 nF	0.5000 nF	0.499 nF	-0.001 nF	0.0098 nF
1 nF	0.9000 nF	0.898 nF	-0.002 nF	0.012 nF
10 nF	1.0000 nF	1.00 nF	0.00 nF	0.013 nF
10 nF	10.0000 nF	9.99 nF	-0.01 nF	0.029 nF
100 nF	10.0000 nF	10.0 nF	0.0 nF	0.064 nF
100 nF	90.0000 nF	90.0 nF	0.0 nF	0.29 nF
1 uF	0.100000 uF	0.100 uF	0.000 uF	0.00064 uF
1 uF	0.50000 uF	0.500 uF	0.000 uF	0.0029 uF
10 uF	1.00000 uF	1.00 uF	0.00 uF	0.0064 uF
10 uF	9.0000 uF	9.00 uF	0.00 uF	0.028 uF
100 uF	10.0000 uF	10.0 uF	0.0 uF	0.064 uF
100 uF	100.000 uF	100 uF	0.0 uF	0.42 uF
1000 uF	900.00 uF	899 uF	-1 uF	0.72 uF
10 mF	1.00000 mF	1.00 mF	0.00 mF	0.0072 mF
10 mF	9.0000 mF	9.00 mF	0.00 mF	0.043 mF
100 mF	10.0000 mF	10.0 mF	0.0 mF	0.072 mF
100 mF	90.0000 mF	89.8 mF	-0.2 mF	0.89 mF

Remark : (*) UUC : Unit Under Calibration

เอกสารไม่ควบคุม

SYSTRONICS INSLAB COMPANY LIMITED
19/11-12, Sukhumvit Rd., Nongphra, Muang Rayong, Rayong 21150, Thailand
Tel: +66(38) 594 145-8, Email: calibration@systronics.co.th

CERTIFICATE OF CALIBRATION

Certificate No. EL241787
Page 5 of 5

Range	Standard Value	UUC*Reading	Error	(±) Uncertainty
Function : Frequency Measurement (Without Adjustment)				
100 Hz	10.00 Hz	10.000 Hz	0.000 Hz	0.00059 Hz
100 Hz	90.00 Hz	90.000 Hz	0.000 Hz	0.00056 Hz
1000 Hz	100.00 Hz	100.000 Hz	0.000 Hz	0.00058 Hz
1000 Hz	900.0 Hz	900.000 Hz	0.000 Hz	0.00061 Hz
10 kHz	1.0000 kHz	1.00000 kHz	0.00000 kHz	0.000058 kHz
10 kHz	9.0000 kHz	9.00000 kHz	0.00000 kHz	0.00007 kHz
100 kHz	10.0000 kHz	10.00000 kHz	0.00000 kHz	0.000058 kHz
100 kHz	90.0000 kHz	90.00000 kHz	0.00000 kHz	0.000061 kHz
1000 kHz	100.0000 kHz	100.00000 kHz	0.00000 kHz	0.000058 kHz
1000 kHz	900.0000 kHz	900.00000 kHz	0.00000 kHz	0.000059 kHz
Function : Thermocouple Measurement K Type (Without Adjustment)				
-200 to 1350 °C	-5.550 mV	-180.0 °C	-178.6 °C	1.4 °C
-200 to 1350 °C	0.000 mV	0.0 °C	0.6 °C	0.24 °C
-200 to 1350 °C	4.096 mV	100.0 °C	100.6 °C	0.6 °C
-200 to 1350 °C	24.905 mV	600.0 °C	600.6 °C	0.6 °C
-200 to 1350 °C	37.326 mV	900.0 °C	900.6 °C	0.6 °C
-200 to 1350 °C	48.838 mV	1200.0 °C	1200.7 °C	0.7 °C

Remark : (*) UUC : Unit Under Calibration

END OF CALIBRATION

ARCHIMEDIA LAB CO., LTD.
Saharat
26 Apr 2025

เอกสารไม่ควบคุม

CERTIFICATE OF CONFORMITY

IC QUALIFICATION TEST BOX II

This certificate validates that the product values referenced below meet or exceed all Thermo Scientific functional specifications and release requirements.

Instrument Serial Number: 24159332
Instrument Part Number: 22000-60001

TEST BOX LOADS AND FUNCTIONS

[x] AES	100Q	+/- 5%	[x] CR-TC 3-pin ANA INT	1.3KQ	+/- 5%
[x] EGC CAP KOH	100Q	+/- 5%	[x] CR-TC 3-pin CAP INT	13.05KQ	+/- 1%
[x] EGC CAP MSA	100Q	+/- 5%	[x] CR-TC 4-pin ANA INT	1.3KQ	+/- 5%
[x] EGC ANA KOH	100Q	+/- 5%	[x] CR-TC 4-pin CAP INT	13.05KQ	+/- 1%
[x] EGC ANA MSA	100Q	+/- 5%	[x] EGC - Memory Test		
[x] ERS (CC)	12Q	+/- 5%	[x] ERS - Memory Test		
[x] ERS (CV)	250Q	+/- 5%	[x] CR-TC - Memory Test		

Tester: Alicia Balicinas
Date: 11-April-2024
Saharat
26 Apr 2025
P/N 22000-57001 C

เอกสารไม่ควบคุม

Certificate of Analysis

Better Separations Through
Better Chemistry

Dionex Nitrate OQ/PQ IC Standards Kit (Set of 6)

Product Number 060254
Certificate of Analysis

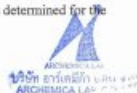
Lot Number 241021

Expiration of Certification
October 2025

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

Dionex Nitrate Standard

Vial #	Concentration (mg/L)
1	4.95 ± 0.09
2	9.97 ± 0.02
3	25.33 ± 0.12
4	50.46 ± 0.28
5	101.4 ± 1
6	1004 ± 4



Saharat
26 Apr 2025

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

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

Document No. 018666-01 20-Dec-2011

thermoscientific.com/dionex
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XX21149-EN 02/05 02/10/11

Thermo Fisher Scientific
1220 Titan Way
P.O. Box 3600
Sunnyvale, CA 94088-3600
408.727.4700

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เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2502228-002-01

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XP6

Resolution: 0.000001 g

Serial No.: R372373893

ID No.: UAE AIR.019/2556

Capacity: 6.1 g

20 March 2025

Page 2 of 3

Environment Condition:	Ambient Temperature:	22.8 ± 0.4 °C	Relative Humidity:	48 ± 0.95 %
------------------------	----------------------	---------------	--------------------	-------------

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

2. *Neurospora crassa* (strain 74-22-112)

Reference Standard

Standard Weight Class E2 1mg to 200g

Instrument	Model
------------	-------

Thermo-Huon Meter

Thermo-Hygro Meter
000-711

3. This certification is valuable to students.

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

Calibration Results:

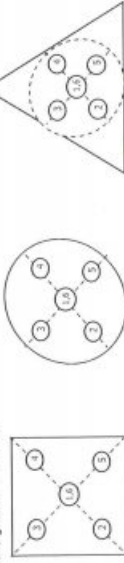
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
3	0.00000079
5	0.00000067

2. Off-Center Error:

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

The balance reading obtained is shown in the table



	1	2	3	4	5	6	(Maximum Difference)
	(g)	(g)	(g)	(g)	(g)	(g)	(g)
2 0000010		2 0000017	2 0000014	2 0000014	2 0000024	2 0000019	0.0000006

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, without the prior written approval of the National Food Institute.

FCS-017 Revision: 01 Date: 20-04-65

[illegible]

MAGNETIC

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

MAGNETIC

เอกสารไม่ควม



oft orth

Calibration Report

Certificate No.: 25022228-002-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XP6

Resolution: 0.000001 g

Serial No.: B322373893

ID No.: UAE-AIR-019/2556

Capacity: 6.1 g

Date of Calibration: 20 March 2025

Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-6 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.0000000	0.000000	0.000000	0.000032	2.00
0.001	0.0010030	0.001002	0.000001	0.000032	2.00
0.01	0.0100030	0.010003	0.000000	0.000034	2.00
0.05	0.0499960	0.050001	-0.000005	0.000044	2.00
0.10	0.1000110	0.100011	0.000000	0.000057	2.00
0.15	0.1500070	0.150010	-0.000003	0.000071	2.00
0.17	0.1700130	0.170012	0.000001	0.000077	2.00
0.20	0.2000110	0.200015	-0.000004	0.000065	2.00
1.50	1.5000190	1.500017	0.000002	0.000017	2.00
3.00	3.0000260	3.000017	0.000009	0.000019	2.00
4.50	4.5000610	4.500023	0.000038	0.000023	2.00
6.00	6.0000180	6.000014	0.000004	0.000023	2.00

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

----- End -----

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

20008 ซอย 36, Anuram Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand

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for N. ingrat













ภาคผนวก จ-2

บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด



ALS Certificate

เอกสารรับรองความสามารถของ ALS Laboratory Group (Thailand) ในขอบข่ายที่ขึ้นทะเบียน สามารถสแกนผ่าน QR CODE หรือพิมพ์ Shorten link

หน่วยงานอนุญาต	สาขาที่ขึ้นทะเบียน	ไฟล์เอกสารแนบ	รายละเอียดการขึ้นทะเบียน
กรมโรงงานอุตสาหกรรม ขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์	สาขากรุงเทพ (สำนักงานใหญ่) (ว-204)	 หรือ https://bit.ly/3arPA7W	น้ำเสีย, น้ำใต้ดิน, อากาศเสียจากปล่องระบาย, ดิน, สิ่งปฏิกูลที่ไม่ใช่แล้ว
กรมวิทยาศาสตร์การแพทย์ ได้รับการรับรอง ISO/IEC 17025 : 2017	สาขากรุงเทพ (สำนักงานใหญ่)	 หรือ https://bit.ly/3Pj6Yxq	อาหาร, เครื่องดื่ม, น้ำบริโภค, น้ำใช้, น้ำแข็ง, ผักและผลไม้, เนื้อสัตว์และผลิตภัณฑ์, สัตว์น้ำ, ผลิตภัณฑ์ทางทะเล, ซอสและเครื่องปรุงรส, นมและผลิตภัณฑ์ของนม, ไขมันและน้ำมัน, ธัญพืช, เครื่องสำอาง, อุปกรณ์การแพทย์
กรมวิทยาศาสตร์บริการ ได้รับการรับรอง ISO/IEC 17025 : 2017	สาขากรุงเทพ (สำนักงานใหญ่)	 หรือ https://bit.ly/3R1pWtd	น้ำ, น้ำเสีย, น้ำทะเล, น้ำในส้วม, น้ำ, ภาชนะบรรจุอาหารและวัสดุสัมผัส, ภาชนะพลาสติก บรรจุอาหาร, อากาศ, เสียงในสิ่งแวดล้อม, อาหารสัตว์และ วัตถุดิบอาหารสัตว์, ขนไก่ปน
ผู้ควบคุมมลพิษด้านสิ่งแวดล้อมจาก กรมโรงงานอุตสาหกรรม	บ.123-48-029	 หรือ https://bit.ly/3tD5pjU	ระบบบำบัดมลพิษน้ำ, อากาศ, กากอุตสาหกรรม
กรมปศุสัตว์	สาขากรุงเทพ (สำนักงานใหญ่)	 หรือ https://bit.ly/3nJHbDZ	อาหาร, สินค้าปศุสัตว์, อาหารสัตว์และวัตถุดิบอาหารสัตว์
กรมประมง	สาขากรุงเทพ (สำนักงานใหญ่)	 หรือ https://bit.ly/3bWia4c	สัตว์น้ำและผลิตภัณฑ์สัตว์น้ำ, อาหารกระป๋อง, ปลาและ น้ำปลา, ซอสปรุงรส, เนื้อเยื่อสัตว์, เครื่องปรุงรส, ขนมน, สาหร่ายและผลิตภัณฑ์จากสาหร่าย
กรมวิชาการเกษตร	สาขากรุงเทพ (สำนักงานใหญ่)	 หรือ https://bit.ly/3063NoL	อาหาร, อาหารกระป๋อง, เส้นก๋วยเตี๋ยว, แป้ง, พืช, เครื่องดื่ม, ธัญพืชและผลิตภัณฑ์ธัญพืช, เครื่องปรุงรส, ผักและ ผลิตภัณฑ์ผัก, ผลไม้และผลิตภัณฑ์ผลไม้, ขนมหวาน, และอื่นๆ
มกอช	สาขากรุงเทพ (สำนักงานใหญ่)	 หรือ https://bit.ly/3Acyghs	อาหาร, อาหารกระป๋อง, เครื่องดื่ม, น้ำดื่ม, น้ำแข็ง, น้ำเสีย, น้ำทะเล, แป้ง, ผักผลไม้, ผลิตภัณฑ์นม, ซ็อกโกแลต, เนื้อสัตว์, ธัญพืช, สินค้าประมง, น้ำปลา, เครื่องปรุงรส, เครื่องเทศ, บรรจุภัณฑ์, วัตถุดิบอาหารสัตว์, และอื่นๆ
กรมสวัสดิการและคุ้มครองแรงงาน	สาขากรุงเทพ (สำนักงานใหญ่)	 หรือ https://bit.ly/3gr3mcT	ใบอนุญาตเป็นผู้ให้บริการตรวจวัดระดับความเข้มข้นของ สารเคมีอันตรายในบรรยากาศ สถานะการทำงาน และ สถานที่เก็บรักษาสารเคมีอันตราย
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ติดต่อเรา

ALS Laboratory Group (Thailand) ห้องปฏิบัติการวิเคราะห์ที่ได้รับการรับรองความสามารถตามมาตรฐานสากล ISO/IEC 17025 และขึ้นทะเบียนห้องปฏิบัติการกับกรมโรงงานอุตสาหกรรม ให้บริการวิเคราะห์ทดสอบครบวงจรทั้งด้านอาหาร ยา เวชภัณฑ์ เครื่องสำอาง และสิ่งแวดล้อม ซึ่งมีความเชี่ยวชาญและประสบการณ์กว่า 38 ปี ด้วยนักวิทยาศาสตร์ที่มีความเชี่ยวชาญกว่า 400 คน พร้อมทั้งเครื่องมือและเทคโนโลยีที่ทันสมัย ปัจจุบันเรามีความพร้อมในการบริการครอบคลุมถึง 8 สาขา อันได้แก่ กรุงเทพฯ ราชบุรี เชียงใหม่ สงขลา สุราษฎร์ธานี นครราชสีมา หนองคาย และภูเก็ต

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