

ภาคผนวก ญ

เอกสารสอบเทียบเครื่องมือ

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Tisch Environmental,Inc.	TE-5025A 3541	Jiranatee Associates Co., Ltd.	CL-012-65	31 Oct 22	30 Oct 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	25P1541	24 Apr 25	23 Apr 26	-
3	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	25P1379	17 Apr 25	16 Apr 26	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	25H812	10 Apr 25	9 Apr 26	-
5	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DR0052	Thai Meteorological Department	112/25	19 Feb 25	18 Feb 26	-
6	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DR0058	Thai Meteorological Department	108/25	19 Feb 25	18 Feb 26	-
7	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV36 107224	Innovative Instrument Co.,Ltd.	24-ACT-091	26 Jun 24	25 Jun 25	-
8	Sound Level Meter	L _{Aeq} 1 hour ^a L _{Aeq} 24 hr ^a L _{Amax} L _{A90}	Larson Davis	LX72 0005396	Electrical And Electronics Institute Foundation For Industrial Development	CP20240291EA	5 Aug 24	4 Aug 25	-
9	Sound Level Meter	L _{Aeq} 1 hour ^a L _{Aeq} 24 hr ^a L _{Amax} L _{A90}	Larson Davis	LX72 0005398	Innovative Instrument Co.,Ltd.	24-SLM-214	2 Jul 24	1 Jul 25	-
10	Sound Level Meter	L _{Aeq} 1 hour ^a L _{Aeq} 24 hr ^a L _{Amax} L _{A90}	Larson Davis	LX72 0005399	Electrical And Electronics Institute Foundation For Industrial Development	CP20240293EA	6 Aug 24	5 Aug 25	-
11	Sound Level Meter	L _{Aeq} 1 hour ^a L _{Aeq} 24 hr ^a L _{Amax} L _{A90}	Larson Davis	LX72 0006691	Innovative Instrument Co.,Ltd.	24-SLM-236	10 Jul 24	9 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
Satck									
1	Pre-Test Console	Total Suspended Particulate	Apex Instruments, USA.	XC-572-V 0807047	Envi Equipment Service Co., Ltd.	E24-080074	26 Aug 24	25 Aug 25	-
2	Pre-Test Console	Total Suspended Particulate	Apex Instruments, USA.	XC-572-V 1904011	Envi Equipment Service Co., Ltd.	E24-08073	21 Aug 24	20 Aug 25	-
3	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide Carbon Monoxide	Testo	Testo 350 60723967	Entech Industrial Sulation Co., Ltd.	G 670643	13 Sep 24	12 Sep 25	-
4	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide Carbon Monoxide	Testo	Testo 350 60899617701	Entech Industrial Sulation Co., Ltd.	G 670763	31 Oct 24	30 Oct 25	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Workplace									
1	Air Flow Meter	Calibrate personal pump	TSI Inc	4146 41461813030	Innovative Instrument Co., Ltd.	24-AFM-223	8 Nov 24	7 Nov 25	-
2	Aneroid Barometer	Total Dust Respirable Dust Silica Oil Mist Xylene Nickel Nitrate as Nickel Ethylene Glycol Monoethyl Ether (2-ETHOXYETHANOL) Dibutyltin Oxide as Sn Phosphoric Acid Hydrofluoric Acid Hydrofluorosilicic Acid as F Acetic Acid	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	25P1359	17 Apr 25	16 Apr 26	-
3	Digital Thermo - Hygrometer	Total Dust Respirable Dust Silica Oil Mist Xylene Nickel Nitrate as Nickel Ethylene Glycol Monoethyl Ether (2-ETHOXYETHANOL) Dibutyltin Oxide as Sn Phosphoric Acid Hydrofluoric Acid Hydrofluorosilicic Acid as F Acetic Acid	Digicon	TH-02 435031147	Technology Promotion Association (Thailand-Japan)	24H1486	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									
4	Sound Level Meter	$L_{Aeq} 12 \text{ hrs}^*$ $L_{Aeq} 8 \text{ hrs}^*$ L_{pmax}	Rion, Japan	NL-42 00709670	Sithiporn Associates Co., Ltd.	ACL25030	13 Jan 25	12 Jan 26	-
5	Sound Level Meter	$L_{Aeq} 12 \text{ hrs}^*$ $L_{Aeq} 8 \text{ hrs}^*$ L_{pmax}	Rion, Japan	NL-42 00408983	Innovative Instrument Co.,Ltd.	25-SLM-108	18 Mar 25	17 Mar 26	-
6	Sound Level Meter	$L_{Aeq} 12 \text{ hrs}^*$ $L_{Aeq} 8 \text{ hrs}^*$ L_{pmax}	Rion, Japan	NL-42 00409023	Sithiporn Associates Co., Ltd.	ACL25230	10 Jun 25	9 Jun 26	-
7	Sound Level Meter	$L_{Aeq} 12 \text{ hrs}^*$ $L_{Aeq} 8 \text{ hrs}^*$ L_{pmax}	Rion, Japan	NL-42 00558212	Sithiporn Associates Co., Ltd.	ACL25115	28 Jan 25	27 Jan 26	-
8	Sound Level Meter	$L_{Aeq} 12 \text{ hrs}^*$ $L_{Aeq} 8 \text{ hrs}^*$ L_{pmax}	Rion, Japan	NL-42 00709651	Sithiporn Associates Co., Ltd.	ACL25028	13 Jan 25	12 Jan 26	-
9	Sound Level Meter	$L_{Aeq} 12 \text{ hrs}^*$ $L_{Aeq} 8 \text{ hrs}^*$ L_{pmax}	Rion, Japan	NL-42 00408980	Sithiporn Associates Co., Ltd.	ACL25113	28 Jan 25	27 Jan 26	-
10	Sound Level Meter	$L_{Aeq} 12 \text{ hrs}^*$ $L_{Aeq} 8 \text{ hrs}^*$ L_{pmax}	Rion, Japan	NL-42 00709656	Sithiporn Associates Co., Ltd.	ACL25212	4 Jun 25	3 Jun 26	-
11	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 128473	Innovative Instrument Co.,Ltd.	25-NDM-064	17 Mar 25	16 Mar 26	-
12	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 128474	Innovative Instrument Co.,Ltd.	25-NDM-063	17 Mar 25	16 Mar 26	-
13	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 128473	Innovative Instrument Co.,Ltd.	25-NDM-064	17 Mar 25	16 Mar 26	-
14	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 128360	Innovative Instrument Co.,Ltd.	25-NDM-062	17 Mar 25	16 Mar 26	-
15	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 131076	Innovative Instrument Co.,Ltd.	24-NDM-167	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									
16	Noise Dosimeter	Noise Dosimeter	Svantek	SV 100IS 131125	Innovative Instrument Co.,Ltd.	24-NDM-168	15 Jul 24	14 Jul 25	-
17	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 34 TEX040009	Innovative Instrument Co.,Ltd.	24-TPM-311	8 Jul 24	7 Jul 25	-
18	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPQ020023	Innovative Instrument Co.,Ltd.	24-TPM-349	6 Aug 24	5 Aug 25	-
19	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 34 TEX040014	Innovative Instrument Co.,Ltd.	24-TPM-310	8 Jul 24	7 Jul 25	-
20	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPS030005	Innovative Instrument Co.,Ltd.	25-TPM-053	28 Jan 25	27 Jan 26	-
21	Thermal Environment Monitor	Heat Meter	Quest Technologies, Inc	QuesTemp 34 TEK120020	Innovative Instrument Co.,Ltd.	24-TPM-371	15 Aug 24	14 Aug 25	-

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	Horiba	LAQUA-PH210 HA9N00046	Technology Promotion Association (Thailand-Japan)	24CH1596	26 Dec 24	25 Dec 25	-

CERTIFICATE OF CALIBRATION

Certificate No. : CL-012-65

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER : Top Load Orifice
MODEL/TYPE : TE-5025A
SERIAL NUMBER : 3541
ID NUMBER : UAE.EFM.177/2561
CONDITION AS-RECEIVED : Used item
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong,
Bangkok 10260

RECEIVED DATE : 25 Oct 2022
MEASUREMENT DATE : 31 Oct 2022
ISSUE DATE : 02 Nov 2022

ENVIRONMENTAL CONDITIONS:

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

CAUTION CONDITION:

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are 24.7 °C and 62.29%RH.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:
The Orifice gas flow device was calibrated against
Standard Rotary Displacement Meter (Roots
Meter) Model G65/MC/WZ-0n. The WZ-0n
was used as a calibration guideline.

Traceability:
This certificate provides a traceability of the
measurement to realization of the national
standards, used to realization of the national
system of units (SI) through the VSL (National
Metrology Institute of Netherlands) via Certificate
number: 02215902

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

Table 1: The results of Q Standard calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _g] °C	Temperature [T _m] °C	Ap_meter mmHg	Ap_Orifice inH ₂ O	Y	Standard Flow [Q _s] m ³ /min
1	0.700	756.152	24.690	24.150	56.497	1.688	1.296	0.647
2	1.001	756.144	24.650	24.100	60.829	3.410	1.843	0.919
3	1.119	756.100	24.670	24.080	41.077	4.527	2.123	1.056
4	1.169	756.072	24.580	24.130	30.350	5.100	2.254	1.119
5	1.417	756.087	24.300	23.850	29.843	7.540	2.742	1.359

Slope (a): 2.02990
Intercept (b): -0.01811
Correlation coefficient (r): 0.99973
Uncertainty (k=2): 0.012 m³/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _g] °C	Temperature [T _m] °C	Ap_meter mmHg	Ap_Orifice inH ₂ O	Y	Standard Flow [Q _s] m ³ /min
1	0.700	756.152	24.690	24.150	56.497	1.688	0.815	0.649
2	1.001	756.144	24.650	24.100	60.829	3.410	1.159	0.922
3	1.119	756.100	24.670	24.080	41.077	4.527	1.335	1.060
4	1.169	756.072	24.580	24.130	30.350	5.100	1.417	1.123
5	1.417	756.087	24.300	23.850	29.843	7.540	1.722	1.363

Slope (a): 1.27142
Intercept (b): -0.01152
Correlation coefficient (r): 0.99973
Uncertainty (k=2): 0.013 m³/min

End of Certificate of Calibration

Calibrated by:
Mr. Sompote Thacholad
Maj. Jiraporn Lertsomphol



Approved signatory:
Mr. Pongsak Booncharoen
Calibration Department Manager



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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 BATTANAKARN ROAD SOI 18, SIAMLIANG, SIAMLIANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX: 0-2719-8484

Certificate of Calibration

Certificate No. : 25P1541
Page : 1 of 2

Equipment : U Tube Manometer

Manufacturer : Dwyer

Model : 1221-36-W/M

Serial No. : -

ID No. : UAE.EFM.077/2568

Condition As-Received: Used item

Received Date: 04 April 2025

Calibration Date: 24 April 2025

Reference: 2504-0192WSC

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

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (90 ± 15) %

Atmospheric Pressure: 1005 mbar

81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,

Phrakhanong, Bangkok 10260

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

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-0218-24	24 Sep 2025

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

3. Scale and conversion factor is 1 kPa = 4.0146293 inH₂O

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

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

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

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

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

-National Institute of Metrology (Thailand), NSC-ONSC Accredited No. Calibration 0144

Calibrated by : Suksan Khanakw
Issue Date : 28 April 2025

Approved Signatory : A Hapol P.
[] Phalinee Prabpajpal
[] Sura Suwanasri
[✓] Atsapol Panurach

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Cert.No.: 25P1541
Page: 2 of 2

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

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

Applied Pressure	High-port side	Low-port side	ΔP	Error
0.00	0.00	0.00	0.00	0.00
2.05	1.00	-1.00	2.00	-0.05
4.06	2.00	-2.00	4.00	-0.05
6.05	3.00	-3.00	6.00	-0.05
8.03	4.00	-4.00	8.00	-0.03
9.98	5.00	-5.00	10.00	0.02
11.97	6.00	-6.00	12.00	0.03
13.97	7.00	-7.00	14.00	0.03
15.96	8.00	-8.00	16.00	0.04
17.95	9.00	-9.00	18.00	0.05
19.93	10.00	-10.00	20.00	0.07
21.93	11.00	-11.00	22.00	0.07
23.89	12.00	-12.00	24.00	0.11
25.89	13.00	-13.00	26.00	0.11
27.85	14.00	-14.00	28.00	0.15
29.85	15.00	-15.00	30.00	0.15
31.85	16.00	-16.00	32.00	0.15
33.85	17.00	-17.00	34.00	0.15
35.85	18.00	-18.00	36.00	0.15

The uncertainty of measurement was ± 0.11 inH₂O

* ΔP = High-port side - Low-port side

* UUC = Unit Under Calibration

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

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Certificate of Calibration

Certificate No.: 25P1379
Page: 1 of 2

Equipment: Aneroid Barometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE/ANV.121/2550

Condition As-Received: Used Item

Received Date: 04 April 2025

Calibration Date: 17 April 2025

Reference: 2504-0196WSC

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

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1005 mbar

81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,
Prakhanong, 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. This result of calibration instrument was in absolute pressure.

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Keerpon Salichai
Issue Date: 21 April 2025

Approved Signatory:

Athapol P.
[] Phalinee Prabpai
[] Sura Suwanasri
[✓] Athapol Panurach

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Result of calibration: Without adjustment

Function: Absolute Pressure Measurement

Range: 960 hPa to 1070 hPa

Scale Interval: 1 hPa (The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	959.71	971.22	982.18	991.71	1003.10	1006.84	1013.02	1023.08	1034.17	1068.92
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1005.0	1010.0	1020.0	1030.0	1060.0
Error (hPa)	0.29	-1.22	-2.18	-1.71	-3.10	-1.94	-3.02	-3.08	-4.17	-8.92

Decreasing Pressure

Applied Pressure (hPa)	1068.95	1033.45	1022.77	1012.49	1007.16	1002.58	992.32	982.17	970.66	959.47
UUC* Indication (hPa)	1060.0	1030.0	1020.0	1010.0	1005.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-8.95	-3.45	-2.77	-2.49	-2.16	-2.58	-2.32	-2.17	-0.86	0.53

The uncertainty of measurement was ± 0.33 hPa

* UUC = Unit Under Calibration

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

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Certificate of Calibration

Certificate No.: 25H812
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE/ANV.132/2550

Condition As-Received: Used Item

Received Date: 04 April 2025

Calibration Date: 10 April 2025

Reference: 2504-0193WSC

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

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,
Prakhanong, Bangkok 10260

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

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Dew Point Hygrometer	Optidew 401	164756	TH-0005-25	05 Feb 2026
2) Handheld Thermometer With Sensor	1523	5717096	241241	18 Nov 2025

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

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

-National Institute of Metrology (Thailand), NSC-ONSC Accredited No. Calibration 0144

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

Calibrated by: Somchai Dumwong
Issue Date: 18 April 2025

Approved Signatory:

Viporn
[] Chakrit Watanwanjua
[] Pornthippa Tameyakul
[✓] Viporn Tantayawut

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Result of Calibration: Without Adjustment

Function: Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Correction (%R.H.)	Uncertainty of Measurement (%R.H.)
25.0	40.1	42	-1.9	1.7
25.0	60.0	60	0.0	1.8
25.0	80.0	76	4.0	1.9

Result of Calibration: Without Adjustment

Function: Temperature Measurement

Standard Temperature (°C)	UUC* Reading (°C)	Correction (°C)	Uncertainty of Measurement (±°C)
20.001	21.0	-0.999	0.72
24.967	25.0	-0.013	0.72
30.021	30.0	0.021	0.72
34.964	34.0	0.964	0.72
40.032	39.0	1.032	0.72

UUC* : Unit Under Calibration

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

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THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 19 February, 2025

Certification No. 112/25

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2111DR0052

Wind Sensor 2111DT0052

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1012.3 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aft Plotting Board

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

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

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

Serial Number 110730029 (sensor 120629596)

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

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

: testo, testo 645 Serial No. 02948057 : Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. 99320001

Calibrated by : Mr. Watcharapol Subwat

Signed : Mr. Pisod Promsri

(Authorized Signatory)

for the Chief

Sub-Standard Instrument

Mr. Watcharapol Subwat

Mechanical Engineer

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

19 February, 2025

Certification No. 112/25

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Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
Ultrasonic Anemometer	m/sec	inches H2O	inches H2O	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.02	-	-	-	11.0	0.02
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Vane Angel Bench Stand Model 18112	
Young Meteorological Instruments	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by : Mr. Watcharapol Subwat

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 112/25

19 February, 2025

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1012.05	1012	0.06
1011.25	1011	0.25
1012.92	1013	-0.08
1010.09	1010	0.09
1008.87	1009	-0.13
1010.43	1011	-0.57
1011.39	1011	0.39
1011.05	1011	0.05
1010.72	1011	-0.28
1010.30	1010	0.30
1009.81	1010	-0.19
1008.93	1009	-0.07
1009.35	1009	0.36
1009.89	1010	-0.11
1010.57	1010	0.57
1011.41	1011	0.41
1012.31	1012	0.31
1009.75	1010	-0.25
1010.67	1011	-0.33
1011.01	1011	0.01

Average

0.04

Calibrated by : Mr. Watcharapol Subwat

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

19 February, 2025

Certification No. 112/25

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
759.10	759	0.10
758.50	758	0.50
759.75	760	-0.25
757.63	758	-0.37
756.71	757	-0.29
757.88	758	-0.12
758.60	758	0.60
758.35	758	0.35
758.10	758	0.10
757.79	758	-0.21
757.42	757	0.42
756.76	757	-0.24
757.07	757	0.07
757.48	757	0.48
757.99	758	-0.01
758.62	759	-0.38
759.29	759	0.29
757.37	757	0.37
758.06	758	0.06
758.32	758	0.32

Average

0.09

Calibrated by : Mr. Watcharapol Subwat

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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

The Result of Calibration

19 February, 2025

Certification No. 112/25

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.5	46	-0.5
30.4	30	0.4
15.6	15	0.6

Calibrated by:

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 19 February, 2025

Certification No. 108/25

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2111DR0058

Wind Sensor 2111DT0058

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1012.0 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

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

N.I.S.T. Test Reference Number 731241460 : Standard Velocity at 20 - 30 m/sec

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

Serial Number 110730029 (sensor 120629586)

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

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

: Iwato, Iwato 645 Serial No. 02848057 : Thermoschneider No.919802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. K4320001

Calibrated by: Mr. Watcharapol Subwat

Mechanical Engineer

Signed:

Mr. Pirod Promsat

(Authorised Signatory)

for the Chief

Sub-Standard Instrument

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

19 February, 2025

Certification No. 108/25

Page : 2 of 5

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches HgO	Vacuum inches HgO	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.02	-	-	-	11.0	0.02
13.01	-	-	-	12.9	0.11
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Vane Angel Bench Stand Model 18112

Young Meteorological Instruments

WIND DIRECTION		TESTED WIND DIRECTION	
0		0	
90		90	
180		180	
270			

Calibrated by:

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

19 February, 2025

Certification No. 108/25

Page : 3 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mbar
1012.05	1012	0.05
1011.25	1011	0.25
1012.92	1013	-0.08
1010.09	1010	0.09
1008.67	1009	-0.13
1010.43	1010	0.43
1011.39	1011	0.39
1011.05	1011	0.05
1010.72	1011	-0.28
1010.30	1010	0.30
1009.81	1010	-0.19
1008.93	1009	-0.07
1009.35	1009	0.35
1009.89	1010	-0.11
1010.57	1011	-0.43
1011.41	1012	-0.59
1012.31	1012	0.31
1009.75	1010	-0.25
1010.67	1011	-0.33
1011.01	1011	0.01
Average		

Calibrated by:

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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

The Result of Calibration

Certification No. 108/25

19 February, 2025

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
759.10	759	0.10
758.50	758	-0.50
759.75	760	-0.25
757.63	758	-0.37
756.71	757	-0.29
757.88	758	-0.12
758.60	759	-0.40
758.35	758	0.35
758.10	758	0.10
757.79	758	-0.21
757.42	757	0.42
756.76	757	-0.24
757.07	757	0.07
757.48	758	-0.52
757.99	758	-0.01
758.62	758	0.62
759.29	759	0.29
757.37	757	0.37
758.06	758	0.06
758.32	758	0.32

Average

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer



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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 108/25

19 February, 2025

Page : 5 of 5

Standard Temp.	Temperature Sensor Reading	
	Reading	Correction
°C	°C	°C
45.5	45	0.5
30.4	30	0.4
15.6	16	-0.4

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau



เอกสารไม่ควบคุม

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/19 MOO 13, SOI SUTINSALORN 11 TAMBON BANG KHAO,
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10140 THAILAND
TEL : 0669-2116-5900-1 FAX: 0669-2116-7140



Page 1 of 3

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-091
Request No : Req-2024-1380

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : SVANTEK
Model : SV 36
Serial Number : 107224
ID : UAE-EFM.171/2564

Class : 1
Range : 94, 114 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details

Temperature : (23 ± 2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ± 10.0 hPa)
Received Date : 24 June 2024
Calibration Date : 26 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. Noppadon Luangart
Service Calibration Engineer

Approved By :

Mr. Pachi Muthavorn
Calibration Engineer Supervisor

Issue Date : 26 June 2024

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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/19 MOO 13, SOI SUTINSALORN 11 TAMBON BANG KHAO,
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10140 THAILAND
TEL : 0669-2116-5900-1 FAX: 0669-2116-7140



Page 2 of 3

Certificate No : 24-ACT-091

Request No : Req-2024-1380

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)	Result
	Measured	Deviated value	Measured	Deviated value			
94 dB / 1000 Hz	94.02	0.02	-	-	0.14	0.25	Pass
114 dB / 1000 Hz	114.05	0.05	-	-	0.13	0.25	Pass

Frequency of Sound pressure level

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

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

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)	Result
	Measured (%)		Measured (%)				
94 dB / 1000 Hz	0.24		-		0.40	2.5	Pass
114 dB / 1000 Hz	0.44		-		0.40	2.5	Pass

Note :

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

Acceptance limit was IEC60942:2017 Class 1

The calibration results exclude the calibrator pressure correction

The calibration results exclude the microphone volume correction

เอกสารไม่ควบคุม

Certificate No : 24-ACT-091
Request No : Req-2024-1380

Decision Rule for Statements of Conformity

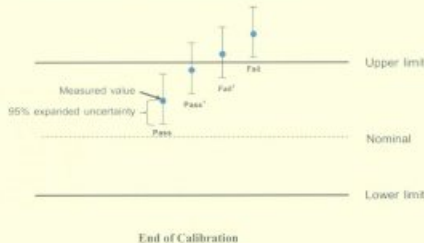
The standard decision rule employed for the statements of conformity in each calibration result will be applied using ILAC-GR-08:2018 Guidelines on the Reporting of Compliance with Specification as following Fig and statements:

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

Pass⁵ - The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail⁵ - 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 Issuing Body.
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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), PRMLxT2C (Preamplifier)

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

ID No.: UAE.EFM.033/2564

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

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

Received Date: 25 July 2024

Calibrated Date: 5 - 6 August 2024

Issued Date: 7 August 2024

Calibrated by: Ms. Juntaporn Kunhakom

Approved by:
(Mr. Sittichai Swaksuriyawong)
Group Manager

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 of Calibration

Certificate No.: CP20240291EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)
Model/Type: LxT2 (Meter), 375A04B02 (Microphone), PRMLxT2C (Preamplifier)
Serial No.: 0005396 (Meter), 329350 (Microphone), 073805 (Preamplifier)
ID No.: UAE.EFM.033/2564
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa

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

Condition of this result of calibration

1. Reference standards instrument :-

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

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

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

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

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

Certificate of Calibration

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 (dB)	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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F-CAL-005 Ed.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
	0.25	130.0	0.0	±1.0
LAE	2	110.0	0.0	+1.0 ; -2.5
	0.25	101.0	0.0	+1.5 ; -5.0

Function : 9. Peak C sound level

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

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
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	0.55
10) Overload indication	0.20	0.25
11) High-Level Stability	0.10	0.10

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

-- End of Report --

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INNOVATIVE INSTRUMENT CALIBRATION LAB

INNOVATIVE INSTRUMENT CO., LTD. (HEAD OFFICE)

7/19 MOO 15, SOI SUTINAKORN 11 TAMBON BANG KALAI,

AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10940 THAILAND

TEL : 0840-2116-5900 FAX: 0840-2116-7140



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Certificate of Calibration

Customer		Certificate No : 24-SLM-214
Name	UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.	
Address	81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260	Request No : Req-2024-1379

Unit Under Calibration Details

Measurement item :	Sound Level Meter	Microphone Class : 2
Manufacturer :	Lamon Davis	Microphone Model : 375A04
Model :	LxT2	Microphone S/N : 328675
Serial Number :	0005398	Preamplifier Model : PRMLxT2C
ID :	UAE.EPM.035/2504	Preamplifier S/N : 073793
Resolution :	0.1 dB	Instrument Status : Used

Calibration Environment and Details


Temperature :	23 °C ± 2 °C
Humidity :	50 %RH ± 20 %RH
Barometric Pressure :	1013 hPa ± 10 hPa
Received Date :	24 June 2024
Calibrated Date :	2 July 2024
Calibration Procedure :	In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration :	Lab Acoustic


Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	FFA100234	26 July 2024	TSI
Audio Generator	Svantek	Scans01	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. Noppodon Luangn
Service Calibration Engineer

Approved By : 
Mr. Paik Mathavom
Calibration Engineer Supervisor
Issue Date : 2 July 2024

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

F30-708-01.24-01 Rev.04 Issue date 5/6/24

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Certificate No : 24-SLM-214
Request No : Req-2024-1379

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR	1 (± dB)	Limit	
Calibrator Setting (dB)		(dB)	(dB)	(dB)	(dB)		(± dB)	
1050 Hz 114 dB	113.76	114.0	0.24	113.8	-0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 59079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	28.8	0.10

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

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

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

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

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FSM-708-0234-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-214
Request No : Req-2024-1379

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

6. Frequency and time weightings at 1kHz

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

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FSM-708-0234-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-214
Request No : Req-2024-1379

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	REF	UUC	ERR	(± dB)	Limit	
STD dB	(dB)	(dB)	(dB)		(± dB)	
120.00	139	139.0	0.0	0.30	1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
128.00	129	129.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	93.9	-0.1		1.1	Pass
89.00	89	88.8	-0.1		1.1	Pass
84.00	84	83.9	-0.1		1.1	Pass
79.00	79	78.9	-0.1		1.1	Pass
74.00	74	73.9	-0.1		1.1	Pass
69.00	69	68.9	-0.1		1.1	Pass
64.00	64	63.9	-0.1		1.1	Pass
59.00	59	58.9	-0.1		1.1	Pass
54.00	54	53.9	-0.1		1.1	Pass
49.00	49	49.0	0.0		1.1	Pass
44.00	44	44.0	0.0		1.1	Pass
39.00	39	39.3	0.3		1.1	Pass
34.00	34	34.4	0.4		1.1	Pass

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FSM-708-0234-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-214
Request No : Req-2024-1379

9. Level linearity including the level range control

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

10. Tone burst response

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

11. Peak C Sound level

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

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FSM-708-0234-01 Rev.04 Issue date 5/6/24



Certificate No : 24-SLM-214
Request No : Req-2024-1379

12. Overload indication

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

13. High Level Stability

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

Note :

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

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

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FSM-700-SLM-01 Rev.04 Issue date 9-6-24



Certificate No : 24-SLM-214
Request No : Req-2024-1379

Decision Rule for Statements of Conformity

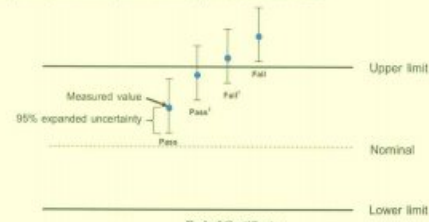
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09:2019. Guidelines on the Reporting of Compliance with Specification as following Fig. and statements:

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

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

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

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



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FSM-700-SLM-01 Rev.04 Issue date 9-6-24



ELECTRICAL AND ELECTRONICS INSTITUTE FOUNDATION FOR INDUSTRIAL DEVELOPMENT

975 Moo 4, Bangpoo Industrial Estate, Soi 8, Sukhumvit Road km 37,
Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280
Tel: +66 2709 4860 Fax: +66 2324 0917



Certificate No.: CP20240293EA
Operation No.: CP2024070256

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)
Model/Type: LxT2 (Meter), 375B02 (Microphone), PRLxT2B (Preamplifier)
Serial No.: 0005399 (Meter), 11789 (Microphone), 056125 (Preamplifier)
ID No.: UAE.EFM.036/2564
Customer: United Analyst and Engineering Consultant Co.,Ltd.
Address: 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak Phrakhanong, Bangkok 10260
Received Date: 25 July 2024
Calibrated Date: 6 - 7 August 2024
Issued Date: 7 August 2024
Calibrated by: Ms. Juntaporn Kunhakom

Approved by:
(Mr. Sittichai Swaksuriyawong)
Group Manager

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

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

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ELECTRICAL AND ELECTRONICS INSTITUTE FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240293EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)
Model/Type: LxT2 (Meter), 375B02 (Microphone), PRLxT2B (Preamplifier)
Serial No.: 0005399 (Meter), 11789 (Microphone), 056125 (Preamplifier)
ID No.: UAE.EFM.036/2564
Ambient Temperature: (23 \pm 2) °C
Relative Humidity: (50 \pm 15) %
Pressure: (101.3 \pm 1.5) kPa

Method of Calibration :-

IEC 61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

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

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

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

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

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

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Certificate No.: CP20240293EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
30.6

2.2 Microphone replaced by the electrical input signal device

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

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

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

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

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

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

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F-CAL-005 Ed.1

Certificate No.: CP20240293EA

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	43.2	0.2	±1.1
42.0	42.2	0.2	±1.1
41.0	41.3	0.3	±1.1
40.0	40.4	0.4	±1.1

Function : 8. Tone burst response

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

Function : 9. Peak C sound level

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

Function : 10. Overload indication

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

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F-CAL-005 Ed.1

Certificate No.: CP20240293EA

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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F-CAL-005 Ed.1

Certificate No.: CP20240293EA

Calibration Report

Function : 11. High-Level Stability

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

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

Uncertainty of measurement

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

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

-- End of Report --

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F-CAL-005 Ed.1

Certificate No : 24-SLM-236
Request No : Req-2024-1455

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / A	REF	UUC	ERR			
UUC Range	(dB)	(dB)	(dB)			
37-139	46.00	46.1	0.1	0.30	1.1	Pass
	134	134.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY (± dB)	Acceptance	Result
A / 37-139	Touchburst	Ref	UUC	ERR		Limit	
UUC Time Response	(ms)	(dB)	(dB)	(dB)		(± dB)	
Fast	200	135.0	135.0	0.0	0.20	1.0	Pass
	2	118.0	117.8	-0.2		+1.0, -2.5	Pass
	0.25	109.0	108.5	-0.5		+1.5, -5.0	Pass
Slow	200	128.6	128.5	-0.1		1.0	Pass
	2	109.0	108.8	-0.2		+1.0, -5.0	Pass
	200	129.0	129.0	0.0		1.0	Pass
SEL	2	109.0	109.0	0.0		+1.0, -2.5	Pass
	0.25	100.0	99.7	-0.3		+1.5, -5.0	Pass

11. Peak C Sound level

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

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

เอกสารไม่ควบคุม

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

Certificate No : 24-SLM-236
Request No : Req-2024-1455

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)		(± dB)	
Positive one-half cycle	144.9			
Negative one-half cycle	144.9			
Deviated	0.0	0.20	1.5	Pass

13. High Level Stability

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

Note :

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

* Acceptance limit and Maximum-permitted Uncertainty was IEC 61072-3:2013

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

Certificate No : 24-SLM-236
Request No : Req-2024-1455

Decision Rule for Statements of Conformity

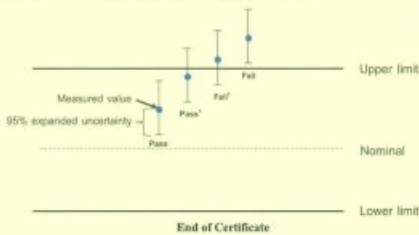
The standard decision rule employed for the statements of conformity to each calibration result will be applied using IAC-08/09/2019; Guidance on the Reporting of Compliance with Specification as following Fig. and statements

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

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

เอกสารไม่ควบคุม

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

บริษัท อีเอส อีควิปเมนต์ เซอร์วิส จำกัด
EES

Envi Equipment Service Co., Ltd.

110/254 Moo 3, Tambon Bang Rak Phuthana, Amphur Bang Bua Thong, Nonthaburi 11110
Tel. 098 362 9152, 089 478 7885
E-mail: sales@envi-ees.com

Certificate No.: E24-080074
Page.: 1 of 6

CERTIFICATE OF CALIBRATION

Customer	: United Analyst and Engineering Consultant Co., Ltd.
Address	: 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Description of Equipment	: Console meter
Manufacturer	: Apex Instrument
Model Number	: XC-572-V
Serial Number	: 0807047
ID/Control No.	: UAE.ANV 212/2551
Environment Conditions	: Temperature (25 \pm 2) °C Humidity (50 \pm 15) % RH
Cal. Date	: 26/08/2024
Issue Date	: 26/08/2024

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

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

Result of Calibration

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

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

Calibrated by : Mr. Sanya Sangnil

Approved by :
(Mr. Mana Fekhud)
Technical Manager

เอกสารไม่ควบคุม

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

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	26/08/2024	01:10 PM	Std Temp	293	K
Console Serial Number	0807047	Calibration Reference No.	SER24-080032			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	755.91	mmHg		K _i	0.386	
DGM Serial Number	00003580	Calibration Meter Gamma	1.001			Console Leak Check	PASS	

Calibration Data									
Metering Console					Calibration Meter				
Run Time	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
Elapsed									
(Q)	(P _w)	(V _{in})	(V _{out})	(t _{in})	(t _{out})	(V _w)	(V _{wf})	(t _{in})	(t _{out})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
11.88	13.0	1160.277	1160.417	24	24	249.83548	249.97320	25	25
11.87	13.0	1160.417	1160.557	23	23	249.97320	250.11036	25	25
8.47	26.0	1160.565	1160.705	23	23	250.11794	250.25472	25	25
8.43	26.0	1160.705	1160.845	23	23	250.25472	250.39116	25	25
13.70	40.0	1160.856	1161.136	24	24	250.39676	250.67384	25	25
13.63	40.0	1161.136	1161.416	24	24	250.67384	250.94928	25	25
10.27	70.0	1161.428	1161.708	25	25	250.95446	251.23044	25	25
10.23	70.0	1161.708	1161.988	26	26	251.23044	251.50574	25	25
8.98	90.0	1162.001	1162.281	26	26	251.51066	251.78586	24	24
8.95	90.0	1162.281	1162.561	27	27	251.78586	252.06032	24	24



เอกสารไม่ควบคุม

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

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	26/08/2024	01:10 PM	Std Temp	293	K
Console Serial Number	0807047	Calibration Reference No.	SER24-080032			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	755.91	mmHg		K _i	0.386	
DGM Serial Number	00003580	Calibration Meter Gamma	1.001			Console Leak Check	PASS	

Calibration Data									
Results									
Standardized Data					Dry Gas Meter				
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate		Std & Corr	
(V _{inst})	(Q _{inst})	(V _{inst})	(Q _{inst})	(Y)	(ΔY)	(Q _{inst})	(ΔH _g)	(ΔH _g)	(ΔH _g)
m ³	m ³ /min	m ³	m ³ /min			m ³ /min	mm H ₂ O		
0.137	0.012	0.135	0.011	0.981	0.005	0.011	44.831	-0.558	
0.137	0.012	0.134	0.011	0.977	0.001	0.011	45.071	-0.318	
0.137	0.016	0.134	0.016	0.974	-0.003	0.016	46.259	0.870	
0.137	0.016	0.133	0.016	0.971	-0.005	0.016	46.125	0.736	
0.275	0.020	0.271	0.020	0.985	0.008	0.020	45.532	0.143	
0.275	0.020	0.269	0.020	0.979	0.002	0.020	45.628	0.240	
0.276	0.027	0.270	0.026	0.978	0.001	0.026	45.368	-0.021	
0.276	0.027	0.269	0.026	0.976	-0.001	0.026	45.297	-0.092	
0.277	0.031	0.270	0.030	0.973	-0.003	0.030	44.935	-0.454	
0.277	0.031	0.269	0.030	0.971	-0.006	0.030	44.843	-0.546	
				0.977	Y Average			45.389	ΔH _g Average

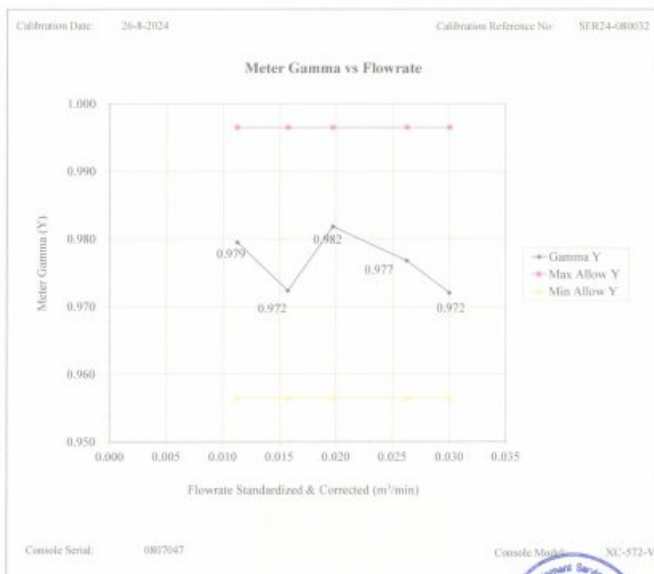
Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ± 0.02 .

For ΔH_g , orifice pressure differential that equates to 0.75 cfm (0.0212 m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ± 0.2 inches (5.1mm) H₂O.



เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	26/08/2024	01:10 PM	Std Temp	293	K
Console Serial Number	0807047	Calibration Reference No.	SER24-080032			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	755.91	mmHg		K _i	0.386	
DGM Serial Number	00003580	Calibration Meter Gamma	1.001			Console Leak Check	PASS	



เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	26/08/2024	01:10 PM	Std Temp	293	K
Console Serial Number	0807047	Calibration Reference No.	SER24-080032			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	755.91	mmHg		K _i	0.386	
DGM Serial Number	00003580	Calibration Meter Gamma	1.001			Console Leak Check	PASS	



เอกสารไม่ควบคุม

THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information	
Console Model Number	XC-572-V
Console Serial Number	0807047
DGM Model Number	SK25EX
DGM Serial Number	00003080
Meter Box Model Number	JENCO 765 KF
Meter Box Serial Number	JC 19778

Calibration Conditions			
Date	Time	26/08/2024	03:10 PM
Calibration Reference No.		SER24-080032	
Reference Thermometer		DIGICON	
Serial Number		183169105	

Results										
Console Thermocouple Simulator										
Channel and test point	Meter Box Channel Temperature Reading (°C)									
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0
Stack	-17.0	25.0	38.0	92.0	147.0	256.0	368.0	485.0	590.0	814.0
Aux	-17.0	25.0	38.0	92.0	147.0					
Probe	-17.0	25.0	38.0	92.0	147.0					
Filter	-17.0	25.0	38.0	92.0	147.0					
Oven	-17.0	25.0	38.0	92.0	147.0					
Exit	-17.0	25.0	38.0							

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



เอกสารไม่ควบคุม

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

Meter Console Information		Calibration Conditions				Factors/Conversions			
Console Model Number	XC-572-V	Date	Time	21/08/2024	10:00 AM	Std Temp	293	K	
Console Serial Number	1904011	Calibration Reference No.		SER24-070026		Std Press	760	mm Hg	
DGM Model Number	SK25EX	Barometric Pressure		758.16		K _i	0.386		
DGM Serial Number	00008685	Calibration Meter Gamma		1.001		Console Leak Check	PASS		

Calibration Data									
Metering Console					Calibration Meter				
Run Time	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
Elapsed (Q)	(P ₀)	(V _{in})	(V _{out})	(t _{in})	(t _{out})	(V _{in})	(V _{out})	(t _{in})	(t _{out})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
11.97	13.0	1.2810	1.4210	30	30	247.58494	247.72266	28	28
12.02	13.0	1.4210	1.5610	30	30	247.72266	247.86142	27	27
8.43	26.0	1.5680	1.7080	29	29	247.86722	248.00508	27	27
8.40	26.0	1.7080	1.8480	29	29	248.00508	248.14262	26	26
13.78	40.0	1.8550	2.1350	29	29	248.15146	248.42930	26	26
13.82	40.0	2.1350	2.4150	29	29	248.42930	248.70800	26	26
10.28	70.0	2.4270	2.7070	30	30	248.71530	248.99226	25	25
10.33	70.0	2.7070	2.9870	30	30	248.99226	249.27106	25	25
8.95	90.0	3.0020	3.2820	31	31	249.27896	249.55508	25	25
8.92	90.0	3.2820	3.5620	31	31	249.55508	249.83062	25	25



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CERTIFICATE OF CALIBRATION

Customer	: United Analyst and Engineering Consultant Co., Ltd.
Address	: 81 Soi Udomsuk 41, Sukhumvit Road, Bangehak, Phrakhanong, Bangkok 10260
Description of Equipment	: Console meter
Manufacturer	: Apex Instrument
Model Number	: XC-572-V
Serial Number	: 1904011
ID/Control No.	: UAE.EFM 118/2562
Environment Conditions	: Temperature (25 ± 2) °C
	: Humidity (50 ± 15) % RH
Cal. Date	: 21/08/2024
Issue Date	: 21/08/2024

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

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

Result of Calibration

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

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

Calibrated by : Mr. Sanya Sangnil

Approved by : (Mr. Mana Fuchud)

Technical Manager

เอกสารไม่ควบคุม

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

Meter Console Information		Calibration Conditions				Factors/Conversions			
Console Model Number	XC-572-V	Date	Time	21/08/2024	10:00 AM	Std Temp	293	K	
Console Serial Number	1904011	Calibration Reference No.		SER24-070026		Std Press	760	mm Hg	
DGM Model Number	SK25EX	Barometric Pressure		758.16		K _i	0.386		
DGM Serial Number	00008685	Calibration Meter Gamma		1.001		Console Leak Check	PASS		

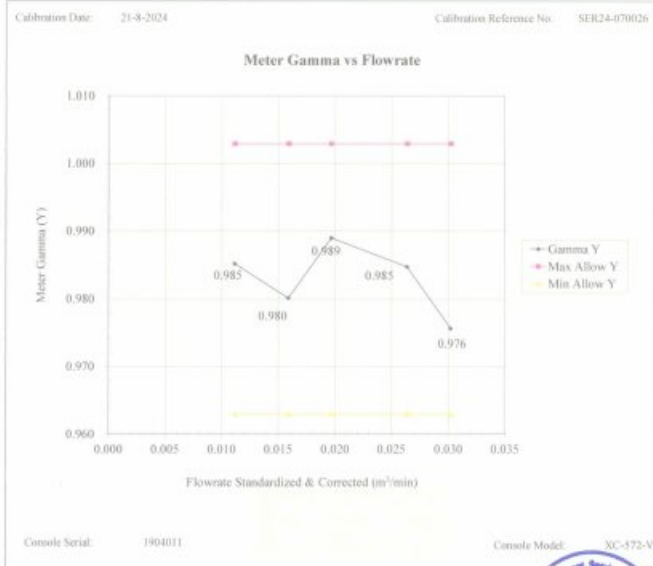
Calibration Data									
Results									
Standardized Data					Dry Gas Meter				
Dry Gas Meter (V _{in})	Calibration Meter (Q _{in})	Value (V _{out})	Variation (ΔY)	Flowrate (Q _{out})	Std & Corr (ΔH _g)		Variation (ΔH _g)		
					Value	Flowrate			
m ³	m ³ /min	m ³	m ³ /min	m ³ /min	mm H ₂ O				
0.136	0.011	0.134	0.011	0.981	-0.001	0.011	45.783	0.623	
0.137	0.011	0.135	0.011	0.989	0.006	0.011	45.326	0.166	
0.137	0.016	0.134	0.016	0.981	-0.002	0.016	45.347	0.187	
0.137	0.016	0.134	0.016	0.979	-0.004	0.016	45.048	-0.112	
0.275	0.020	0.271	0.020	0.987	0.005	0.020	45.852	0.692	
0.275	0.020	0.272	0.020	0.991	0.008	0.020	45.790	0.630	
0.276	0.027	0.271	0.026	0.981	-0.001	0.026	45.058	-0.102	
0.276	0.027	0.273	0.026	0.988	0.005	0.026	44.899	-0.261	
0.277	0.031	0.271	0.030	0.977	-0.006	0.030	44.320	-0.840	
0.277	0.031	0.270	0.030	0.975	-0.008	0.030	44.176	-0.984	
0.983 Y Average							45.160	ΔH _g Average	

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

For ΔH_g, orifice pressure differential that equates to 0.75 cfm (0.0212 m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm) H₂O.

เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	21/08/2024	10:00 AM	Std Temp	293	K
Console Serial Number	1904011	Calibration Reference No.	SER24-070026			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	758.16			K ₁	0.386	
DGM Serial Number	00008685	Calibration Meter Gamma	1.001			Console Leak Check	PASS	



เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	21/08/2024	10:00 AM	Std Temp	293	K
Console Serial Number	1904011	Calibration Reference No.	SER24-070026			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	758.16			K ₁	0.386	
DGM Serial Number	00008685	Calibration Meter Gamma	1.001			Console Leak Check	PASS	



เอกสารไม่ควบคุม

THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions			
Console Model Number	XC-572-V	Date	Time	21/08/2024	00:00 PM
Console Serial Number	1904011	Calibration Reference No.	SER24-070026		
DGM Model Number	SK25EX	Reference Thermometer	DIGICON		
DGM Serial Number	00008685	Serial Number	183169105		
Meter Box Model Number	JENCO 765 KF				
Meter Box Serial Number	JC 17215				

Results											
Console Thermocouple Simulator											
Channel and test point	Meter Box Channel Temperature Reading (°C)										
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	1038.0
Stack	-19.0	24.0	37.0	93.0	148.0	257.0	368.0	477.0	586.0	805.0	1025.0
Aux	-19.0	24.0	37.0	93.0	148.0						
Probe	-19.0	24.0	37.0	93.0	148.0						
Filter	-19.0	24.0	37.0	93.0	148.0						
Oven	-19.0	24.0	37.0	93.0	148.0						
Exit	-19.0	24.0	37.0								

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



เอกสารไม่ควบคุม

Instrument description	Flue Gas Analyzer
Instrument model	Testo 350 New
Instrument serial no.	60723967/609
Control unit serial no.	03064673/609
ID no. or control no.	UAE.EFM.027/2559
Manufacturer	Testo SE & Co. KGaA
Probe description	-
Probe model	-
Probe serial no.	-
Customer name	UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Customer address	81 SOI UDOMSUKHAI, SUKHUMVIT ROAD, BANGCHAK PRAKONG BANGKOK 10260

Total pages of certificate	2 Pages
Receiving no.	L-243478
Receiving date.	06-Sep-24
Parameter of calibration	Gas Calibration(Oxygen 2.50,10.04,21.02 %vol, Carbon Monoxide 80.18,302,1007 ppm, Nitrogen Dioxide 30.68,81.32,201.9 ppm, Nitric Oxide 30.01,151.5,322.5 ppm, Sulphur Dioxide 50.36,100.8,600.8 ppm)
Condition of UUC.	Used
Ambient condition	All of the Measurement were carried out the stabilized laboratory Temperature : 23 ± 5 °C Humidity : 55 ± 15 %RH
Calibration place	17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Lakso, Bangkok 10210
Calibration procedure no.:	This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

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

Date of calibration : 13-Sep-24

Kunmethip
Mr. Kwanchai Khamboung
Calibration Technician

Wittu
Mrs. Nongluk Wongsettee
Technical Manager

เอกสารไม่ควบคุม

Certificate No.: G 670643

Certificate No: G 670763
Date of issue : 31-Oct-24

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O2) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen (O2) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O2) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.18 ppm	CG-0002-24	Nimt	11-Jan-29
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1007 ppm	1870/24	Linde	17-Jun-26
Nitrogen Dioxide (NO2) 30.68 ppm	2832/24	Linde	08-Sep-26
Nitrogen Dioxide (NO2) 81.8 ppm	3546/23	Linde	14-Jan-26
Nitrogen Dioxide (NO2) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide (NO) 30.01 ppm	CG-0014-23	Nimt	19-Feb-25
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (SO2) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO2) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO2) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 22.7 °C Humidity : 61.2 %RH Pressure : 1010.7 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1013.8 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.50	2.47	-0.03	0.15
O2 (%Vol)	10.04	10.11	0.07	0.20
O2 (%Vol)	21.02	21.12	0.10	0.30
CO (ppm)	80.18	81	0.82	3.0
CO (ppm)	302	304	2	6.0
CO (ppm)	1007	1011	4	12
NO2 (ppm)	30.68	32.9	2.56	8.0
NO2 (ppm)	81.82	80.2	-1.12	8.0
NO2 (ppm)	201.9	204.2	2.3	12
NO (ppm)	30.01	31	0.99	8.0
NO (ppm)	151.5	154	2.5	8.0
NO (ppm)	322.5	324	1.5	12
SO2 (ppm)	50.36	51	0.64	6.0
SO2 (ppm)	100.8	100	-0.8	6.0
SO2 (ppm)	600.8	598	-2.8	13

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

End of Report

FM-CL-09-C Rev.8

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Issued Date 26/02/16

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ENTECH INDUSTRIAL SOLUTION CO.,LTD.

17/121 Soi Ngarnwongwan 47 Yaek 48, Toongsonghong, Laks, Bangkok 10210 THAILAND Tel: 0-2779-8888 Fax: 0-2779-8889 info@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

Certificate No.: G 670763

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O2) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen (O2) 9.984 % Vol	CG-0113-24	Nimt	01-Aug-29
Oxygen (O2) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.18 ppm	CG-0002-24	Nimt	11-Jan-29
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1007 ppm	1870/24	Linde	17-Jun-26
Nitrogen Dioxide (NO2) 30.68 ppm	2832/24	Linde	08-Sep-26
Nitrogen Dioxide (NO2) 81.8 ppm	2330/24	Linde	01-Aug-26
Nitrogen Dioxide (NO2) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide (NO) 30.0 ppm	CG-0065-24	Nimt	06-May-26
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (SO2) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO2) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO2) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 23.2 °C Humidity : 67.4 %RH Pressure : 1010.1 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1013.5 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.50	2.46	-0.04	0.15
O2 (%Vol)	9.984	9.92	-0.064	0.20
O2 (%Vol)	21.02	21.14	0.12	0.30
CO (ppm)	80.18	79	-1.18	3.0
CO (ppm)	302	302	0	6.0
CO (ppm)	1007	1005	-2	12
NO2 (ppm)	30.68	32.3	1.62	8.0
NO2 (ppm)	81.8	80.5	-1.3	8.0
NO2 (ppm)	201.9	200.2	-1.7	12
NO (ppm)	30.0	31	1.0	8.0
NO (ppm)	151.5	154	2.5	8.0
NO (ppm)	322.5	322	-0.5	12
SO2 (ppm)	50.36	51	0.64	6.0
SO2 (ppm)	100.8	101	0.2	6.0
SO2 (ppm)	600.8	603	2.2	13

Remark : 1 cmol/mol = 1 %vol, 1 µmol/mol = 1 ppm., Sensor CO, NO, SO2 New Sensor

End of Report

FM-CL-09-C Rev.8

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Issued Date 26/02/16

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ENTECH INDUSTRIAL SOLUTION CO.,LTD.

17/121 Soi Ngarnwongwan 47 Yaek 48, Toongsonghong, Laks, Bangkok 10210 THAILAND Tel: 0-2779-8888 Fax: 0-2779-8889 info@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

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

Total pages of certificate : 2 Pages

Receiving no. : L-244222

Receiving date. : 30-Oct-24

Parameter of calibration : Gas Calibration(Oxygen 2.50,9.984,21.02 %vol, Carbon Monoxide 80.18,302,1007 ppm, Nitrogen Dioxide 30.68, 81.8, 201.9 ppm, Nitric Oxide 30.0, 151.5, 322.5 ppm, Sulphur Dioxide 50.36, 100.8, 600.8 ppm)

Condition of UUC. : Used

Ambient condition : All of the Measurement were carried out the stabilized laboratory

Temperature : 23 ±5 °C

Humidity : 55 ± 15 %RH

Calibration place : 17/121 Soi Ngarnwongwan 47 Yaek 48, Toongsonghong, Laks, Bangkok 10210

Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-2B-C

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

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

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

Date of calibration : 31-Oct-24

Kwanthai
Mr. Kwanthai Khamdoung
Calibration Technician

P. Wuttu
Mrs. Nongluck Wongsettee
Technical Manager

FM-CL-09-C Rev.8

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Issued Date 26/02/16

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ENTECH INDUSTRIAL SOLUTION CO.,LTD.

17/121 Soi Ngarnwongwan 47 Yaek 48, Toongsonghong, Laks, Bangkok 10210 THAILAND Tel: 0-2779-8888 Fax: 0-2779-8889 info@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

INNOVATIVE INSTRUMENT CALIBRATION LAB

INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE

7/139 MOO 11, SOI SUNTEPAKORN, T1, TAMBON, BANG KAO,

AMPHIE, BANG PHLI SAMUT, PRAKAN PROVINCE, 10540 THA

TEL: 0660-2116-5800-1 FAX: 0660-2116-7140



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Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Name : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Request No : Req-2024-1952

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : TSI
Model : 4146
Serial Number : 4146183030
ID : UAE.EFM.102/2561
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	18501010006	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	2 August 2025
Temperature meter	GT 11	06000957	Qecbom	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 : *Thi*
Mr. Noppadol Luangari
Service Calibration Engineer

Approved By : *Mr. P*
Mr. Paiti Mathavom
Calibration Engineer Supervisor
Issue Date : 8 November 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-AFM-01 Rev.04 Issue date 17/6/24

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

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	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	1.010	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	101.95	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 :

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

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

* Indicates non accredited

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

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

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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 17/6/24

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

Decision Rule for Statements of Conformity

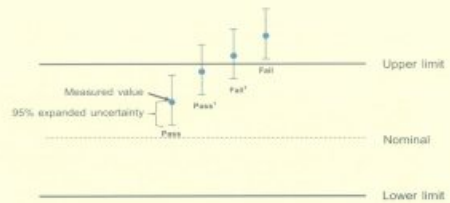
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09-2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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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 17/6/24



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL: 0-2717-3000-24 FAX: 0-2710-9484



Certificate of Calibration

Certificate No. : 25P1359
Page : 1 of 2

Equipment : Aneroid Barometer

Manufacturer: Bango

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

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1009 mbar

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

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

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

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

Condition of this result of calibration

1.Reference standards Instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DP1142	1422505046	MP-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 : Kserkpon Saivichai
Issue Date : 21 April 2025

Approved Signatory: Attapol P.
[] Phalinee Prabpai
[] Sura Suwannasri
[✓] Attapol Panurach

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Cert.No.: 25P1359
Page: 2 of 2

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	728.95	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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Certificate of Calibration

Certificate No.: 24H1486
Page: 1 of 2

Cert. No.: 24H1486
Page.: 2 of 2

Equipment : Digital Thermo-Hygrometer

Manufacturer: Digison

Model : TH-02A

Serial No.: 435031147

ID No.: UAE.EFM.005/2567

Condition As-Received: New Item

Received Date: 10 July 2024

Calibration Date: 15 July 2024

Reference: 2407-0393WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

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

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

Procedure used: Calibration were conducted using in-house calibration procedure CP-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	31853	21618	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, NVLAB Accreditation No. Calibration 200582-0
- Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

Calibrated by : Sunat Phansudol
Issue Date : 17 July 2024

Approved Signatory :

[] Chakrit Wiewwanjua
[✓] Viporn Tantiyawutti
[] Ummaphol Harachai

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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	69	-1.2	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	30.2	0.150	0.42
40.027	40.1	0.073	0.42

UUC* : Unit Under Calibration

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

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SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

401-4B/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel. +66 2431 8331 Email : calibration@sithiporn.com



Cert. No.: ACL25030
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER

Manufacturer : RION

Model : NL-42 / Microphone UC-52 / Preamplifier NH-24

Serial No.: 00709670 / 188531 / 01221

ID No.: UAE.EFM.022/2564

Condition As Found : GOOD

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

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SITHIPORN associates

SITHIPORN ASSOCIATES CALIBRATION LABORATORY

Cert. No.: ACL25030
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).

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Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	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

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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

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Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.6

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

Frequency Weighting	Weighting (dB)
A - weight	12.6
C - weight	18.7
Flat	24.3

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	0.4	0.4	0.4	± 1.0
8000	3.1	3.2	3.2	±5.0

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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.2	0.2	± 1.1
25.0	25.2	0.2	± 1.1

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Cert. No. : ACL25030
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8. Level linearity including the level range control

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

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.9	-0.1	±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	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

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

11. Overload indication

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

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/131 MOO 13, SOE SUTINAKORN II, TAMBON BANG KAO,
AMPHUR BANG PHU SAMUT PRAKAN PROVINCE 10140 THAILAND
TEL : 08-09-2110-5909 / FAX : 08-09-2110-7140



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Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD. Certificate No : 25-SLM-108
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260 Request No : Req-2025-0595

Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2
Manufacturer : RION Microphone Model : UC-52
Model : NL-42 Microphone S/N : 186173
Serial Number : 00408983 Preamplifier Model : NH-24
ID : UAE EFM 010/2564 Preamplifier S/N : 90428
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 5 March 2025
Calibrated Date : 18 March 2025
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61072-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	Briel & Kjaer	4192	2294985	25 June 2025	NIMT
Audio Generator	Svanteck	Svans401	131	15 October 2025	WK Electric

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

Calibrated By : Mr. Noppadol Luangprue
Service Calibration Engineer

Approved By : Mr. Pich Mahavorn
Calibration Engineer Supervisor
Issue Date : 18 March 2025

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
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Certificate No : 25-SLM-108
Request No : Req-2025-0595

1. Indication at the calibration check frequency

UUC Setting	Nominal Level	Before Adjust		After Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)			
FAST / A / 30-130								
Calibrator Setting								
1000 Hz 114 dB	114.02	114.0	-0.03	114.0	-0.03	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTER, Model SV 35, SN44792

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 30-130		
UUC Weighting	(dB)	(± dB)
A	16.3	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	12.6	0.10
C	17.0	0.10
Z	20.1	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A	C	Z			
FAST / 30-130						
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.2	0.4	0.4	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	1.1	1.1	1.1	0.60	3.0	Pass
8000 Hz	0.4	0.4	0.3	0.70	5.0	Pass

Certificate No : 25-SLM-108
Request No : Req-2025-0595

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

UUC Setting	Deviation from various Frequency			UNCERTAINTY	Acceptance	Result
FAST / 30-130	Weighting Response curve				Limit	
STD Setting	A (dB)	C (dB)	Z (dB)	(± dB)	(± dB)	
63 Hz	-0.2	0.0	-0.1	0.20	2.0	Pass
125 Hz	-0.1	0.0	0.0		1.5	Pass
250 Hz	-0.1	0.0	0.0		1.5	Pass
500 Hz	0.0	0.0	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.0	0.1	0.0		2.0	Pass
4000 Hz	0.0	0.0	0.0		3.0	Pass
8000 Hz	0.1	0.1	0.0		5.0	Pass
16000 Hz	-1.3	-1.4	0.0		= 5, -INF	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
FAST / 30-130	REF	UUC	ERR			
UUC Weighting	(dB)	(dB)	(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	Acceptance	Result
30-130 / A	REF	UUC	ERR			
UUC Time Response	(dB)	(dB)	(dB)	(± dB)	(± dB)	
Fast	114.00	114.0	0.0	0.20	0.10	Pass1
Slow	114.00	114.0	0.0		0.10	Pass1
Leq	114.00	114.0	0.0		0.10	Pass1

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Certificate No : 25-SLM-108
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7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 30-130	UUC			
STD Setting	(dB)	(± dB)	(± dB)	
Initial	114.0			
Final	114.0			
Deviated	0.0	0.10	0.30	Pass

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance	Result
FAST / A / 30-130	REF	UUC	ERR			
STD dB	(dB)	(dB)	(dB)	(± dB)	(± dB)	
120.00	138	137.9	-0.1	0.30	1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
128.00	129	128.9	-0.1		1.1	Pass
124.00	124	123.9	-0.1		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	94.0	0.0		1.1	Pass
89.00	89	89.0	0.0		1.1	Pass
84.00	84	84.0	0.0		1.1	Pass
79.00	79	79.0	0.0		1.1	Pass
74.00	74	74.0	0.0		1.1	Pass
69.00	69	69.0	0.0		1.1	Pass
64.00	64	64.0	0.0		1.1	Pass
59.00	59	59.0	0.0		1.1	Pass
54.00	54	54.0	0.0		1.1	Pass
49.00	49	49.0	0.0		1.1	Pass
44.00	44	44.0	0.0		1.1	Pass
39.00	39	39.0	0.0		1.1	Pass
34.00	34	34.0	0.0		1.1	Pass
29.00	29	29.1	0.1		1.1	Pass
24.00	24	24.3	0.3		1.1	Pass

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Certificate No : 25-SLM-108
Request No : Req-2025-0595

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
FAST / A	REF	UUC	ERR			
UUC Range	(dB)	(dB)	(dB)	(± dB)	(± dB)	
30-130	29.30	29.5	0.2	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
A / 30-130	Toneburst	Ref	UUC	ERR			
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)	(± dB)	
Fast	200	126.0	126.0	0.0	0.20	1.0	Pass
	2	109.0	109.0	0.0		+1.0, -2.5	Pass
	0.25	100.0	99.9	-0.1		+1.5, -5.0	Pass
Slow	200	119.6	119.6	0.0		1.0	Pass
	2	100.0	100.0	0.0		+1.0, -5.0	Pass
	200	120.9	120.0	0.0		1.0	Pass
SEL	2	100.0	100.0	0.0		+1.0, -2.5	Pass
	0.25	91.0	90.9	-0.1		+1.5, -5.0	Pass

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
FAST / C / 35-141	REF	UUC	ERR			
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)	
Complete cycle	135.4	135.8	-0.40	0.20	3.0	Pass
Positive half cycle	135.4	135.2	-0.20		2.0	Pass
Negative half cycle	135.4	135.2	-0.20		2.0	Pass

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ISO-700-01 Rev.04 Issue date 5/6/24

Certificate No : 25-SLM-108
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12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 30-130	UUC			
STD Setting	(dB)	(± dB)	(± dB)	
Positive one-half cycle	139.4			
Negative one-half cycle	139.4			
Deviated	0.0	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 30-130	UUC			
STD Setting	(dB)	(± dB)	(± dB)	
Initial	129.0			
Final	129.0			
Deviated	0.0	0.10	0.30	Pass

Note :

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

* Acceptance limit and Maximum permitted Uncertainty was IEC 61672-1:2003

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Certificate No : 25-SLM-108
Request No : Req-2025-0595

Decision Rule for Statements of Conformity

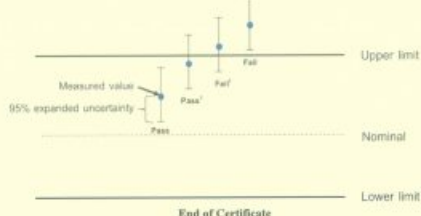
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09-2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



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

ISO 17025-SLM-01 Rev.04 Issue Date 5/6/24

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SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL25230
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00409023 / 185669 / 90468
ID No. : UAE.EFM.011/2564

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 : 26 MAY 2025
Calibration Date : 10 - 11 JUNE 2025
Date of Issue : 13 JUNE 2025

Calibrated by : Nathakorn Pisutpaisan

Approved by : *Wichok B.*
(Wichok Ekpongpradit)

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

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SITHIPORN ASSOCIATES
CALIBRATION LABORATORY

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-0011-25	11-FEB-26
Waveform Generator	33511B	MY52302742	EF-0012-25	11-FEB-26
Digital Multimeter	33461A	MY53220104	EEL-BP 24/0268	22-APR-26
Digital Multimeter	33461A	MY53220076	EEL-BP 23/0268	22-APR-26
Digital Multimeter	34461A	MY60024273	CA2025120EA	18-MAR-26
Programmable Attenuator	MAT-1070	62100114	EF-0006-25	11-FEB-26
Condenser Microphone	4180	2977900	AA-1002-25	19-FEB-26
Measuring Amplifier	NA-42KA1	34560495	AA-3002-25	19-FEB-26

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).
- 3.3 Electrical And Electronics Institute (EEI).

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Cert. No. : ACL25230
Job No. : VC68AC0113
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

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Cert. No. : ACL25230
Job No. : VC68AC0113
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)
15.4

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

Frequency Weighting (dB)	Weighting (dB)
A - weight	12.6
C - weight	18.5
Flat	24.1

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	0.1	0.1	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	2.3	2.4	2.4	±5.0

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Wichan B.

Cert. No. : ACL25230
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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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Cert. No. : ACL25230
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.1	0.1	± 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	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

เอกสารไม่ควบคุม

Wichan B.

Cert. No. : ACL25230
Job No. : VC68AC0113
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	28.9	-0.1	±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	108.0	0.0	1.0 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

เอกสารไม่ควบคุม

Wichan B.

Cert. No. : ACL25230
Job No. : VC68AC0113
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.4	0.0	±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

11. Overload indication

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

เอกสารไม่ควบคุม

Sithiporn P.

Cert. No. : ACL25115
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00558212 / 157973 / 48067
ID No. : UAE.EFM.044/2558

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 : 14 JANUARY 2025
Calibration Date : 28 JANUARY 2025
Date of Issue : 30 JANUARY 2025

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

เอกสารไม่ควบคุม

Cert. No. : ACL25115
Job No. : VC68AC0061
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

Sithiporn P.

Cert. No. : ACL25115
Job No. : VC68AC0061
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

Sithiporn P.

Cert. No. : ACL25115
Job No. : VC68AC0061
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)
16.1

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

Frequency Weighting	Weighting (dB)
A - weight	13.1
C - weight	19.1
Flat	24.8

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	0.5	0.5	0.5	±5.0

Cert. No. : ACL25115
Job No. : VC68AC0061
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	0.0	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	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

เอกสารไม่ควบคุม

T. P. Pohn.

เอกสารไม่ควบคุม

T. P. Pohn.

Cert. No. : ACL25115
Job No. : VC68AC0061
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.1	0.1	± 1.1
30.0	30.2	0.2	± 1.1
29.0	29.2	0.2	± 1.1
28.0	28.2	0.2	± 1.1
27.0	27.3	0.3	± 1.1
26.0	26.3	0.3	± 1.1
25.0	25.4	0.4	± 1.1

เอกสารไม่ควบคุม

T. P. Pohn.

Cert. No. : ACL25115
Job No. : VC68AC0061
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	28.9	-0.1	±1.1

9. Tone burst response

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

เอกสารไม่ควบคุม

T. P. Pohn.

Cert. No. : ACL25115
Job No. : VC68AC0061
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	133.4	0.0	±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		
89.5	89.5	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

เอกสารไม่ควบคุม

T. Petchur

Cert. No. : ACL25028
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00709651 / 188529 / 00801
ID No.: UAE.EFM.019/2564

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 :

T. Petchur
(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. : ACL25028
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

T. Petchur

Cert. No. : ACL25028
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

T. Petchur

Cert. No. : ACL25028
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)
14.6

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

Frequency Weighting	Weighting (dB)
A - weight	11.6
C - weight	17.5
Flat	23.4

3. Acoustical signal tests of frequency weightings

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

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

Cert. No. : ACL25028
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	-0.1	-0.1	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.1

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Cert. No. : ACL25028
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	137.1	0.1	± 1.1
136.0	136.1	0.1	± 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	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.1	0.1	± 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	25.2	0.2	± 1.1

เอกสารไม่ควบคุม

Cert. No. : ACL25028
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	29.1	0.1	±1.1

9. Tone burst response

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

เอกสารไม่ควบคุม

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.1	-0.3	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±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	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Weighting				
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. : ACL25113
Pages : 1 of 8

Calibration Certificate

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

Condition As Found : GOOD

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

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

Received Date : 14 JANUARY 2025
Calibration Date : 28 JANUARY 2025
Date of Issue : 30 JANUARY 2025

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

เอกสารไม่ควบคุม

Cert. No. : ACL25114
Job No. : VC68AC0061
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).

Cert. No. : ACL25114
Job No. : VC68AC0061
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

เอกสารไม่ควบคุม

Cert. No. : ACL25114
Job No. : VC68AC0061
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)
14.8

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

Frequency Weighting	Weighting (dB)
A - weight	11.6
C - weight	17.7
Flat	23.6

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	0.3	0.3	0.3	± 1.5
1000	0.2	0.2	0.2	± 1.0
8000	2.4	2.4	2.4	±5.0

Cert. No. : ACL25114
Job No. : VC68AC0061
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	0.1	0.1	0.0	±1.5
250	0.1	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

เอกสารไม่ควบคุม
T. Pich.เอกสารไม่ควบคุม
T. Pich.Cert. No. : ACL25114
Job No. : VC68AC0061
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.2	0.2	± 1.1

เอกสารไม่ควบคุม
T. Pich.Cert. No. : ACL25114
Job No. : VC68AC0061
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	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

เอกสารไม่ควบคุม
T. Pich.

Cert. No. : ACL25114
Job No. : VC68AC0061
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	133.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	132.9	-0.1	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

11. Overload indication

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

เอกสารไม่ควบคุม

S. Ketchum

Cert. No. : ACL25212
Job No. : VC68AC0105
Pages : 2 of 8

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-0011-25	11-FEB-26
Waveform Generator	33511B	MY52302742	EF-0012-25	11-FEB-26
Digital Multimeter	33461A	MY53220104	EEL_BP 24/0268	22-APR-26
Digital Multimeter	33461A	MY53220076	EEL_BP 23/0268	22-APR-26
Digital Multimeter	34461A	MY60024273	CA2025120EA	18-MAR-26
Programmable Attenuator	MAT-1070	62100114	EF-0006-25	11-FEB-26
Condenser Microphone	4180	2977900	AA-1002-25	19-FEB-26
Measuring Amplifier	NA-42KA1	34560495	AA-3002-25	19-FEB-26

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).
- 3.3 Electrical And Electronics Institute (EEI).

เอกสารไม่ควบคุม

S. Ketchum

Calibration Certificate

Cert. No. : ACL25212
Pages : 1 of 8

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00709656 / 189028 / 01207
ID No. : UAE.EFM.021/2564

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 : 22 MAY 2025
Calibration Date : 04 JUNE 2025
Date of Issue : 05 JUNE 2025

Calibrated by : Nathakorn Pisutpaisan

Approved by :

Wichok E.
(Wichok Ekpongpradit)

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. : ACL25212
Job No. : VC68AC0105
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

S. Ketchum

Cert. No. : ACL25212
Job No. : VC68AC0105
Page : 4 of 8

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)
14.8

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

Frequency Weighting	Weighting (dB)
A - weight	11.6
C - weight	17.6
Flat	23.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.3	0.2	± 1.5
1000	0.2	0.2	0.2	± 1.0
8000	1.0	1.0	1.2	± 5.0

เอกสารไม่ควบคุม

Sithiporn B.

Cert. No. : ACL25212
Job No. : VC68AC0105
Pages : 6 of 8

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	131.9	-0.1	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

เอกสารไม่ควบคุม

Sithiporn B.

Cert. No. : ACL25212
Job No. : VC68AC0105
Pages : 5 of 8

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

เอกสารไม่ควบคุม

Sithiporn B.

Cert. No. : ACL25212
Job No. : VC68AC0105
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	28.8	-0.2	±1.1

9. Tone burst response

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

เอกสารไม่ควบคุม

Sithiporn B.

Cert. No. : ACL25212
Job No. : VC68AC0105
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.4	0.0	±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

11. Overload indication

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

เอกสารไม่ควบคุม

PM-709-NDM-01 Rev.05 Issue date 2/9/24

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 : 25-NDM-064
Request No : Req-2025-0466

Unit Under Calibration Details

Measurement Item : Noise Dosimeter
Microphone Class : 2
Manufacturer : SVANTEK
Microphone Model : SV 2715
Model : SV 1045
Microphone S/N : 103527
Serial Number : 128473
Preamplifier Model : -
ID : UAEFTM085/2566
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 hPa ± 10 hPa
Received Date : 19 February 2025
Calibrated Date : 17 March 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	2294985	25 June 2025	NIMT
Audio-Generator	Svsmok	SVAN 401	131	15 October 2025	WK Electric
Timer	EXTech	-	95-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 Luangnit
Service Calibration Engineer

Approved By :
Mr. Paitt Mathavorn
Calibration Engineer Supervisor
Issue Date : 17 March 2025

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

เอกสารไม่ควบคุม

PM-709-NDM-01 Rev.05 Issue date 2/9/24

Certificate No : 25-NDM-064
Request No : Req-2025-0466

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)	Result
	Ref	UUC	Ref (Pa ² h)	UUC (Pa ² h)	Error (%)			
FAST / A / 60-140 Calibrator Setting	(s)	(s)						
1000 Hz 134 dB	120	120	3.37	3.36	-0.3	3.1	-21, +26	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35, SN: 44792

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY (± dB)	Tolerances Limit (± dB)	Result
	A	C			
FAST / 60-140 STD Setting	(dB)	(dB)			
*63 Hz	0.1	0.0	0.40	2.0	Pass
125 Hz	-0.2	0.0	0.40	1.5	Pass
250 Hz	-0.3	-0.2	0.40	1.5	Pass
500 Hz	-0.2	-0.1	0.40	1.5	Pass
1000 Hz	0.0	0.0	0.40	-	-
2000 Hz	0.7	0.7	0.40	2.0	Pass
4000 Hz	1.5	1.5	0.40	3.0	Pass
8000 Hz	3.4	3.7	0.40	5.0	Pass

Certificate No : 25-NDM-064
Request No : Req-2025-0466

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)	60.0	80.0	90.0	100.0	110.0	114.0	120.0	140.0
1000 Hz	Level A	(dB)	60.1	80.3	90.3	100.1	110.0	114.0	120.0	140.0
	Error	(dB)	0.1	0.3	0.3	0.1	0.0	0.0	0.0	0.0
	Ref	(dB)	88.9	98.9	108.9	112.9	118.9	128.9	138.9	
8000 Hz	Level A	(dB)	89.0	98.9	108.9	112.9	118.9	128.9	138.9	
	Error	(dB)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
	Ref	(dB)	87.8	93.8	103.8	113.8	123.8	133.8	143.8	
63 Hz	Level A	(dB)	87.8	93.8	103.8	113.8	123.8	133.8	143.8	
	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 Limit (%)	Result
	Ref	UUC	Ref (Pa ² h)	UUC (Pa ² h)	Error (%)			
FAST / A / 60-140 Calibrator Setting	(s)	(s)						
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	10.13	+1.30			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

Certificate No : 25-NDM-064
Request No : Req-2025-0466

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)	(Pa ² ·h)	
4000 Hz 95 dB	2846	2846	1.00	0.98	-0.02	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	0.98	-2.00	5.6	-21 ~ +26	Pass
Burst 1 ms, 100 dB	900	900	1.00	0.98	-2.00		-29 ~ +41	Pass
Burst 1 ms, 108 dB	143	143	1.00	0.99	-1.00		-29 ~ +41	Pass

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement		UNCERTAINTY	Tolerances	Result
FAST / A / 60-140	Ref	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

Certificate No : 25-NDM-064
Request No : Req-2025-0466

Decision Rule for Statements of Conformity

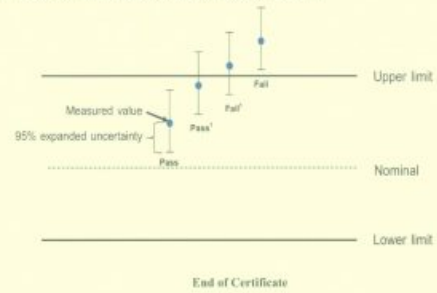
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09 2009. Guidelines on the Reporting of Compliance with Specification as following Fig. and statements.

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 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-063
Request No : Req-2025-0465

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104IS
Serial Number : I28474
ID : UAEJFM.0162566
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 27IS
Microphone S/N : 133728
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 : 19 February 2025
Calibrated Date : 17 March 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	2294985	25 June 2025	NIMT
Audio Generator	SvanteK	SVAN 401	131	15 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 Lumgert
Service Calibration Engineer

Approved By : 
Mr. Paitit Mathavom
Calibration Engineer Supervisor
Issue Date : 17 March 2025

Certificate No : 25-NDM-063
Request No : Req-2025-0465

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	3.37	3.36	-0.3	3.1	-21, +26	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35, SN. 44792

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances	Result
FAST / 60-140	A	C		Limit	
STD Setting	(dB)	(dB)	(± dB)	(± dB)	
*63 Hz	0.2	0.1	0.40	2.0	Pass
125 Hz	-0.1	0.0	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	0.1	0.2	0.40	2.0	Pass
4000 Hz	-0.9	-0.9	0.40	3.0	Pass
8000 Hz	1.3	1.9	0.40	5.0	Pass

Certificate No : 25-NDM-063
Request No : Req-2025-0465

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)	60.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0			
	Level A	(dB)	60.0	80.1	90.1	100.0	110.0	114.0	119.9	129.9	139.9			
	Error	(dB)	0.0	0.1	0.1	0.0	0.0	0.0	-0.1	-0.1	-0.1			
8000 Hz	Ref	(dB)				88.9	98.9	108.9	112.9	118.9	128.9	138.9		
	Level A	(dB)				89.0	98.9	108.9	112.9	118.9	128.9	138.8		
	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	93.8	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 Limit	Result
FAST / A / 60-140		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	-21, +26	Pass
1000 Hz 110 dB		45	45	0.50	0.50	0.00			Pass
1000 Hz 110 dB		90	90	1.00	0.99	-1.00			Pass
1000 Hz 110 dB		180	180	2.00	1.98	-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	10.13	+1.30			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

Certificate No : 25-NDM-063
Request No : Req-2025-0465

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit	Result
FAST / A / 60-140		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	0.98	-0.02	0.052	-0.29 - +0.41	Pass

b. Sound exposure meter response for series of toneburst impulses

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit	Result
FAST / A / 60-140		Ref	UUC	Ref	UUC	Error			
Calibrator Setting		(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)	
Burst 1 ms, 95 dB		2846	2846	1.00	0.98	-2.00	5.6	-21 - +26	Pass
Burst 1 ms, 100 dB		900	900	1.00	0.98	-2.00		-29 - +41	Pass
Burst 1 ms, 108 dB		143	143	1.00	0.99	-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 ² h)	(%)	(%)	(%)	
Continuous Rectangle +	29	10.37	0.00	3.7	-21 - +26	Pass
Continuous Rectangle -		10.37				Pass

* Indicates non accredited

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

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

เอกสารไม่ควบคุม

Certificate No : 25-NDM-063
Request No : Req-2025-0465

Decision Rule for Statements of Conformity

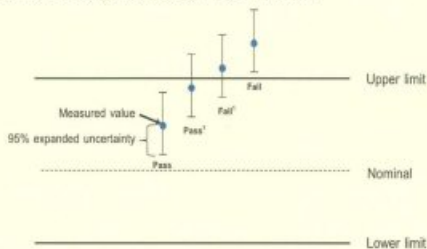
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:2019, Guidelines on the Reporting of Conformity with Specification as following Fig. and statements

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

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

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

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



End of Certificate

Page: 1/5

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD. Certificate No : 25-NDM-064
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260 Request No : Req-2025-0466

Unit Under Calibration Details

Measurement item : Noise Dosimeter Microphone Class : 2
Manufacturer : SVANTEK Microphone Model : SV 2715
Model : SV 104S Microphone S/N : 103527
Serial Number : 128473 Pre-amplifier Model : -
ID : UAE.EFM.085/2566 Pre-amplifier S/N : -
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 19 February 2025
Calibrated Date : 17 March 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	Brüel&Kjaer	4192	2294985	25 June 2025	NIMT
Audio Generator	Svanok	SVAN 401	131	15 October 2025	WK Electric
Timer	EXTech	-	65-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 Luangn
Service Calibration Engineer

Approved By : 
Mr. Paitit Mathavorn
Calibration Engineer Supervisor
Issue Date : 17 March 2025

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

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

เอกสารไม่ควบคุม

Certificate No : 25-NDM-064
Request No : Req-2025-0466

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit	Result
	Ref	UUC	Ref	UUC	Error			
Calibrator Setting	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)	(%)	(%)	
1000 Hz 134 dB	120	120	3.37	3.36	-0.3	3.1	-21, +26	Pass

Note: Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35, SN: 44792

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit	Result
	A	C			
FAST / A / 60-140	(dB)	(dB)	(± dB)	(± dB)	
STD Setting	(dB)	(dB)			
*63 Hz	0.1	0.0	0.40	2.0	Pass
125 Hz	-0.2	0.0	0.40	1.5	Pass
250 Hz	-0.3	-0.2	0.40	1.5	Pass
500 Hz	-0.2	-0.1	0.40	1.5	Pass
1000 Hz	0.0	0.0	0.40	-	-
2000 Hz	0.7	0.7	0.40	2.0	Pass
4000 Hz	1.5	1.5	0.40	3.0	Pass
8000 Hz	3.4	3.7	0.40	5.0	Pass

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เอกสารไม่ควบคุม

PM-700-NDM-01 Rev.05 Issue date 2/9/24

Certificate No : 25-NDM-064
Request No : Req-2025-0466

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)	60.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0	
1000 Hz	Level A	(dB)	60.1	80.3	90.1	100.1	110.0	114.0	120.0	130.0	140.0	
	Error	(dB)	0.1	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	
	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9	
8000 Hz	Level A	(dB)										
	Error	(dB)										
	Ref	(dB)										
63 Hz	Level A	(dB)										
	Error	(dB)										
	Ref	(dB)										
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 Limit	Result
	Ref	UUC	Ref	UUC	Error			
FAST / A / 60-140	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)	(%)	(%)	
Calibrator Setting								
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	10.13	+1.30			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

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เอกสารไม่ควบคุม

PM-700-NDM-01 Rev.05 Issue date 2/9/24

Certificate No : 25-NDM-064
Request No : Req-2025-0466

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit	Result
	Ref	UUC	Ref	UUC	Error			
FAST / A / 60-140	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(Pa ² ·h)	(%)	(Pa ² ·h)	
Calibrator Setting								
4000 Hz 95 dB	2846	2846	1.00	0.98	-0.02	0.052	-0.29 ~ -0.41	Pass

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit	Result
	Ref	UUC	Ref	UUC	Error			
FAST / A / 60-140	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)	(%)	(%)	
Calibrator Setting								
Burst 1 ms, 95 dB	2846	2846	1.00	0.98	-2.00	5.6	-21 ~ +26	Pass
Burst 1 ms, 100 dB	900	900	1.00	0.98	-2.00		-29 ~ +41	Pass
Burst 1 ms, 108 dB	143	143	1.00	0.99	-1.00		-29 ~ +41	Pass

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement		UNCERTAINTY	Tolerances Limit	Result
	Ref	UUC	UUC	Different			
FAST / A / 60-140	(s)	(s)	(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

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

เอกสารไม่ควบคุม

PM-700-NDM-01 Rev.05 Issue date 2/9/24

Certificate No : 25-NDM-064
Request No : Req-2025-0466

Decision Rule for Statements of Conformity

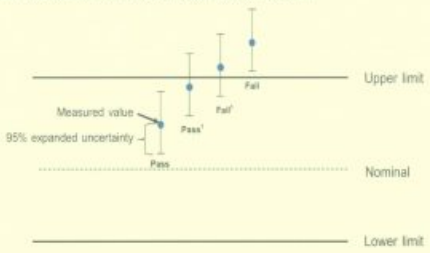
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09 2009: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements.

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

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

PM-700-NDM-01 Rev.05 Issue date 2/9/24

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 : 25-NDM-062
Request No : Req-2025-0464

Unit Under Calibration Details

Measurement Item	○ Noise Dosimeter	Microphone Class	2
Manufacturer	○ SVANTEK	Microphone Model	SV 2718
Model	○ SV 1048S	Microphone S/N	133702
Serial Number	○ 128360	Preamplifier Model	-
ID	○ UAE.EFM.079.2566	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 hPa ± 10 hPa
Received Date	19 February 2025
Calibrated Date	17 March 2025
Calibration Procedure	In-house method CP-NDM-01 based on IEC 61257 : 2017
Location of Calibration	Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	BrüelKjær	4192	2294985	25 June 2025	NIMT
Audio Generator	Svante	SVAN 401	131	15 October 2025	WK EPC
Timer	EXTECH	-	05-ACT	11 March 2026	TPA

Nate

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

Calibrated By : mpc
Mr. Neppaden Luangari
Service Calibration Engineer

Approved By : 
Mr. Pankaj Mathur
Calibration Engineer Supervisor
Issue Date : 17 March 2025

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

Certificate No	:	25-NDM-062
Request No	:	Req-2025-0464

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	3.37	3.36	-0.3	3.1	-21, +26	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35, SN. 44792

2. Frequency weightings

UVC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit	Result
FAST / 60-140 STD Setting	A (dB)	C (dB)	(\pm dB)	(\pm dB)	
563 Hz	0.0	0.2	0.40	2.0	PASS
125 Hz	0.1	0.3	0.40	3.5	PASS
250 Hz	-0.1	0.0	0.40	1.5	PASS
500 Hz	-0.1	0.0	0.40	1.5	PASS
1000 Hz	0.0	0.0	0.40	-	-
2000 Hz	0.6	0.6	0.40	2.0	PASS
4000 Hz	1.1	1.1	0.40	3.0	PASS
8000 Hz	3.2	3.4	0.40	5.0	PASS

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

Certificate No	:	25-NDM-062
Request No	:	Req-2025-0464

3. Linearity of response to steady signals

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

Sound exposure time, linearity of response for changes of input sinusoidal signal level											
UUC Setting			FAST / A / High								
1000 Hz	Ref	[dB]	60.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
	Level A	[dB]	60.3	80.2	90.2	100.1	110.1	114.0	120.0	130.0	140.0
	Error	[dB]	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0
		[dB]									
8000 Hz	Ref	[dB]	88.9	98.9	108.9	112.9	118.9	128.9	138.9		
	Level A	[dB]			89.0	98.9	108.9	112.9	118.9	128.9	138.9
	Error	[dB]			0.1	0.0	0.0	0.0	0.0	0.0	-0.1
		[dB]									
63 Hz	Ref	[dB]						87.8	93.8	103.8	113.8
	Level A	[dB]						87.8	93.9	103.8	113.8
	Error	[dB]							0.0	0.1	0.0
		[dB]									
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				
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	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	5.6		Pass	
1000 Hz 120 dB	360	360	40.00	40.54	+0.83	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 the Bureau of Standards. **เอกสารไม่ควบคุม**

Certificate No	:	25-NDM-062
Request No	:	Req-2025-0464

4. Response to short duration

a. Response for sinusoidal signals - reference level

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

EUC Setting		Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 60-140	Time	Ref	UUC	Error			
Calibrator Setting	(s)	(s)	(Pa ² h)	(%)	(%)	Limit (%)	
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00	-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 Limit	Result
FAST / A / 60-140	UUC	UUC	Different			
Calibrator Setting	(s)	(Pa·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 Bureau of Standards. **เอกสารไม่ควบคุม**

Certificate No : 25-NDM-082
Request No : Req-2025-0464

Decision Rule for Statements of Conformity

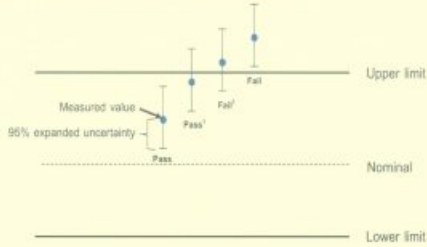
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8 (09/2019), Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

เอกสารไม่ควบคุม

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

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udumouk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10290

Certificate No : 24-NDM-167
Request No : Req-2024-1466

Unit Under Calibration Details

Measurement Item : Noise Dosimeter
Manufacturer : SVANTER
Model : SV 104HS
Serial Number : 131076
ID : UAE-ETM152/2546
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 27HS
Microphone S/N : 137755
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 MPa ± 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
Multi-frequency Calibrator	Quest	Quest-cal	EFA000234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Sine Generator	Svantek	Svan401	131	9 October 2024	WK Electric
Timer	EXTECH	-	05-ACT	14 March 2025	TPA

Note

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

Calibrated By : 
Mr. Noppadon Luangrat
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathayom
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

เอกสารไม่ควบคุม

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

Certificate No : 24-NDM-167
Request No : Req-2024-1466

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 SVANTER, Model SV 35A, 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)			
763 Hz	-0.4	0.1	0.40	2.0	Pass
125 Hz	-0.5	-0.2	0.40	1.5	Pass
250 Hz	-0.3	-0.2	0.40	1.5	Pass
500 Hz	-0.1	0.0	0.40	1.5	Pass
1000 Hz	0.0	0.0	0.40	-	-
2000 Hz	0.1	0.1	0.40	2.0	Pass
4000 Hz	1.6	1.5	0.40	3.0	Pass
8000 Hz	-0.4	-0.4	0.40	3.0	Pass

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เอกสารไม่ควบคุม

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

Certificate No : 24-NDM-167
Request No : Req-2024-1466

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)	60.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0	
	Level A	(dB)	60.0	80.2	90.2	100.1	110.0	114.0	120.0	130.0	140.0	
	Error	(dB)	0.0	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)			89.0	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	93.8	103.8	113.8	
	Error	(dB)						0.0	0.1	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	0.99	-1.00			Pass
1000 Hz 110 dB	180	180	2.00	1.98	-1.00			Pass
1000 Hz 120 dB	36	36	4.00	3.94	-1.50			Pass
1000 Hz 120 dB	72	72	8.00	7.87	-1.63	5.6		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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เอกสารไม่ควบคุม

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

Certificate No : 24-NDM-167
Request No : Req-2024-1466

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)	(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 ~ +43	Pass
Burst 1 ms, 108 dB	143	143	1.00	1.01	+1.00		-29 ~ +43	Pass

5. Response to unipolar pulse

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)	(%)	(%)	(%)	
Continuous Rectangle +	28		10.13		0.00	3.7	-21 ~ +26	Pass
Continuous Rectangle -			10.13					Pass

* Indicates non accredited

Certificate No : 24-NDM-167
Request No : Req-2024-1466

Decision Rule for Statements of Conformity

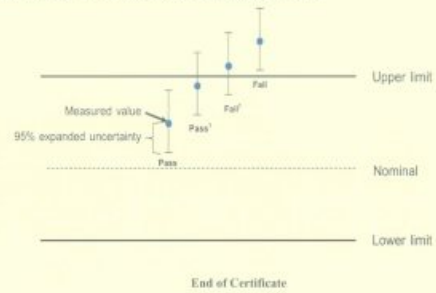
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:2019. Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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เอกสารไม่ควบคุม

FM-709-NDM-01 Rev.04 Issue date 5/6/24

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

เอกสารไม่ควบคุม

FM-709-NDM-01 Rev.04 Issue date 5/6/24

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD. Certificate No : 24-NDM-168
Address : 81 Soi Udomek 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260 Request No : Req-2024-1467

Unit Under Calibration Details

Measurement item : Noise Dosimeter Microphone Class : 2
Manufacturer : SVANTEK Microphone Model : SV 2715
Model : SV 104HS Microphone S/N : 136415
Serial Number : 131125 Pre-amplifier Model : -
ID : UAEFTM1542566 Pre-amplifier S/N : -
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 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	S/N	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	EFA00024	25 July 2024	TSL
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Sine Generator	Svante	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 Luangrit
Service Calibration Engineer

Approved By :
Mr. Puchit Mathavorn
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

เอกสารไม่ควบคุม

FM-709-NDM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-NDM-168
Request No : Req-2024-1467

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 SVANTEK, Model SV 35A, SN. 58079

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances	Result
FAST / 60-140	A	C	(± dB)	(± dB)	
STD Setting	(dB)	(dB)			
963 Hz	-0.1	0.1	0.40	2.0	Pass
125 Hz	-0.1	-0.1	0.40	1.5	Pass
250 Hz	-0.2	0.0	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	0.0	0.1	0.40	2.0	Pass
4000 Hz	1.3	1.4	0.40	3.0	Pass
8000 Hz	-0.4	-0.3	0.40	5.0	Pass

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เอกสารไม่ควบคุม

FM-709-NDM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-NDM-168
Request No : Req-2024-1467

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)	60.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0			
Level A	(dB)	59.9	80.1	90.1	100.0	110.0	114.0	120.0	130.0	140.0			
Error	(dB)	-0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0			
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)			0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2		
Ref	(dB)						87.8	93.8	103.8	113.8			
Level A	(dB)						87.8	93.8	103.8	113.8			
Error	(dB)						0.0	0.0	0.0	0.0			
Tolerances Limit		(±dB)	1.0										
UNCERTAINTY		(±dB)	0.3										
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				
Calibrator Setting	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)	(%)	(%)	-21, +26	Pass
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6			
1000 Hz 110 dB	45	45	0.50	0.50	0.00				
1000 Hz 110 dB	90	90	1.00	0.99	-1.00				
1000 Hz 110 dB	180	180	2.00	1.98	-1.00				
1000 Hz 120 dB	36	36	4.00	3.94	-1.50				
1000 Hz 120 dB	72	72	8.00	7.87	-1.63	5.6			
1000 Hz 120 dB	90	90	10.00	9.90	-1.00				
1000 Hz 120 dB	180	180	20.00	19.76	-1.20				
1000 Hz 120 dB	360	360	40.00	39.42	-1.45				
1000 Hz 120 dB	720	720	80.00	78.66	-1.68				

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

เอกสารไม่ควบคุม

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

Certificate No : 24-NDM-168
Request No : Req-2024-1467

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 ¹ ·h)	(Pa ² ·h)	
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.052	-0.29 - +0.43	Pass

b. Sound exposure meter response for series of toneburst impulses

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances	
FAST / A / 60-140	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 / 60-140	UUC	UUC	Different	Limit			
Calibrator Setting	(s)	(Pa ² ·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 items calibrated. The certificate shall not be reproduced except in full, without written approval of

เอกสารไม่ควบคุม

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

Certificate No : 24-NDM-168
Request No : Req-2024-1467

Decision Rule for Statements of Conformity

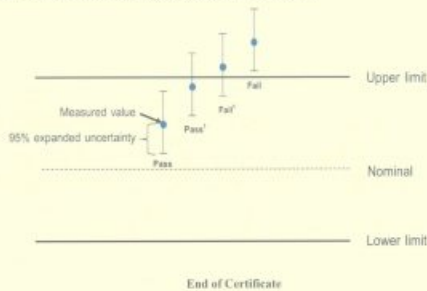
The standard decision rule employed for the statements of conformity in each calibration result will be applied using IIC-GS-09-2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

Certificate of Calibration

Customer

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

Certificate No : 24-TPM-311

Request No : Req-2024-1484

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature

Instrument Name : Thermal Environment Monitor

Manufacturer : TSI QUEST

Model : QT-34

Serial Number : TEX040009

Resolution : 0.1 °C

ID Number : UAE.EFM.113/2566

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 : 3 July 2024

Calibrated Date : 8 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: 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. Noppadol Luangrat
Technical Manager

Issue Date :

10 July 2024

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

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

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.

PM-708-TPM-01 Rev.01 Issue date 13/02/20

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Calibration Note
UUC Adjustment : Not Adjust
Certificate No : 24-TPM-311
Request No : Req-2024-1484
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.052	20.0	0.0	0.13
	25.032	25.1	- 0.1	0.13
	30.051	30.0	0.0	0.13
	35.057	35.1	- 0.1	0.13
	40.040	40.2	- 0.2	0.13
	45.038	45.1	- 0.1	0.13
	50.042	50.0	0.0	0.13
	60.045	60.1	- 0.1	0.13
DRY	20.033	20.1	- 0.1	0.13
	25.030	25.2	- 0.2	0.13
	30.033	30.1	- 0.1	0.13
	35.034	35.2	- 0.2	0.13
	40.039	40.3	- 0.3	0.13
	45.038	45.1	- 0.3	0.13
	50.042	50.1	- 0.1	0.13
	60.040	60.3	- 0.3	0.13
GLOBE	20.033	20.1	- 0.1	0.13
	25.030	25.2	- 0.2	0.13
	30.033	30.1	- 0.1	0.13
	35.035	35.1	- 0.1	0.13
	40.038	40.2	- 0.2	0.13
	45.041	45.2	- 0.2	0.13
	50.040	50.2	- 0.2	0.13
	60.045	60.2	- 0.2	0.13

End of Certificate

Calibrated By :
Mr. Sirichok Jirapaksakul

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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.
PM-708-TPM-01 Rev.01 Issue date 13/02/20



Certificate of Calibration
Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Name : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Certificate No : 24-TPM-349
Request No : Req-2024-1621
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : 3M
Model : QT-32
Serial Number : TPQ020023
Resolution : 0.1 °C
ID Number : UAE.EFM.006.2559
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 : 19 July 2024
Calibrated Date : 6 August 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: 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 : 6 August 2024

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.
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PM-708-TPM-01 Rev.01 Issue date 13/02/20



Calibration Note
UUC Adjustment : Not Adjust
Certificate No : 24-TPM-349
Request No : Req-2024-1621
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.030	19.9	+ 0.1	0.13
	25.033	24.9	+ 0.1	0.13
	30.034	29.9	+ 0.1	0.13
	35.037	34.9	+ 0.1	0.13
	40.039	39.9	+ 0.1	0.13
	45.039	44.9	+ 0.1	0.13
	50.042	49.9	+ 0.1	0.13
	60.047	59.9	+ 0.1	0.13
DRY	20.032	19.9	+ 0.1	0.13
	25.034	24.9	+ 0.1	0.13
	30.035	29.9	+ 0.1	0.13
	35.036	34.9	+ 0.1	0.13
	40.037	39.9	+ 0.1	0.13
	45.041	44.9	+ 0.1	0.13
	50.042	49.9	+ 0.1	0.13
	60.046	59.9	+ 0.1	0.13
GLOBE	20.031	19.9	+ 0.1	0.13
	25.033	24.9	+ 0.1	0.13
	30.034	29.9	+ 0.1	0.13
	35.037	34.8	+ 0.1	0.13
	40.038	39.9	+ 0.1	0.13
	45.040	44.9	+ 0.1	0.13
	50.042	49.9	+ 0.1	0.13
	60.045	59.9	+ 0.1	0.13

End of Certificate

Calibrated By :
Mr. Sirichok Jirapaksakul

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PM-708-TPM-01 Rev.01 Issue date 13/02/20



Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Name : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Certificate No : 24-TPM-310
Request No : Req-2024-1483
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-34
Serial Number : TEX040014
Resolution : 0.1 °C
ID Number : UAE.EFM.118/2566
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 : 3 July 2024
Calibrated Date : 8 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: 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 : 10 July 2024

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PM-708-TPM-01 Rev.01 Issue date 13/02/20

Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 24-TPM-310

Request No : Req-2024-1483

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.032	20.0	0.0	0.13
	25.032	25.1	-0.1	0.13
	30.031	30.0	0.0	0.13
	35.037	35.0	0.0	0.13
	40.040	40.0	0.0	0.13
	45.038	45.1	-0.1	0.13
	50.042	50.1	-0.1	0.13
DRY	60.045	60.1	-0.1	0.13
	20.033	20.0	0.0	0.13
	25.030	25.1	-0.1	0.13
	30.033	30.1	-0.1	0.13
	35.034	35.1	-0.1	0.13
	40.039	40.1	-0.1	0.13
	45.038	45.1	-0.1	0.13
GLOBE	50.042	50.1	-0.1	0.13
	60.046	60.2	-0.2	0.13
	20.033	20.1	-0.1	0.13
	25.030	25.2	-0.2	0.13
	30.033	30.2	-0.2	0.13
	35.035	35.1	-0.1	0.13
	40.038	40.1	-0.1	0.13
	45.041	45.2	-0.2	0.13
	50.040	50.2	-0.2	0.13
	60.045	60.2	-0.2	0.13

End of Certificate

Calibrated By :

Mr. Sirichok Jirapukdeesakul

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FM-708-TPM-01 Rev.01 Issue date 13/02/20

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Certificate of Calibration

Customer

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

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

Certificate No : 25-TPM-053

Request No : Req-2024-2839

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature

Instrument Name : Thermal Environment Monitor

Manufacturer : TSI QUEST

Model : QT-32

Serial Number : TPS030005

Resolution : 0.1 °C

ID Number : UAE.EFM.080/2561

Range Calibration : 20 °C to 60 °C

Type of Sensor : RTD

Sensor Diameter (mm) : 4.5

Calibration Position (mm) : 67.5

Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 15 %RH

Received Date : 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

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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUNTINAKORN 11 TAMBON BANG KAE0,
AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: 6690-2116-5860-1 FAX: 6690-2116-7140



Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 25-TPM-053

Request No : Req-2024-2839

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.030	20.1	-0.1	0.13
	25.032	25.1	-0.1	0.13
	30.034	30.1	-0.1	0.13
	35.037	35.1	-0.1	0.13
	40.037	40.2	-0.2	0.13
	45.040	45.1	-0.1	0.13
	50.042	50.1	-0.1	0.13
DRY	60.045	60.1	-0.1	0.13
	20.032	20.1	-0.1	0.13
	25.032	25.1	-0.1	0.13
	30.036	30.1	-0.1	0.13
	35.036	35.1	-0.1	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	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.033	30.1	-0.1	0.13
	35.035	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
	60.046	60.1	-0.1	0.13

End of Certificate

Calibrated By :



Mr. Sirichok Jirapukdeesakul

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FM-708-TPM-01 Rev.01 Issue date 13/02/20

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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUNTINAKORN 11 TAMBON BANG KAE0,
AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: 6690-2116-5860-1 FAX: 6690-2116-7140



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-TPM-371

Request No : Req-2024-1693

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature

Instrument Name : Thermal Environment Monitor

Manufacturer : TSI QUEST

Model : QT-34

Serial Number : TEK120020

Resolution : 0.1 °C

ID Number : UAE.EMAZ.023/2555

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 : 2 August 2024

Calibrated Date : 15 August 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: 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 : 19 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-TPM-01 Rev.01 Issue date 13/02/20

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Calibration Note
UUC Adjustment : ☐ Not Adjust

Certificate No : 24-TPM-571
Request No : Req2024-1663
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
	25.031	25.3	-0.3	0.13
	30.034	30.0	0.0	0.13
	35.036	35.0	0.0	0.13
	40.035	40.0	0.0	0.13
	45.038	45.2	-0.2	0.13
	50.041	50.0	0.0	0.13
	60.046	60.0	0.0	0.13
DRY	20.032	19.9	+0.1	0.13
	25.031	25.3	-0.3	0.13
	30.034	29.9	+0.1	0.13
	35.036	35.1	-0.1	0.13
	40.037	39.9	+0.1	0.13
	45.038	45.1	-0.1	0.13
	50.041	49.9	+0.1	0.13
	60.046	59.9	+0.1	0.13
GLOBE	20.032	19.9	+0.1	0.13
	25.030	25.2	-0.2	0.13
	30.035	29.9	+0.1	0.13
	35.035	35.1	-0.1	0.13
	40.037	39.9	+0.1	0.13
	45.040	45.1	-0.1	0.13
	50.040	50.0	0.0	0.13
	60.045	60.0	0.0	0.13

End of Certificate

Calibrated By :

Mr. Sirichok Jirapongkarnkul

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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.
TPM-500-TPM-01 Rev 01 Issue date: 13/02/20



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



Certificate of Calibration

Cert.No.: 24CH1596
Page: 1 of 3

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA9M0046
ID No. : UAE.EFM.001/2563(EFM.pH.01/63)
Condition As-Received: Used Item
Received Date : 24 December 2024
Calibration Date : 26 December 2024
Reference : 2412-0601WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

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

Calibrated by : Warakorn Lerngatrakul

Approved by :

Approved Signatory

() Pornthippa Tameyakul
() Ponpan Paipim
(✓) Sathip Meangmai

Issue Date : 27 December 2024

The Uncertainties are for a confidence probability of approximately 95%

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

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Cert.No.: 24CH1596
Page.: 2 of 3

Condition of this calibration result

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

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

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

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

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N : HA9M0046	4.00	177.48	177.6	4.01	0.058	2.00
	7.00	0.00	0.2	7.00	0.058	2.00
	7.00	0.00	0.2	7.00	0.058	2.00
	10.00	-177.48	-177.1	10.01	0.058	2.00

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Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (\pm)	Coverage factor k
pH Electrode S/N : -	4.008	4.01	184.8	0.0071	2.00
	7.000	6.99	9.1	0.0092	2.00
	7.000	7.00	9.1	0.0085	2.00
	10.010	10.01	-164.5	0.011	2.07

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -

- Serial No. : -

Dimension of probe

- Length : 112 mm.

- Diameter : 16 mm.

- Immersion Depth : 100 mm.

Calibration Point ($^{\circ}\text{C}$)	Standard Temperature ($^{\circ}\text{C}$)	UUC* Reading ($^{\circ}\text{C}$)	Error ($^{\circ}\text{C}$)	Uncertainty of measurement (\pm $^{\circ}\text{C}$)	Coverage factor k
15.0	15.001	15.0	-0.001	0.13	2.00
30.0	30.003	30.0	-0.003	0.13	2.00
45.0	45.004	45.0	-0.004	0.13	2.00

Remark - UUC* = Unit Under Calibration

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

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List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Atomic Absorption Spectrometer	NICKEL	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	30/1/2025	29/1/2026
2	Analytical Balance	PARTICULATE MATTER (PM10) TOTAL SUSPENDED PARTICULATE	Mettler Toledo	MS204TS/00 / C252436235	National Food Institute, Ministry of Industry, Thailand	2502228-003-01	19/3/2025	18/3/2026
3	Gas Chromatography	BUTYL CELLOSOLVE (2-BUTOXYETHANOL)	Agilent	GC 7890A / CN11021007	Agilent Technologies (Thailand) Co.,Ltd.	Certificate of System Qualification GC-OQ	18/2/2025	17/2/2026
4	Gas Chromatography	ACETIC ACID	Agilent	7890B GC / CN13113001	Agilent Technologies (Thailand) Co.,Ltd.	Certificate of System Qualification GC-OQ	1/4/2025	31/3/2026
5	Gas Chromatography	XYLENE	SCION INSTRUMENT, USA	456-GC / GC1802G112	Thai Unique Co.,Ltd.	SV0425/23011	26/4/2025	25/4/2026
6	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	TIN	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	4/11/2024	3/11/2025
7	Dionex Aquion RFIC Ion Chromatography	FLUORIDE HYDROGEN FLUORIDE PHOSPHORIC ACID	Thermo Scientific	Dionex Aquion RFIC / 220380031	ARCHEMICA LAB CO., LTD	ID1047	23/4/2025	22/4/2026
8	Microbalance	RESPIRABLE DUST TOTAL DUST	Mettler Toledo	XP6 / B322373893	National Food Institute, Ministry of Industry, Thailand	2502228 002 01	20/3/2025	19/3/2026
9	UV/VIS Spectrophotometer	SILICA	Hitachi	U-5100 / 23A4-008	DQE Services Co.,Ltd.	SP24-028	11/9/2024	9/9/2025

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

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11/5/2024	10/5/2025
			Mettler Toledo	AB204-S/FACT / 1129361010	United Analyst and Engineering Consultant Co., Ltd.	250422 1 BL002 25	23/4/2025	22/4/2026
2	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2402283-002-01	21/4/2024	1/4/2025
			Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2502226-002-01	20/3/2025	19/3/2026
3	Analytical Balance	TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2402283-001-01	21/4/2024	1/4/2025
			Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2502226-001-01	20/3/2025	19/3/2026
4	BOD Incubator	BIOCHEMICAL OXYGEN DEMAND	ARCO	UC4-1320 / 1021	Technology Promotion Association (Thailand-Japan)	24TM1113	11/7/2024	16/7/2025
5	BOD Incubator	BIOCHEMICAL OXYGEN DEMAND	ARCO	UR-1320 / -	Technology Promotion Association (Thailand-Japan)	24TM587	11/4/2024	31/3/2025
6	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21/2/2024	20/2/2025
			YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	25TW29	18/2/2025	16/2/2026
7	Heating Block	CHEMICAL OXYGEN DEMAND	Hanna Instruments Italia Srl.	HI 839800-02 / H 018500 I	Hanna Instruments (Thailand) Ltd.	HIT-2510-0375	7/3/2025	6/3/2026
8	Heating Block	CHEMICAL OXYGEN DEMAND	Hanna Instruments Inc.(Romania)	HI839800-02 / 4500052101	Hanna Instruments (Thailand) Ltd.	HIT-2427-0942	1/7/2024	30/6/2025

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
9	Hot Air Oven	TOTAL DISSOLVED SOLIDS	Memmert	UF55 / B216.1686	National Food Institute, Ministry of Industry, Thailand	2500116-001-01	8/10/2024	7/10/2025
10	Hot Air Oven	TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	25TM579	19/3/2025	18/3/2026
11	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	COPPER LEAD MAGNESIUM NICKEL TOTAL IRON ZINC	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	4/11/2024	3/11/2025
12	pH Meter	pH	Horiba	LAQUA-PH210 / HA0A0007	technology promotion association (thailand-japan	25CH353	20/3/2025	18/3/2026
13	pH Meter	pH	Horiba	LAQUA-PH210 / HA9M0047	technology promotion association (thailand-japan	25CH354	20/3/2025	18/3/2026
14	pH Meter	pH	Horiba	LAQUA-PH210 / HA0A0006	technology promotion association (thailand-japan	24CH724	19/6/2024	17/6/2025
15	pH Meter	pH	Horiba	LAQUA-PH210 / HA0D0082	technology promotion association (thailand-japan	24CH727	19/6/2024	17/6/2025
16	Spectrophotometer	COLOUR (pH 7.0) COLOUR (pH Sample)	Agilent	Cary 60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP25-019	26/5/2025	25/5/2026
17	UV-VIS Spectrophotometer	FLUORIDE FLUORINE	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP25-001	3/1/2025	2/1/2026

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

Agilent 55 240 280 Series Atomic Absorption Spectroscopy Systems

Preventive Maintenance Checklist

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

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the installation.

Note: While non-current production AA instrument and/or accessory models are not covered specifically in this document it can be used as a basic reference.

For more information about Agilent Technologies services please visit our web site using the following URL: <http://www.agilent.com/en-us/services>

Introduction

Customer Information

- 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.
- 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.

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Important Customer Web Links

- For more information about Agilent Technologies services, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- To access Agilent University, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful Agilent Resource Center web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>
- Need technical support, FAQs, supplies? – visit our Support Home page at <http://www.agilent.com/search/support>
- Get answers. Share insights. Build connections. Join the Agilent Community at <https://community.agilent.com/welcome>

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Confirm the ability of the instrument to deliver continued safe operation as established via the Agilent AA safe operation flow chart. (Refer directly to the AA 55/240/280 Preventive Maintenance Scope of Work to make this decision.)
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page.
- Complete the total number of pages field in the Service Completion section.
- Ask the customer to sign the Service Completion section including the customer's and your signature.

This information is subject to change without notice.

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Instrument Maintenance

System Information

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

Instrument System Name and ID	240 FS AAS
Instrument System Site and Location	United Analyst and Engineering Consultant

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 8432 A	M1 13160001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

Preparation, Safe operation and Initial performance checks

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- ☐ Agilent AA safe operation flow chart inspections (to determine if the PM can be performed).

NOTE: If by following the flow chart the instrument is deemed to be unsafe for continued use you MUST NOT continue PM work. Inform the customer immediately of the Agilent recommendation that use of the instrument be discontinued.

- ☒ Discuss any specific issues with the customer before starting.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. **NA**
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Use SVD to perform a Full Wavelength Scan for Cu HCL - "As found test_1"
- ☒ Perform a Basic Cu ABS test - "As found test_2"
- ☒ Print the Details page or screen captures of the test results and attach to the end of this checklist.

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Preventive Maintenance Procedures

FLAME SYSTEM section

☐ Section not applicable

Electronic components

- ☒ Review and confirm instrument configuration data in SVD
- ☒ Confirm power supply voltages using the **SVD Power Supply diagnostic**.
- ☒ For Dual Beam instruments - Confirm RBC frequency using the **SVD RBC frequency diagnostic**.

Mechanical components

- ☒ Check the burner adjuster controls for complete and free movement. If the burner adjuster needs lubrication, use Molykote 321 or mineral-based molybdenum disulphide grease.
- ☒ Run SVD tests to exercise all motor drives over the full range of their travel:
 - ☒ Monochromator drive
 - ☒ Slit drive
 - ☒ Lamp selector
 - ☐ ABA

Optics components

- ☒ Check that external optical surfaces are clean – Clean or replace as required.
- ☒ Use SVD and perform **Mono Wavelength Correction**.
- ☒ Use SVD and perform **Slit Calibration**.
- ☒ Use SVD and perform **Grating Squareness Diagnostic**.
- ☒ Use SVD and perform **Zero Order Offset/Mono Correction**.
- ☒ Use SVD and perform **Wavelength Repeatability**.
- ☒ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.
- ☒ Check that the signal energy of the D2 and HC lamps track properly. Advise customer if their D2 lamp is showing emission degradation due to age.

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Sample Introduction and Atomization

- ☒ Inspect the burner interlock plate to ensure that the interlock pin is secure and correct for the burner type.
- ☒ Clean the burner slot with a clean white card.
- ☒ Check the uniformity of the slot width.
- ☒ Clean the burner if required.
- ☒ Change the burner o-ring.
- ☒ Clean the nebulizer, spray chamber and liquid trap.
- ☒ Change all o-rings and seals in the nebulizer, nebulizer block and spray chamber.
- ☒ Check that the pressure relief bung releases readily.
- ☒ Change o-rings on the fuel and oxidant delivery bars.
- ☒ Leave the liquid trap EMPTY and verify the flame will not ignite in this state.
- ☒ Refill liquid trap and check that overflow drains freely into the drain/waste tube.
- ☒ Check the drain/waste tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.
- ☒ Check and clean the igniter electrode

Gas handling components and safety interlocks

- ☒ Pressure test for leaks
- ☒ Leak test gasbox internal components and connections
- ☒ Check safety interlock status and operation using the **SVD Interlock monitoring diagnostic**.

Analytical performance for Flame systems

- ☒ Ignite a flame.
- ☒ Check that you can adjust the nebulizer uptake rate from 4 to 6.5 mL per minute.
- ☒ Optimize the instrument ready to perform Cu sensitivity test.
- ☒ Create a manual method to perform a Basic Cu ABS test - "Final Performance Testing"
- ☒ Run a PM completed sensitivity test for a 5 ppm copper sample and record the results in the AA PM Performance test results and measurements table.

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FURNACE SYSTEM section

☒ Section not applicable

Electronic components

- ☐ Review and confirm instrument configuration data in SVD
- ☐ Confirm power supply voltages using the **SVD Power Supply diagnostic**.

Mechanical components

- ☐ Run SVD tests to exercise all motor drives over the full range of their travel:
 - ☐ Monochromator drive
 - ☐ Slit drive
 - ☐ Lamp selector

Optics components

- ☐ Check that external optical surfaces are clean – Clean or replace as required.
- ☐ Use SVD and perform **Mono Wavelength Correction**.
- ☐ Use SVD and perform **Slit Calibration**.
- ☐ Use SVD and perform **Grating Squareness Diagnostic**.
- ☐ Use SVD and perform **Zero Order Offset/Mono Correction**.
- ☐ Use SVD and perform **Wavelength Repeatability**.
- ☐ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.

Gas handling, water system and workhead component checks

- ☐ Inspect the GTA workhead gas hoses and connections for leaks.
- ☐ Pressure test for gas leaks
- ☐ If the cooler system is accessible (stand-alone) check for correct operation and coolant/water level – this includes any temperature and pressure settings plus filter cleaning (air flow and water).
- ☐ Inspect the GTA workhead water hoses and connections for leaks.
- ☐ Check all graphite components and replace if necessary.

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- ☐ Tube
- ☐ Electrodes
- ☐ Shroud

Analytical performance for Furnace systems

- ☐ Check and clean the end windows on the workhead.
- ☐ Check safety interlock operation.
- ☐ Optimize the instrument ready to perform Cu sensitivity test.
- ☐ Run the sensitivity test for a 25 ppb copper sample and record the results in the results table.

PSD autosampler accessory for Furnace systems

- ☒ Section NOT Applicable
- ☐ Check condition of the PSD capillary – replace if necessary
- ☐ Check condition and operation of PSD syringe – ensure it does not have air locks and bubbles.
- ☐ Change PSD rinse bottle o-ring.
- ☐ Check and clean the rinse vessel.
- ☐ Check the drain tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.
- ☐ Ensure that the waste vessel is suitable for use with the furnace system.

Sample introduction pump system (SIPS) accessory

- ☒ Section NOT Applicable
- ☐ Re-torque screws securing the hubs, presser arms and pump rotors.
- ☐ Adjust each roller so that it rotates freely.
- ☐ Wipe clean the pump rotor rollers and pump bands with a dry clean cloth.
- ☐ Ensure that the presser arms and the surfaces near the pump are free from dirt and spills.
- ☐ Remove the pump module rear cover and check for the incursion of liquids and any signs of corrosion.
- ☐ Re-torque the nuts that fasten the motor mounting plates to the chassis.
- ☐ Check clips securing the diluents holder and replace if necessary.
- ☐ Disconnect, clean T-piece, and reassemble the tubing using the following steps.

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- ☐ Remove the T-piece by disconnecting the pump tubes, the pump bands and all other tubing.
- ☐ Place the T-piece in an ultrasonic bath containing strong detergent 1-5% Decon 30 or similar, for approximately 5-10 minutes.
- ☐ Wash the T-piece under a tap with a strong flow of water.
- ☐ Rinse with distilled water through all of the inlets in the reverse direction to normal sample flow.
- ☐ Reassemble.

Sample preparation system (SPS 4) accessory

☒ Section NOT Applicable

The Agilent SPS 4 autosampler is designed to need minimal maintenance.

The following maintenance requirements are suggested to maintain the performance of the autosampler.

- ☐ Cleaning the spill tray, rack location mat, end frames and chassis accessories with a damp soft cloth and diluted mild detergent.
- ☐ Cleaning the autosampler cover panels with domestic window cleaner.
- ☐ Checking the X- axis and Z- axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes..
- ☐ Check the X- axis, Theta- axis and Z- axis FFC cables for cracks, incorrect positioning, damaged edge or damaged connectors.

NOTE: The autosampler requires no extra lubrication throughout its lifetime.

For further details refer to the SPS 4 service manual G8410-90050.

Sample preparation system (SPS 3) accessory

☒ Section NOT Applicable

- ☐ Check the x-axis and z-axis timing belts - Replace if there is any cracks, splits or color deterioration and belt tension.
- ☐ Check belt tensions - adjust if required
- ☐ Check the lubrication pad for single x-axis shaft. If pad is dry or customer has observed any vibration or erratic movements of the x-axis carriage, add 1 mL of Dow Corning 200 @ Fluid, 200 CS into the well.
- ☐ Check the auto-sampler ability to find tube positions - Calibrate if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

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Vapor generation accessory VGA (hydride generator)

☒ Section NOT Applicable

- ☐ Inspect VGA gas supply hose.
- ☐ Inspect/replace VGA pump tubing.
- ☐ Check low gas pressure interlock setting - adjust if required.
- ☐ Check precision orifice gas flow setting - adjust if required.
- ☐ Check gas regulator pressure to 46 psi (325 kPa) - adjust if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

UltrAA lamp accessory (external)

☒ Section NOT Applicable

- ☐ Check the condition of the power cable.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

Restore System

- ☐ If you have altered the customer's instrumentation during the course of PM, restore to the original status to allow the customer to conduct their normal activities (e.g., reload the customer's method.)

Guidance

If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

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Signature Page

Service Review

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

Test Results

Test Description	Expected Test Result	Actual Test Result
Flame optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	49.7
Flame performance test with 5 ppm copper sample		
Air /acetylene, mixing paddle removed	Abs value > 0.5	0.559%
Air /acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	0.27
Deuterium furnace optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	-
Deuterium furnace performance test with 25 ppb copper sample (324.8 nm)		
Precision %RSD	≤ 4.0%	-
Abs value	≥ 0.15	-
Zeeman furnace analytical performance: 25 ppb copper sample (327.4 nm)		
Precision %RSD	≤ 4.0%	-
Abs value	≥ 0.10	-
MSR%	≥ 70 %	-

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AA consumable and parts list table

Part Description	Part Number	Product/Model # where used	PM supplied or Consumable	Instrument-Type
Test Solution - Cu 5ppm solution	6610030100	50 55 140 240 280	PM supplied	Common
Test Solution - Blank solution	5190-7001	50 55 140 240 280	PM supplied	Common
Copper, 1000 ug/ml, 100ml	5190-8279	50 55 140 240 280	*	Common
Kit, Mk 7 O-rings, aqueous, complete set	9910093400	50 55 140 240 280	PM supplied	Flame
Organic Kit	9910093500	50 55 140 240 280	PM supplied	Flame
Wire Nebulizer Cleaning	9910024700	50 55 140 240 280	consumable	Flame
Tubing-Capillary Std Nebs	9910024800	50 55 140 240 280	consumable	Flame
Capillary Tube Hivac Neb (3) (organics only)	9910044000	50 55 140 240 280	consumable	Flame
Glass impact beads (5/pk)	9910025700	50 55 140 240 280	consumable	Flame
Teflon impact beads (5/pk) (organics only)	9910053300	50 55 140 240 280	consumable	Flame
Burner cleaning strip (100/pk)	9910053900	50 55 140 240 280	consumable	Flame
Window UV silica - round (right side)	2010082600	50 55 140 240 280	PM supplied	Common
Window UV silica - rectangular (left side)	2010082500	50 55 140 240 280	PM supplied	Common
Pad adhesive window (round)	4910012700	50 55 140 240 280	PM supplied	Common
Pad adhesive window (rectangular)	4910012800	50 55 140 240 280	PM supplied	Common
Electrode kit (1 pr) (D2)	6310003400	GTA120	PM supplied	Furnace
Shroud (D2)	6310003100	GTA120	PM supplied	Furnace
Zeeman electrode kit (1 pr)	6310003500	GTA120	PM supplied	Furnace
Zeeman shroud	6310003600	GTA120	PM supplied	Furnace
O-ring PSD rinse bottle	6910025900	PSD120	PM supplied	Furnace

* For engineers who only service AA instruments 5190-8279 can be used as a cheaper alternative for 6610030100.

Items classified as PM supplied in the above table are included in the standard PM

Those classified as consumable should be provided by the customer or charged to the customer if supplied by the Agilent service engineer.

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Service Engineer Comments (optional)

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

Service Completion

Service request number 6007549143 Date service completed 30 Jan 2023
 Agilent signature Kanyakorn S. Customer signature David Y.
 Total number of pages in this document 13



Frequency:

Averaging Period: 30.0
 Datapoint Count: 20
 Upper Limit: 51.00
 Lower Limit: 49.00
 Average Frequency: 50.00
 Highest Measured Frequency: 50.00
 Lowest Measured Frequency: 50.00
 Result: **Passed**

Power Supply:

	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	12.12	13.20	Passed
-12.00 V Rail	-13.20	-11.90	-10.80	Passed
5.00 V Rail	4.50	5.04	5.50	Passed
310.00 V Rail	270.00	330.00	341.00	Passed

เอกสารไม่ควบคุม

SVD Results Report



Report ID: Diagnostic Start Time: 1/30/2023 9:13:26 AM Diagnostic End Time: 1/30/2023 9:47:25 AM
 Customer: UAE Service Engineer: Kanyakorn S.
 Address: Soi Udomsuk 41, Sukhumvit Rd. Contact Details: 02637636381
 Bangkok

Configuration:

Serial Number: MY13100001 Turret Type: Automatic
 Instrument Model: Varian AA140/240/280 Number Of Lamps: 4
 Flame Instrument: True Mono Type: Automatic
 Furnace Instrument: True Gasbox Type: Y Gas Box
 Zeeman Present: False Auto Burner Adjuster: False
 Internal Zeeman: False Mains Frequency: 50
 Internal UltraAA: False Firmware Version: 2.11
 Optics Type: Double Beam Photomultiplier Type: Normal(900nm)
 D2 BG Correction Fitted: True PWB Version: 45
 Boot Block Version: 1.09

EEPROM Data:

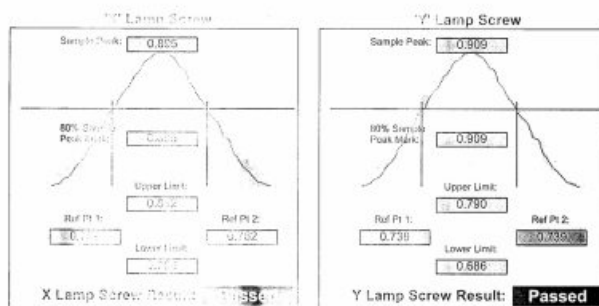
Instrument Run Hours: 69918.180 D2 Run Hours: 53396.500
 Zero Wavelength Offset: 30.133 D2 Serial Number: not set 1
 Mono Correction: 0.770 D2 Install Date: 1/1/1970
 Flame Hours: 32411.834 D2 Original Intensity: 1.000
 D2 Last Intensity: 475.000

เอกสารไม่ควบคุม

Optics

Beam Balance:

Lamp Type: Copper
 Lamp Socket Used: 3
 Peak Selected: 324.80
 Lamp Alignment: **Performed**



Grating Scan

	Lower Limit (nm)	Measured (nm)	Upper Limit (nm)	Result:
Zero Order	-8.10	0.00	0.10	Passed
First Order	324.45	324.75	325.15	Passed
Second Order	648.90	649.50	649.97	Passed

เอกสารไม่ควบคุม

Wavelength Repeatable Error:

Lamp Used: Copper
Peak Used(nm): 324.759
Connected to Socket: 3

Lamp Current(mA): 4
Slit Width(nm): 0.2
Slit Height: Normal

Lamp Alignment:

Lower Limit(nm): 324.773
Upper Limit(nm): 324.888

(Typical from Zero Error) (Typical from end)

Sample 1: 324.823
Sample 2: 324.823
Sample 3: 324.873
Sample 4: 324.823
Sample 5: 324.823
Sample 6: 324.819
Sample 7: 324.819
Sample 8: 324.819
Sample 9: 324.823
Sample 10: 324.819

Mean: 324.823
Standard Deviation: 0.003

Result:

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Auto Lamp Recognition:

Lamp 1: Unpaired Lamp/Not Connected
Lamp 2: 67 - Silver Cadmium Lamp/Dec(Ultra) (Ag/C Lamp) Not Supported
Lamp 3: 14 - Copper (Cu)
Lamp 4: Unpaired Lamp/Not Connected
Lamp 5: Not Supported
Lamp 6: Not Supported
Lamp 7: Not Supported
Lamp 8: Not Supported

Result:

GTA Temperature Monitoring:

Notes:

Signatures:

Date

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Method:

Wavelength Drive:

Slit Drive:

Turret Drive:

Auto Burner Adjuster:

Method:

Signal Processing Linearity:

On-Scale - Scale: New Date Mode

	Lower Limit	Actual	Upper Limit	Result:
S2	114	3	297	
S3	118	14	191	
S4	271	1.2	332	
S5	474	7	579	
S6	935	1	1008	
S7	1435	9	1754	
S8	2438	1.29	3053	
S9	4747	1.1	5313	

Interlocks:

Burner Flame:

NO Burner Flame:

Flame Off/On Check:

Gas Control Flame:

Pressure Release Gas Flame:

Liquid Trap Flame:

Flame Detect:

SCU Active:

Oxidant Pressure:

Oxidant Changeover:

Ignition:

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Sequential by time report 1/30/2025 10:53 AM Page 1 of 1 SpectraAA

Analyst: 1/30/2025 10:33 AM GMT: 1/30/2025 3:33 AM
Date Started:
Worksheet: Sensitivity Test 01
Comment:
Methods: Cu
Computer name: DESKTOP-RSUIFRS
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Conc. mg/L	%RSD	Mean Abs		
CAL Z1110	0.000	38.8	0.0002		
	Readings				
	0.0002	0.0003	0.0001	1/30/2025	10:51:48 AM
STANDARD 1	5.000	0.1	0.5571		
	Readings				
	0.5571	0.5563	0.5575	1/30/2025	10:52:22 AM

Abs **Linear Origin - Cal. Set 1**

Curve Fit: = Linear Origin
Characteristic Conc: = 0.038 mg/L
r: = 1.0000
Calculated Conc: = 0.002 5.000
Residuals: = -0.007 0.000

Abs = 0.11141 x C

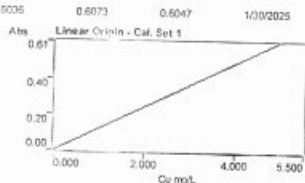
5 ppm Cu					
	5.000	0.3	0.5598		
	Readings				
	0.5552	0.5596	0.5615	1/30/2025	10:52:54 AM

เอกสารไม่ควบคุม

Analyst
Date Started 1/30/2025 10:33 AM GMT: 1/30/2025 3:33 AM
Worksheet Precision Test
Comment
Methods Cu
Computer name DESKTOP-BSUFRS
Serial Number MY13160001

Method: Cu (Flame)

Sample ID	Conc. mg/L	%RSD	Mean Abs
CAL ZERO	0.000	64.1	-0.0002
Readings			
	-0.0003	-0.0003	-0.0001
STANDARD 1	5.000	0.3	0.6052
Readings			
	0.5035	0.6073	0.6047



Curve Fit = Linear Origin
Characteristic Conc = 0.039 mg/L
r = 1.0000
Calculated Conc = -0.002 5.000
Residuals = 0.002 0.000

Abs = 0.12105 x C						
5 ppm Cu	5.007	0.2	0.6051			
	Readings					
	0.6065	0.6052	0.6047	0.6047	0.6042	0.6079
	0.6055	0.6076	0.6064	0.6079	1/30/2025	10:48:32 AM

SPS 4

Down height 0.50 (mm)
Pump speed Medium

Key to tube colors
Sample
Calibration
Calibration/QC
Sample/QC
Not Assigned

Sensitivity Check 1.5 mg/L gives about 0.2 Abs at 324.8 nm, A/A burner

Optimization: Lamp
HC Lamp 1.30
1.00
0.50
0.00
0.917
Optimize Lamp
Optimize Sign
Rescale
First Zero
Gain 49 %
Ok

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Calibration Certificate

Certificate No.: 2502228-003-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: MS204TS/00
Serial No.: C252436235
ID No.: UAE.AIR.023/2566
Order No.: 2502228
Operation No.: 2502228-003
Date of Receipt: 19 March 2025
Date of Calibration: 19 March 2025

Calibrated by Mr.Yothin Charoensuk
Scientist
Approved by *for N. Niyadats*
(Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 25 March 2025

The uncertainties are for a confidence probability of approximately 95%

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

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

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Calibration Report

Certificate No.: 2502228-003-01
Equipment: Electronic Balance
Model: MS204TS/00
Serial No.: C252436235
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g
ID No.: UAE.AIR.023/2566

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Date of Calibration: 19 March 2025
Environment Condition: Ambient Temperature: 23.1 ± 0.6 °C Relative Humidity: 55 ± 0.75 %
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-PA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8505567572	TCS	M24041005	19 April 2025
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-HL	NFI.BTH 017/23	Quality Reborn	QR25-0542	10 February 2026

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

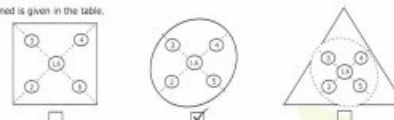
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000052
200	0.000079

2. Off-Center Error:

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

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
99.9997	99.9995	99.9995	99.9997	99.9999	99.9998	0.0003

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

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System Information

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

Instrument System Name and ID	UAE_TOX.007
Instrument System Site and Location	Laboratory

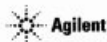
List System Component Product Numbers	List the Serial Numbers of each Component
1. G3440A	CN11021007
2. G4513A	CN20030059
3. G4514A	CN20020060
4.	
5.	
6.	
7.	
8.	
9.	
10.	

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, settings as defined by current Service Notes.
- ☑ Check for required firmware updates and verify with customers if they would like them installed.
- ☑ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.

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Preventive Maintenance Procedure

Clean and inspect GC

- ☑ Unplug power cord from the power source.
- ☑ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ☑ Inspect internal connectors for proper contact and placement.
- ☑ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- ☑ Verify oven motor spins freely and turns on with the oven door closed; off when the door is opened.
- ☑ Verify operation of all other fans - the inlet and EPC cooling fans.
- ☑ Verify oven intake/outlet flap assembly is operating smoothly while heating and cooling the oven

Inlet and detector consumable replacement

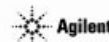
- ☑ For the inlets installed, perform inlet maintenance as defined in the 7890 manual - "Maintaining Your GC" - for the inlet(s) installed.
- ☑ Replace the split vent trap cartridge filter on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
- ☑ If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- ☑ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castle assemblies for contamination - clean as necessary.

Zero Sensors and Leak test

- ☑ Zero all pressure sensors per the procedure in the 7890 "Advanced User Guide".
- ☑ Perform inlet pressure decay test(s) as defined in the 7890 "Troubleshooting Manual". If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.
- ☑ Record if test passed or failed in the results table.

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ALS Maintenance

- ☐ Section NOT applicable
- ☑ Check all cabling and configuration settings between GC, tray, and injectors.
- ☑ Vacuum or remove any dust, especially around fans.
- ☑ Check operation of all fans.
- ☑ Check syringe for smooth plunger operation.
- ☑ Check for smooth operation of the needle support - clean if necessary

Restore Instrument

- ☑ Restore the normal operating conditions or customer method using the Data System.
- ☑ Purge the system with carrier flow for 15 minutes
- ☑ Bake out the system, then restore the normal operating conditions
- ☑ After equilibration, check and record the post PM detector signal output values. Results should be similar or lower than the detector outputs recorded prior to PM.
- ☑ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Note: 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.

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Signature Page

Service Review

- ☑ Attach available reports/printouts of all tests to this documentation.
- ☑ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☑ Update/reset instrument maintenance counters as appropriate.
- ☑ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☑ Complete the Service Engineer Comments section if there are additional comments.
- ☑ Review with the customer this service, parts replaced, and test results obtained.
- ☑ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

7890 GC Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Front detector output	313.5	313.5
Back detector output	24.5	19.3
AUX detector output	n/a	n/a
Pressure decay test	Expected test result	Actual test result
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	n/a

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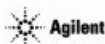
7890 Parts List Table

The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

Part description	Part number	Product or model# where used	Quantity consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	7890A/B	1
SSL Capillary Inlet PM kit, split	5188-6496	7890A/B	-
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	-
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	-
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	7890A/B	-
PP Inlet PM kit	5188-6498	7890A/B	-
Split vent trap PM kit, single cartridge (for MMI, PTV & VI)	5188-6495	7890A/B	-
MMI Cleaning Kit	G3510-60820	7890A/B	-
PTV Septumless Head Rebuild Kit	5182-9747	7890A/B	-
PTV Septumless Head Teflon Guide	5182-9748	7890A/B	-
Ignitor (glow plug) assembly with O-ring	19231-60680	7890A/B	1
FID Collector Rebuild/Cleaning Kit	G1531-67000	7890A/B	-
Standard .011-inch FID Jet for capillary FID base	G1531-80560	7890A/B	-
High Temperature .018-inch FID Jet for capillary FID base	G1531-80620	7890A/B	-
Standard .018-inch FID Jet for packed column with packed FID base	18710-20119	7890A/B	-
Standard .011-inch FID Jet for capillary column with packed/adaptable FID base	19244-80560	7890A/B	1
High Temperature .018-inch FID Jet for capillary column with packed/adaptable FID base	19244-80620	7890A/B	-
NPD Jet, universal fit, .011-inch ID	G1534-80580	7890A/B	-
NPD Jet, universal fit, .011-inch ID Extended tip	G1534-80590	7890A/B	-
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	-
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	-
**FID Collector Replacement Kit, if needed	G1531-67001	7890A/B	-

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Service Engineer Comments

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

- The Equipment can operate as normally.

Service Completion

Service request number 6007319635 Date service completed 18 Feb 2025
 Agilent signature Adisak R. Customer signature _____
 Total number of pages in this document 9

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Agilent CrossLab Start Up Services

Agilent 7890 Gas Chromatograph Preventive Maintenance Checklist

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 everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.

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.
- 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.

Important Customer Web Links

- For more information about **Agilent Technologies services**, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- 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>.
- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>.
- Need technical support, FAQs, supplies? – visit our **Support Home page** <http://www.agilent.com/search/support>.
- Videos** about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>.
- 7890B Manuals** are also available on Agilent.com:
 - Safety** https://www.agilent.com/cs/library/usermanuals/public/7890B_Safety.pdf
 - Installation and First Startup** https://www.agilent.com/cs/library/usermanuals/Public/7890B_Installation.pdf
 - Operation Manual** https://www.agilent.com/cs/library/usermanuals/Public/7890B_Operation.pdf
 - Maintaining Your GC** https://www.agilent.com/cs/library/usermanuals/public/G3430-90052%207890B_Maintaining%20Guide.pdf

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Service Engineer's Responsibilities

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

Additional Instruction Notes

- Check for any active service notes for this unit. If there are any applicable "Safety" or "Modification Recommended" Service notes, plan to implement the changes on this unit before doing any qualification service.
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with the instrument control software.

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System Information

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

Instrument System Name and ID	UAE.TOX.021
Instrument System Site and Location	Laboratory

List System Component Product Numbers	List the Serial Numbers of each Component
1. G3440B	CN13113001
2. G4513A	CN22285355
3. G4514A	CN13200169
4.	
5.	
6.	
7.	
8.	
9.	
10.	

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, settings as defined by current Service Notes.
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.

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Preventive Maintenance Procedure

Clean and inspect GC

- ☒ Unplug power cord from the power source.
- ☒ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ☒ Inspect internal connectors for proper contact and placement.
- ☒ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- ☒ Verify oven motor spins freely and turns on with the oven door closed; off when the door is opened.
- ☒ Verify operation of all other fans - the inlet and EPC cooling fans.
- ☒ Verify oven intake/outlet flap assembly is operating smoothly while heating and cooling the oven

Inlet and detector consumable replacement

- ☒ For the inlets installed, perform inlet maintenance as defined in the 7890 manual – "Maintaining Your GC" – for the inlet(s) installed.
- ☒ Replace the split vent trap cartridge filter on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
- ☒ If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- ☒ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castle assemblies for contamination – clean as necessary.

Zero Sensors and Leak test

- ☒ Zero all pressure sensors per the procedure in the 7890 "Advanced User Guide".
- ☒ Perform inlet pressure decay test(s) as defined in the 7890 "Troubleshooting Manual". If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.
- ☒ Record if test passed or failed in the results table.

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ALS Maintenance

- ☐ Section NOT applicable
- ☒ Check all cabling and configuration settings between GC, tray, and injectors.
- ☒ Vacuum or remove any dust, especially around fans.
- ☒ Check operation of all fans.
- ☒ Check syringe for smooth plunger operation.
- ☒ Check for smooth operation of the needle support – clean if necessary

Restore Instrument

- ☒ Restore the normal operating conditions or customer method using the Data System.
- ☒ Purge the system with carrier flow for 15 minutes
- ☒ Bake out the system, then restore the normal operating conditions
- ☒ After equilibration, check and record the post PM detector signal output values. Results should be similar or lower than the detector outputs recorded prior to PM.
- ☒ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Note: 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.

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Signature Page

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review with the customer this service, parts replaced, and test results obtained.
- ☐ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

7890 GC Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Front detector output	23.5	23.5
Back detector output	n/a	n/a
AUX detector output	n/a	n/a
Pressure decay test	Expected test result	Actual test result
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	n/a

Revision: 2.01, Issued: September 15, 2021
 Agile Document Number: D0013618
 DE number: 44166.759722222
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7890 Parts List Table

The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

Part description	Part number	Product or model# where used	Quantity consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	7890A/B	1
SSL Capillary Inlet PM kit, split	5188-6496	7890A/B	-
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	-
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	-
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	7890A/B	-
PP Inlet PM kit	5188-6498	7890A/B	-
Split vent trap PM kit, single cartridge (for MMI, PTV & VI)	5188-6495	7890A/B	-
MMI Cleaning Kit	G3510-60820	7890A/B	-
PTV Septumless Head Rebuild Kit	5182-9747	7890A/B	-
PTV Septumless Head Teflon Guide	5182-9748	7890A/B	-
Ignitor (glow plug) assembly with O-ring	19231-60680	7890A/B	-
FID Collector Rebuild/Cleaning Kit	G1531-67000	7890A/B	-
Standard .011-inch FID Jet for capillary FID base	G1531-80560	7890A/B	1
High Temperature .018-inch FID Jet for capillary FID base	G1531-80620	7890A/B	-
Standard .018-inch FID Jet for packed column with packed FID base	18710-20119	7890A/B	-
Standard .011-inch FID Jet for capillary column with packed/adaptable FID base	19244-80560	7890A/B	-
High Temperature .018-inch FID Jet for capillary column with packed/adaptable FID base	19244-80620	7890A/B	-
NPD Jet, universal fit, .011-inch ID	G1534-80580	7890A/B	-
NPD Jet, universal fit, .011-inch ID Extended tip	G1534-80590	7890A/B	-
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	-
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	-
**FID Collector Replacement Kit, if needed	G1531-67001	7890A/B	-

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Service Engineer Comments

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

- The Equipment can operate as normally.

Service Completion

Service request number 6007521609 Date service completed 1 APR 2025

Agilent signature Adisak R. Customer signature _____

Total number of pages in this document 9

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 DE number: 44166.759722222
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บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
 80-82 Prachathipatai Rd., Bangkokunphrom, Pranakorn, Bangkok 10200
 Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail: thawat@thaiunique.com, Website : www.thaiunique.com

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, Prakhonong, 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 $\geq 1,667 \mu V \cdot Min$) = 14,380.3 $\mu V \cdot Min$.

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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 Poltongkam

Date : 26/04/2025




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



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SERVICE DEPARTMENT

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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.)

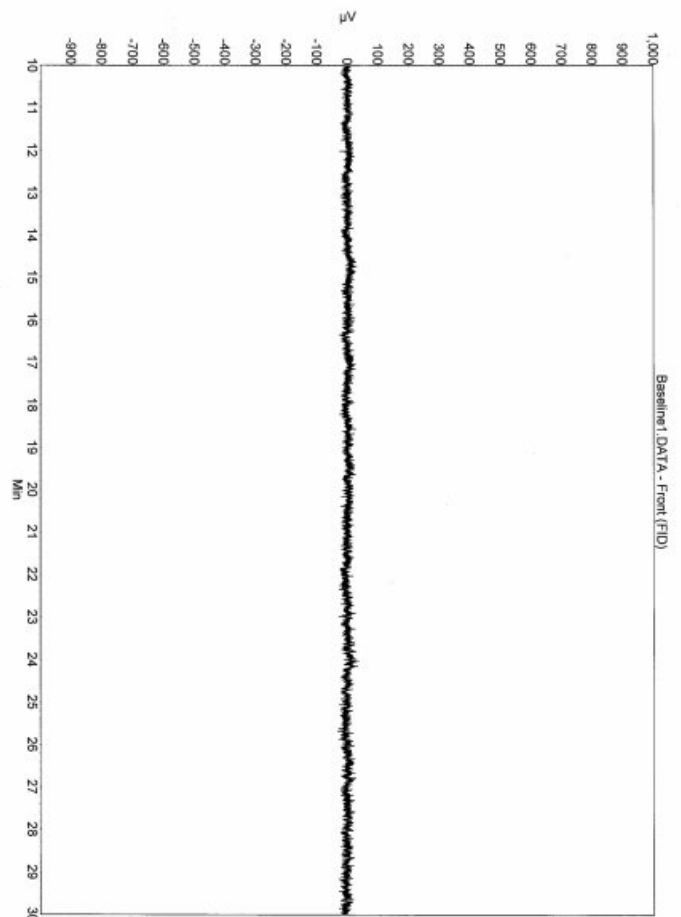
$$\% \text{ RSD} = (\text{std.dev} / \text{avg}) * 100$$

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



Comments		
Reviewed by		Date 26/04/2025

Chromatogram : Baseline1_channel1



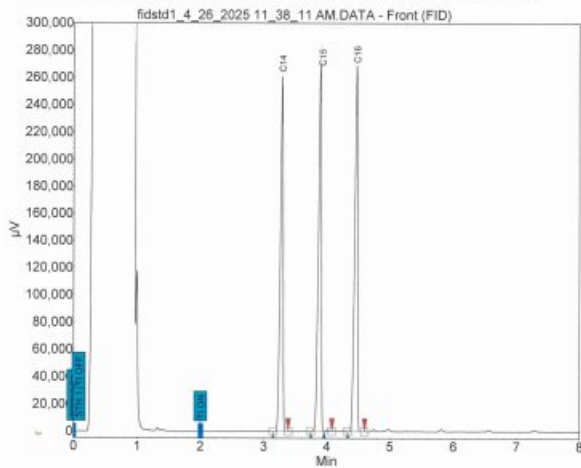
1/1

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เอกสารไม่ควบคุม

ANALYSIS / TEST REPORT

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

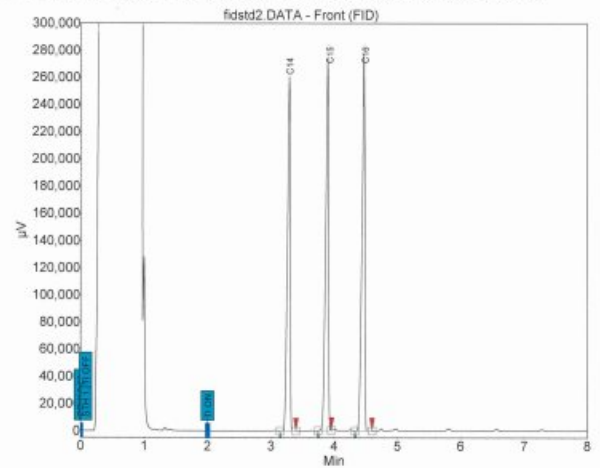


Index	Name	Time [Min]	Quantity [ng/µL]	Height [µV]	Area % [%]	Area [µV Min]	Area [µV Sec]	Width 50% [Min]
1	C14	3.28	30.09	261050.9	31.334	13207.7	792462.3	0.05
2	C15	3.90	30.11	270040.3	34.240	14432.6	865958.5	0.05
4	C16	4.47	30.09	268890.5	34.283	14454.9	867295.1	0.05
Total		90.28	90385.1	100.000	42151.4	2529083.7		

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ANALYSIS / TEST REPORT

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

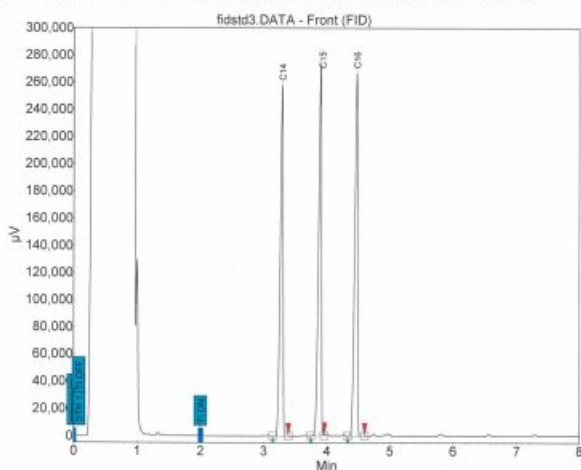


Index	Name	Time [Min]	Quantity [ng/µL]	Height [µV]	Area % [%]	Area [µV Min]	Area [µV Sec]	Width 50% [Min]
1	C14	3.28	29.97	260370.6	31.386	13155.5	789331.9	0.05
2	C15	3.90	29.95	273845.9	34.248	14355.2	861305.7	0.05
3	C16	4.47	29.98	276895.6	34.365	14404.1	864243.3	0.05
Total		89.90	891115.0	100.000	41914.7	2514885.9		

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ANALYSIS / TEST REPORT

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

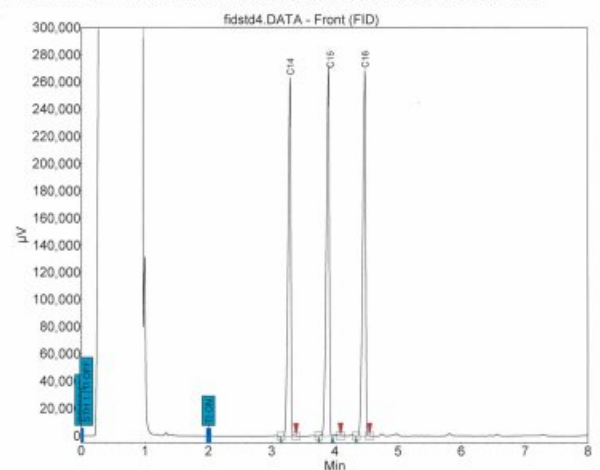


Index	Name	Time [Min]	Quantity [ng/µL]	Height [µV]	Area % [%]	Area [µV Min]	Area [µV Sec]	Width 50% [Min]
1	C14	3.28	29.86	257876.7	31.400	13106.6	786393.4	0.05
2	C15	3.90	29.82	273243.5	34.250	14296.1	857767.2	0.05
3	C16	4.47	29.85	266672.1	34.349	14337.3	860240.2	0.05
Total		89.53	797792.3	100.000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

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ANALYSIS / TEST REPORT

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

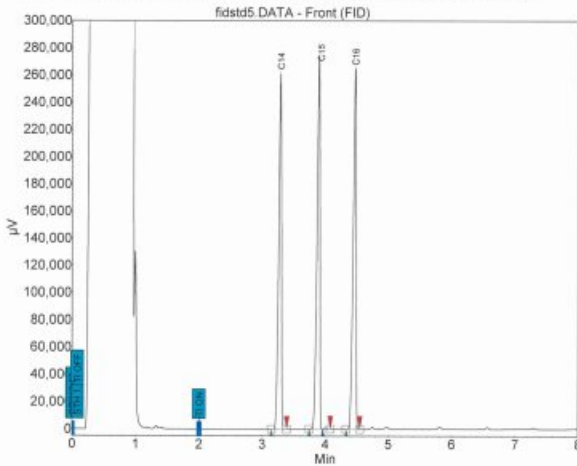


Index	Name	Time [Min]	Quantity [ng/µL]	Height [µV]	Area % [%]	Area [µV Min]	Area [µV Sec]	Width 50% [Min]
1	C14	3.28	30.23	263354.5	31.347	13268.2	796090.9	0.05
2	C15	3.90	30.23	271861.3	34.234	14490.1	869404.6	0.05
4	C16	4.47	30.21	268560.8	34.288	14513.0	870781.9	0.05
Total		90.67	904657.1	100.000	42326.3	2539580.9		

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ANALYSIS / TEST REPORT

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

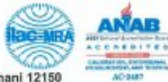


Index	Name	Time (Min)	Quantity (µg/mL)	Height (µV)	Area (µV·Min)	Area (%)	Width (Min)
1	C14	3.28	29.86	261381.7	31.330	13107.3	786435.0
2	C15	3.50	29.89	274115.5	34.248	14327.5	859548.1
4	C16	4.47	29.87	265568.4	34.294	14347.5	860849.8
Total		89.62	801922.2	100.000	41836.3	2510180.7	

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WK Electric Co., Ltd.

68/242 Moo 5, Sawalpracharaj Rd., Tumbol Ladsawai, Amphur Lamukha, 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 Prachathipatai Rd., Bangkokphrom,
Pranakorn, Bangkok 10200

Instrument : AMD Flow Meter
Manufacturer : Agilent Technologies
Model : G6691A
Serial No. : MY16470347
Identity No. : SV-DP-001
Range : 0 ml/min to 750 ml/min
Resolution : See to Data
Calibration Method : CP-WK-M10

Ambient Temperature : (23 ± 2) °C
Humidity : (50 ± 15) %RH
Received Date : 4-Dec-24
Calibrated Date : 11-Dec-24
Issued Date : 13-Dec-24
Calibrated Location : In Lab

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. Thippatit Mungpungklang

Approved by:

Ms. Budsagorn 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.



Certificate of Analysis

FID-TCD Performance Evaluation Sample Kit

Agilent Part Number: 5080-8842, 18710-60170

Sample Lot Number: 0006750304

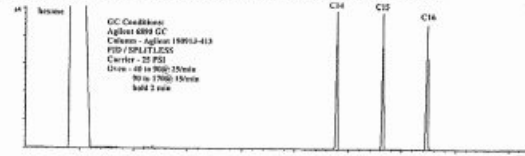
This analytical reference material was manufactured and verified in accordance with an ISO 9001 registered quality system, and the analyte concentrations were verified by an ISO 17025 accredited laboratory. The certified value for each analyte was determined gravimetrically.

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/NCCL 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
QMS Representative

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

Mrs. Nanthiya Ngampring
Metrology Technician

Approved by

Mrs. Arunee 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

F5100

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เอกสารไม่ควบคุม

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: 



Varian Analytical Instruments
Varian Chrompack International BV
Herselweg 10
P.O. Box 8033
4230 EA Middelburg
The Netherlands
Tel.: +31 118 671000
Fax: +31 118 633110
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.

Revision: A.02, Issued: 21 January 2022
Document Number: G8014-90075
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Agilent 5100, 5110 Preventive Maintenance Checklist



Introduction

Customer Information

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

Agilent 5100, 5110 Preventive Maintenance Checklist



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](#)

Revision: A.02, Issued: 21 January 2022
Document Number: G8014-90075
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Service Engineer's Responsibilities

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

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 805A	77 76030001
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 HIF application systems, if standard sample introduction system was not installed, ask the customer to install it. (11)
- ☒ 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. (11)
- ☒ 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	7492.1	13017.9	31121.6
Al 396.152 nm SBR	9.9	10.7	9.9	21.1
K 766.491 nm SBR	5.7	29.1	4.8	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	Pass
Air Flow	Pass
Water Flow	Pass
Gas Flows	Pass
RF Generator	Pass
Camera Test	Pass
Optics Test	Pass
Nebulizer test	Pass

Resolution Test			Pass
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 (260.588 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 (493.408 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	

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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	16911.7
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	6956460.4	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	0.98	
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
Flame/View	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	Radial 3184054 Axial 3177175
Wavelength	Radial 737.212 Axial 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 (206.138 nm)	≤ 13.40	9.06	
Zn (213.637 nm)	≤ 8.70	6.70	
Pb (220.353 nm)	≤ 8.50	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	25.44	
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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เอกสารไม่ควบคุม

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 (213.637 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	2059203.0	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 (206.200 nm)	≥ 234.0	SRBR	740.9	6836.0	83.1	
Zn (213.637 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	0.96	
Zn (213.637 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 (206.200 nm)	≤ 1.50	0.79	
Zn (213.637 nm)	≤ 1.50	0.81	
Cd (214.439 nm)	≤ 1.50	0.35	
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)	≤ 38.00	25.74
Ba (614.171 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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เอกสารไม่ควบคุม

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	6398.3	157551.5	601.7
Cd (214.439 nm)	≥ 4227.0	SRBR	5089.2	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	8460421.5	60122.8
K (766.491 nm)	≥ 24.0	SBR	30.2	1639840.6	52582.1

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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)	≤ 2.80	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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เอกสารไม่ควบคุม



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)

PM

Preventive Maintenance

Check List

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

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
24/Apr/2025
Date

Simon
Customer
24/Apr/2025
Date

เอกสารไม่ควบคุม



General ICS Maintenance Checklist

No.	Description	Result			
		Checked	Cleaned	Replaced	N/A
1	Power on & Connection	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
2	Instrument connection	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
3	Rebuilt injection valve 6 port	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	- Rotor seal	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	- Stator face	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Rebuilt auxiliary valve - port	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7	- Rotor seal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
8	- Stator face	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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 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 and Priming 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			
		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"/>
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"/>
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"/>	Lubricated	-	<input type="checkbox"/>
9.	AS-DV cover	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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 Qualification

เอกสารไม่ควบคุม

ThermoFisher
SCIENTIFIC
Chromeleon Operational Qualification

General Information

Instrument Controller: DESKTOP-C4FS3L7
Client: DESKTOP-C4FS3L7
Operator: Saharat Popayom
Computer Name: Version Number:
7.3.1 Build 6535
7.3.1.6535
Overall Test Result: **Passed**

Comparison Format:

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

Suran 24/Apr/2025
Reviewer's Signature // Date


Signature: 24 Apr 2025
Operator's Signature // Date

เอกสารไม่ควบคุม

ThermoFisher
SCIENTIFIC
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

ThermoFisher
SCIENTIFIC
Chromeleon Operational Qualification, Part 1
Verification of Selected Results

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

เอกสารไม่ควบคุม

ThermoFisher
SCIENTIFIC
Chromeleon Operational Qualification, Part 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, WithOffset
Evaluation Type: Area
Standard Method: External
Calibration Mode: Total

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



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

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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



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	RF-Value	Acetanilide	ok
	RF-Value	Acetophenone	ok
	RF-Value	Propiophenone	ok
	No. of Points	Acetanilide	ok
	No. of Points	Acetophenone	ok

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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
	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

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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

Test Result: Passed

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Chromeleon Operational Qualification, Part 3

System Suitability Test: Comparison with Expected Results

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

Test Result: Passed

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PQ

Performance Qualification

IC PUMP FLOW RATE ACCURACY

ThermoFisher
SCIENTIFIC

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

OVERALL TEST RESULT: PASS
ARCHIMEGA LAB

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

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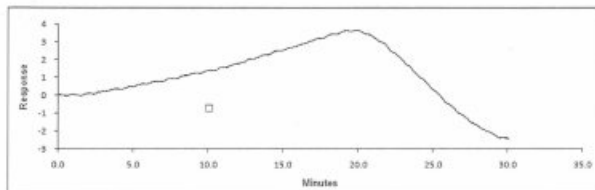
23-Apr-2025
IC Pump Flow Rate Accuracy Report Page 1 of 1

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

NOISE AND DRIFT (CD)

ThermoFisher
SCIENTIFIC



Information

System Name	AquionRFIC
Detector SN	220390045
Data Path	chrom://desktop-c4fs3f7/ChromleonLocal/Archemical/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

OVERALL TEST RESULT: PASS
ARCHIMEGA LAB

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

RPG Reports v2.070
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23-Apr-2025
Noise and Drift (CD) Report Page 1 of 1

เอกสารไม่ควบคุม

TEST EQUIPMENT AND STANDARDS

ThermoFisher
SCIENTIFIC

Test Equipment

Equipment	Manufacturer	Model	Serial Number	Cal/Ver Date	Good Until
Multimeter	Fluke	289	56270015	N/A	N/A
Thermocouple	Fluke	K-Type	56270015	N/A	N/A
Balance	MettlerToledo	AB204-S	1129361010	N/A	N/A
IC Qualification	Thermo Scientific	Test Box	24159332	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

OVERALL TEST RESULT: PASS
ARCHIMEGA LAB

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

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23-Apr-2025
Test Equipment and Standards Report Page 1 of 1

เอกสารไม่ควบคุม

REPEATABILITY (CD)

ThermoFisher
SCIENTIFIC

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

OVERALL TEST RESULT: PASS
ARCHIMECA LAB CO., LTD.

Field Service Representative Signature:	Customer Signature:
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	0.4467	47.903
Carryover	25	0.4467	0.06

Results

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

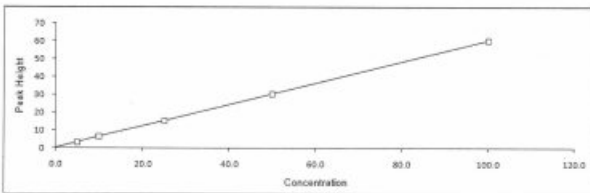
OVERALL TEST RESULT: PASS
ARCHIMECA LAB CO., LTD.

Field Service Representative Signature:	Customer Signature:
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
ARCHIMECA LAB CO., LTD.

Field Service Representative Signature:	Customer Signature:
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
ARCHIMECA LAB CO., LTD.




Field Service Representative Signature:	Customer Signature:
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: Archemica 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: 59270015	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:				
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: (50 +/- 15) %				
Calibration Information: - The result of calibration was found accurate as show 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. Suputhane Prasessi				
Approved by:  Mr. Tanawat Sirpisakdee				
This certificate may not be reproduced, except in full unless permission for the publication of an approved abstract is obtained in writing from the calibration organization issuing this report.				

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 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	-0.205 mV	0.0022 mV
50 mV	45.0000 mV	44.993 mV	-0.007 mV	0.0022 mV
50 mV	450.0000 mV	450.002 mV	0.002 mV	0.0022 mV
500 mV	50.0000 mV	50.000 mV	0.000 mV	0.0061 mV
500 mV	450.0000 mV	449.98 mV	-0.02 mV	0.0080 mV
500 mV	450.0000 mV	449.99 mV	-0.01 mV	0.0080 mV
5 V	0.500000 V	0.50000 V	0.00000 V	0.00059 V
5 V	4.50000 V	4.4997 V	-0.0003 V	0.00082 V
5 V	45.0000 V	44.997 V	-0.003 V	0.00082 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
50 V	450.0000 V	449.997 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	0.059 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	0.0000000 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	900.0 V	0.0 V	0.060 V
1000 V	900.000 V	900.0 V	-0.0 V	0.060 V
Function: AC Voltage Measurement (Without Adjustment)				
50 mV	5.000 mV	4.988 mV	-0.012 mV	0.0053 mV
50 mV	45.000 mV	45.003 mV	0.003 mV	0.013 mV
500 mV	50.000 mV	49.94 mV	-0.06 mV	0.014 mV
500 mV	450.00 mV	450.13 mV	0.13 mV	0.11 mV
5 V	0.50000 V	0.4986 V	-0.0014 V	0.00012 V
5 V	4.5000 V	4.5012 V	0.0012 V	0.0011 V
50 V	5.0000 V	4.988 V	-0.012 V	0.0012 V
50 V	45.000 V	45.012 V	0.012 V	0.0085 V
500 V	50.000 V	49.88 V	-0.12 V	0.011 V
500 V	450.00 V	450.16 V	0.16 V	0.12 V
1000 V	100.000 V	100.0 V	0.0 V	0.060 V
1000 V	900.00 V	900.4 V	0.4 V	0.23 V
Remark: (*) UUC: Unit Under Calibration				

เอกสารไม่ควบคุม

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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	0.4 V
1000 V	900.00 V	50 Hz	905.7 V	5.7 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	0.028 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	45.000 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	45.000 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(0) 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	0.000060 kΩ
5 kΩ	4.50000 kΩ	4.4996 kΩ	-0.0004 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	0.4999 MΩ	-0.0002 MΩ	0.000061 MΩ
5 MΩ	4.50000 MΩ	4.4991 MΩ	-0.0009 MΩ	0.00056 MΩ
30 MΩ	3.00000 MΩ	3.000 MΩ	0.000 MΩ	0.00061 MΩ
50 MΩ	5.00000 MΩ	26.987 MΩ	-0.013 MΩ	0.0075 MΩ
50 MΩ	45.0000 MΩ	5.00 MΩ	0.00 MΩ	0.0059 MΩ
100 MΩ	10.00000 MΩ	44.97 MΩ	-0.03 MΩ	0.021 MΩ
100 MΩ	90.0000 MΩ	10.0 MΩ	0.0 MΩ	0.058 MΩ
500 MΩ	250.0000 MΩ	89.4 MΩ	-0.1 MΩ	0.069 MΩ
500 MΩ	450.000 MΩ	249.4 MΩ	-0.6 MΩ	0.58 MΩ
500 MΩ	450.000 MΩ	448.0 MΩ	-2.0 MΩ	5.9 MΩ
Function : Resistance Measurement LoR (Without Adjustment)				
50 Ω	0.0000 Ω	0.000 Ω	0.000 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	0.896 nF	-0.002 nF	0.012 nF
10 nF	1.0000 nF	1.00 nF	0.00 nF	0.013 nF
10 nF	9.0000 nF	9.00 nF	0.00 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 μF	0.100000 μF	0.100 μF	0.000 μF	0.00064 μF
1 μF	0.50000 μF	0.500 μF	0.000 μF	0.0029 μF
1 μF	1.00000 μF	1.00 μF	0.00 μF	0.0064 μF
10 μF	9.0000 μF	9.00 μF	0.00 μF	0.028 μF
100 μF	10.0000 μF	10.0 μF	0.0 μF	0.064 μF
1000 μF	100.000 μF	100 μF	0.0 μF	0.42 μF
1000 μF	900.000 μF	899 μF	-1 μF	0.72 μF
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

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Tel: +66(0) 694 145-8, 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	@ 1 V	10.000 Hz	0.00059 Hz
100 Hz	90.00 Hz	@ 1 V	90.000 Hz	0.00066 Hz
1000 Hz	100.00 Hz	@ 1 V	100.00 Hz	0.00058 Hz
1000 Hz	900.0 Hz	@ 1 V	900.0 Hz	0.0061 Hz
10 kHz	1.0000 kHz	@ 1 V	1.0000 kHz	0.000058 kHz
10 kHz	9.000 kHz	@ 1 V	9.0000 kHz	0.00007 kHz
100 kHz	10.000 kHz	@ 1 V	10.000 kHz	0.00058 kHz
100 kHz	90.000 kHz	@ 1 V	90.000 kHz	0.00061 kHz
1000 kHz	100.00 kHz	@ 1 V	100.00 kHz	0.00058 kHz
1000 kHz	500.0 kHz	@ 1 V	500.0 kHz	0.0059 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

ARCHIMECHA LAB
ARCHIMECHA LAB CO., LTD.
Saharat
24 Apr 2015

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ระบบชุดทดสอบ

Thermo Scientific
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: 22000-00001

Tester: Alicia Talavera
Date: 11-Apr-2015

TEST BOX LOADS AND FUNCTIONS

Test	Result	Specification
[X] ABE	100Q	+/- 5%
[X] EOC CAP ROH	100Q	+/- 5%
[X] EOC CAP MSA	100Q	+/- 5%
[X] EOC ANA ROH	100Q	+/- 5%
[X] EOC ANA MSA	100Q	+/- 5%
[X] ERS (CV)	250Q	+/- 5%
[X] CR-TC 3-pin ANA INT	1.3KQ	+/- 5%
[X] CR-TC 3-pin CAP INT	1.3KQ	+/- 1%
[X] CR-TC 4-pin ANA INT	1.3KQ	+/- 5%
[X] CR-TC 4-pin CAP INT	1.3KQ	+/- 1%
[X] EOC - Memory Test	12Q	+/- 5%
[X] CR-TC - Memory Test	12Q	+/- 5%

ARCHIMECHA LAB CO., LTD.
Saharat
24 Apr 2015

EN 12000-27001 C

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

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. 078890-01

20-Dec-2011

thermoscientific.com/dionex

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Thermo Fisher Scientific
1225 Third Way
P.O. Box 1000
Sunnyvale, CA 94089-3003
(408) 727-4700

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Valid for 3 years from:
Aug/26/2024

OTT RPG Mentoring: Ion Chromatography System Qualification/Service Training

Has successfully completed
Saharat Popayom

This certifies that

Certificate of Completion

ThermoFisher
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ThermoFisher Scientific is a global leader in serving science. The world leader in serving science. The world leader in serving science.

Calibration Certificate

Certificate No.: 2502228-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udumsook 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XP6
Serial No.: B322373893
ID No.: UAE.AIR.019/2556
Order No.: 2502228
Operation No.: 2502228-002
Date of Receipt: 19 March 2025
Date of Calibration: 20 March 2025

Calibrated by Mr.Yothin Charoensuk Scientist
Approved by N. Ningsubot (Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 25 March 2025

The uncertainties are for a confidence probability of approximately 95%
This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

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

2008 Dekongkiet Road 38 Nuekprang Road Bangkok 10110 Thailand
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Calibration Report

Certificate No.: 2502228-002-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XP6
Serial No.: B322373893
Capacity: 6.1 g
Date of Calibration: 20 March 2025
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:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8905567572	TCS	M04041005	19 April 2025
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo Hygro Meter	608-H1	NFLBTH 017/23	Quality Reborn	QK25-0542	10 February 2025

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

Calibration Results:

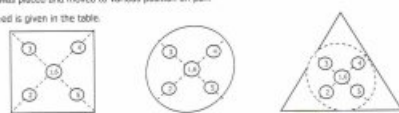
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
3	0.0000079
6	0.0000067

2. Off-Center Error:

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

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
2.000018	2.000017	2.000014	2.000014	2.000024	2.000019	0.000005

Calibration Report

Certificate No.: 2502228-002-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XP6
Serial No.: B322373893
Capacity: 6.1 g
Date of Calibration: 20 March 2025
Calibration Results: (Continued)
Calibration Range: 0-6 g
Calibration Adjustment: Internal Calibration
3. Departure from Nominal Value:

Page 3 of 3

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor K
Unloaded	0.0000000	0.0000000	0.0000000	0.0000032	2.00
0.001	0.0010030	0.0010032	0.0000001	0.0000032	2.00
0.01	0.0100030	0.0100032	0.0000001	0.0000032	2.00
0.05	0.0499960	0.0500001	-0.0000005	0.0000044	2.00
0.10	0.1000110	0.1000111	0.0000001	0.0000057	2.00
0.15	0.1500070	0.1500100	-0.0000003	0.0000071	2.00
0.17	0.1700130	0.170012	0.0000001	0.0000077	2.00
0.20	0.2000110	0.200015	-0.0000004	0.0000065	2.00
1.50	1.5000190	1.500017	0.0000002	0.000017	2.00
3.00	3.0000260	3.000017	0.0000009	0.000019	2.00
4.50	4.5000310	4.500023	0.0000008	0.000023	2.00
6.00	6.0000180	6.000014	0.0000004	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

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



CERTIFICATE OF CALIBRATION

Certificate No. : SP24-028Page 1 of 5

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

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

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : HITACHI

Model : U-5100

Serial No. : 23A4-008

ID No. : UAE.WAS.010/2567

Received Date : 10 September 2024

Calibration Date : 10 September 2024

Issue Date : 13 September 2024

Condition Instrument : Good

Calibrated by : 
(Mr.Tanawat Ritidach)
Technical Manager

Approved by : 
(Ms. Chonthicha Sangern)
Quality Manager

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

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

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FSM-708-02 R01 1/11/2021

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



REPORT OF CALIBRATION

Certificate No. : SP24-028Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

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

Certified Reference Materials :

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

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

Spectral Band Width of UUC : 5.0 nm.



Scan Speed of UUC : 40

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

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



REPORT OF CALIBRATION

Certificate No. : SP24-028Page 3 of 5



Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.044	0.0044	0.0029	2.00
	2.1876	2.190	-0.0024	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.557	0.0025	0.0034	2.00
	1.0239	1.021	0.0029	0.0035	2.00
	2.1230	2.121	0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.519	0.0040	0.0029	2.00
	0.9633	0.961	0.0023	0.0028	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.515	0.0031	0.0031	2.00
	1.0002	0.997	0.0032	0.0033	2.00
	1.9973	1.996	0.0013	0.0085	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.549	0.0027	0.0030	2.00
	1.0803	1.078	0.0023	0.0029	2.00
	2.0373	2.031	0.0063	0.0081	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.557	0.0021	0.0031	2.00
	1.0518	1.049	0.0028	0.0029	2.00
	1.9274	1.923	0.0044	0.0080	2.00

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

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



REPORT OF CALIBRATION

Certificate No. : SP24-028Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.743	0.0039	0.0056	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.862	0.0054	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.291	0.0009	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.639	0.0040	0.0055	2.00

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

DQE

Services

DQE Services Co.,Ltd.

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

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

REPORT OF CALIBRATION

Certificate No. : SP24-028

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.00	240.4	0.60	0.18	2.00
279.30	278.7	0.60	0.18	2.00
288.90	288.5	0.40	0.18	2.00
334.50	334.2	0.30	0.18	2.00
361.40	361.1	0.30	0.18	2.00
418.40	418.0	0.40	0.18	2.00
447.20	446.7	0.50	0.18	2.00
459.30	459.6	-0.30	0.18	2.00
537.00	536.6	0.40	0.18	2.00
638.00	637.4	0.60	0.18	2.00
441.29	440.8	0.49	0.18	2.00
479.88	479.6	0.28	0.18	2.00
513.75	513.5	0.25	0.18	2.00
528.59	528.6	-0.01	0.18	2.00
575.10	574.9	0.20	0.18	2.00
585.56	585.3	0.26	0.20	2.00
684.70	684.1	0.60	0.18	2.00
740.51	740.0	0.51	0.20	2.00
747.61	747.2	0.41	0.18	2.00
807.04	806.3	0.74	0.18	2.00
879.68	878.9	0.78	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- End of Certificate -

เอกสารไม่ควบคุม
P3M-708-02 R01 1/1/2021

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

Certificate of Calibration

Cert.No.: 24MM292

Page.: 1 of 3

Equipment :	Electronic Balance
Manufacturer :	Mettler Toledo
Model :	AB204-S/FACT
Serial No. :	1129361010
ID No. :	UAE.WAS.002/2552
Submitted by :	United Analyst and Engineering Consultant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Location :	Balance Room (108)
Received order :	11 May 2024
Calibration Date :	11 May 2024
Ambient Temperature :	15 °C to 40 °C
Relative Humidity :	30 % to 90 %
Calibrated by :	Khit Ruttanaprapachai
Approved by :	<u>Kunchit</u> Approved Signatory
() Ponpan Paipim	
() Suwit Imjai	
(✓) Kunchit Promprat	
Issue Date :	15 May 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

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

Cert.No.: 24MM292
Page: 2 of 3

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

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0013-24	25 Jan 2026

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

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

4. This certificate is not certified for any commercial transaction.

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

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

Range capacity : 0 g to 220 g Resolution 0.0001 g

Before Adjustment :

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

After Adjustment :

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

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

เอกสารไม่ควบคุม

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

Result of calibration

2. Effect of off center loading

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

Position 1	Position 2	Position 3	Position 4	Position 5	Maximum difference between off-center and central loading
(g)	(g)	(g)	(g)	(g)	(g)
-0.0004	-0.0004	-0.0003	-0.0003	-0.0004	0.0001

3. Departure from nominal value

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

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

-o0o-

เอกสารไม่ควบคุม

Certificate of Calibration

Certificate No.: 250422-1-BL002-25

Code No.: BL002-25

Page: 1 of 3

Customer Name: United Analyst and Engineering Consultant Co., Ltd.
Address: 3 Soi Udomsuk 41, Sukhumvit Rd., Bang Chak, Phrakhanong, Bangkok 10260

Equipment: Electronic Balance

Manufacturer: Mettler Toledo

Model: AB204-S/FACT

Serial No.: 1129361010

Asset No.: UAE.WAS.002/2552

Building: N/A Floor: 1 Room: 107

Received Date: April 22, 2025

Date of Calibration: April 23, 2025

Calibration Conditions: Temperature 22.8 °C to 23.4 °C
Humidity 54.8 % to 68.9 %
Pressure 756.6 mmHg to 758.2 mmHg

Calibrated by: Sakkarin Srirahang

Approved by: Suwit Chotnok

Signature: 

Issued Date: April 25, 2025

Note: 1) The Uncertainties are for a confidence probability of approximately 95%

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

3) This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the United Analyst and Engineering Consultant Co., Ltd. (UAE)

เอกสารไม่ควบคุม

Certificate No.: 250422-1-BL002-25

Code No.: BL002-25

Page: 2 of 3

Equipment: Electronic Balance

Model: AB204-S/FACT

Serial No.: 1129361010

Max. Capacity: 220 g

Calibration Date: April 23, 2025

Condition As-Received: In Condition

Manufacturer: Mettler Toledo

Readability: 0.0001 g

ID No.: UAE.WAS.002/2552

Condition of Equipment:

Condition of This Result of Calibration:

1. Calibration Method: This instrument was calibrated by method UAE-CP-CAL-006 In-House Method based on UKAS Lab 14: 2022

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Traceability	Due Date
Standard Weight Class E2 (IDML)	1 mg to 1 kg	8749109122	AMARC	25-009359	Mettler-Toledo	21-Jan-27
Standard Weight Class F1 (IDML)	1 mg to 200 g	11119512	AMARC	24-013840	Mettler-Toledo	04-Feb-26
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Traceability	Due Date
Thermo-Hygro-Baro Meter	NB-38250	AK.66457	SUCCESS	SG-H-00997/67	Success Gateway	21-Nov-25
Thermo-Hygro-Baro Meter	NB-38250	AK.66457	TPA	25P795	TPA	25-Feb-26

3. This certification is traceable to SI Unit

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

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

6. Through the reference standard laboratory of AMARC 25-009359 Calibration 0152

Calibration Result:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
200*	0.00045

2. Eccentric or off-center loading

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

The Balance reading obtained is given in the table.



1 (g)	2 (g)	3 (g)	4 (g)	5 (g)	Maximum Difference (g)
100.0000	99.9996	99.9997	100.0003	100.0005	0.0005

เอกสารไม่ควบคุม

Certificate No.: 250422-1-BL002-25

Code No.: BL002-25

Page: 3 of 3

Equipment: Electronic Balance

Model: AB204-S/FACT

Serial No.: 1129361010

Max. Capacity: 220 g

Calibration Date: April 23, 2025

Calibration Result: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Error of indication from nominal or conventional mass value:

Nominal Value (g)	Reference Value (g)	Indication (g)	Correction (g)	Uncertainty (± mg)	Coverage Factor k
Unload	0.0000000	0.0000	0.0000	0.10	2.05
0.01	0.0100025	0.0099	0.0001	0.10	2.05
0.05	0.0500056	0.0500	0.0000	0.10	2.05
0.1	0.1000012	0.0999	0.0001	0.10	2.05
0.5	0.5000133	0.5000	0.0000	0.10	2.05
1	1.0000105	1.0000	0.0000	0.10	2.05
10	10.000010	10.0000	0.0000	0.11	2.04
40	40.000076	40.0000	0.0000	0.14	2.00
50	50.000056	50.0000	0.0001	0.13	2.00
80	80.000107	80.0000	0.0001	0.18	2.00
100	100.000109	99.9999	0.0002	0.17	2.00
120	120.00013	119.9999	0.0003	0.21	2.00
150	150.000165	149.9998	0.0003	0.24	2.00
160	160.000175	159.9997	0.0005	0.26	2.00
200	200.000129	199.9998	0.0004	0.30	2.00

4. Effect of Tare test:

Tare Load (g)	Test Load (g)	Indication (g)	Correction (g)
100	20.000041	19.9999	0.0001
	40.000076	39.9998	0.0002
	60.000066	59.9997	0.0003
	80.000107	79.9999	0.0002
	100.000168	100.0004	-0.0003

Remark:

The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k, providing

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2402283-002-01

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

Address: 3 SOI UDOMSUK 41, SUKHUMVIT ROAD,
Bangchak, Phrakhanong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Serial No.: C210685394

ID No.: UAE.WAO.010/2565

Order No.: 2402283

Operation No.: 2402283-002

Date of Receipt: 2 April 2024

Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong

Scientist

Approved by 

(Mr.Pheraphat Tuanjit)

Manager, Division of Calibration Laboratory

Date of Issue: 9 April 2024

Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%

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

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

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C210685394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024 Page 2 of 4

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

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8505347572	TCS	M23040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 016/23	Quality Raborn	QR24-0343	9 February 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

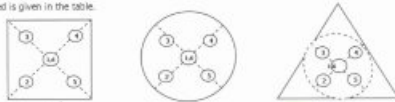
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000042
80	0.000052
100	0.000048
200	0.000048

2. Off-Center Error:

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

The balance reading obtained is given in the table.



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

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

2008 เอสอีเอ็มเอส 35 มูลนิธิพัฒนาอาหาร
2008 Soi 35, Aun Amarin Road, Bang Yikhen Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8688 Fax: +66(0) 2422 8545



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C210685394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024 Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

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

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor
Unloaded	0.000000	0.000000	0.000000	0.0000086	2.00
0.001	0.001003	0.001011	-0.000011	0.0000089	2.00
0.005	0.005003	0.005020	-0.000017	0.0000092	2.00
0.01	0.010003	0.010000	0.000003	0.0000089	2.00
0.05	0.049996	0.050000	-0.000004	0.0000086	2.00
0.1	0.100011	0.100000	0.000011	0.000011	2.00
0.5	0.500016	0.500011	0.000005	0.000014	2.00
1	1.000003	1.000002	-0.000001	0.000016	2.00
2	2.000023	2.000011	-0.000012	0.000017	2.00
5	5.000017	5.000002	-0.000015	0.000020	2.00
10	10.000009	10.000000	-0.000009	0.000026	2.00
20	20.000031	20.000000	-0.000031	0.000037	2.00
30	30.000040	30.000001	-0.000039	0.000050	2.00
50	50.000028	50.000002	-0.000026	0.000068	2.00
80	80.000068	80.000002	-0.000066	0.000111	2.00

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

2008 เอสอีเอ็มเอส 35 มูลนิธิพัฒนาอาหาร
2008 Soi 35, Aun Amarin Road, Bang Yikhen Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8688 Fax: +66(0) 2422 8545

Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C210685394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024 Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 81 - 200 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor
90	90.00010	90.00011	0.00001	0.00015	2.00
100	100.00006	100.00001	-0.00005	0.00015	2.00
110	110.00007	110.00001	-0.00006	0.00016	2.00
120	120.00009	120.00000	-0.00009	0.00017	2.00
130	130.00010	130.00000	-0.00010	0.00019	2.00
140	140.00014	140.00000	-0.00014	0.00020	2.00
150	150.00009	150.00001	-0.00008	0.00020	2.00
160	160.00010	160.00001	-0.00009	0.00022	2.00
170	170.00012	170.00001	-0.00011	0.00023	2.00
200	200.00016	200.00002	-0.00014	0.00028	2.00

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

----- End -----

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

2008 เอสอีเอ็มเอส 35 มูลนิธิพัฒนาอาหาร
2008 Soi 35, Aun Amarin Road, Bang Yikhen Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8688 Fax: +66(0) 2422 8545



Calibration Certificate

Certificate No.: 2502226-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhnong, Bangkok 10260

Date of Calibration: 20 March 2025 Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Serial No.: C210685394

ID No.: UAE.WAO.010/2565

Order No.: 2502226

Operation No.: 2502226-002

Date of Receipt: 19 March 2025

Date of Calibration: 20 March 2025

Calibrated by Mr.Yothin Charoensuk
Scientist

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

Date of Issue: 25 March 2025

The uncertainties are for a confidence probability of approximately 95%

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

F-CS-008 Revision: 01 Date: 20-04-65

2008 เอสอีเอ็มเอส 35 มูลนิธิพัฒนาอาหาร
2008 Soi 35, Aun Amarin Road, Bang Yikhen Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8688 Fax: +66(0) 2422 8545



Calibration Report

Certificate No.: 2502226-002-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Resolution: 0.0001 g / 0.0001 g
Serial No.: C210685394
ID No.: UAE.WAO.010/2565
Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025 **Page 2 of 4**

Environment Condition: Ambient Temperature: 21.2 ± 0.6 °C Relative Humidity: 46 ± 3.5 %

Place of Calibration: 208 Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8503567572	TCS	M04041005	19 April 2025
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NF18TH 017/23	Quality Reborn	QR25-0542	10 February 2026

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

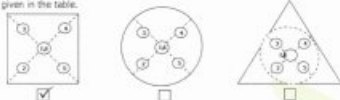
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000042
80	0.000042
100	0.000000
200	0.000000

2. Off-Center Error:

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

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0001	100.0001	100.0001	100.0001	100.0001	100.0001	0.0000

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

2008 ต.สุขุมวิท 35 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2008 Soi 35, Asoke Road, Bang Yai Khwa Subdistrict, Bang Phai District, Bangkok 10110, Thailand
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545

เอกสารไม่ควบคุม

nfi.com

Calibration Report

Certificate No.: 2502226-002-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Resolution: 0.0001 g / 0.0001 g
Serial No.: C210685394
ID No.: UAE.WAO.010/2565
Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025 **Page 3 of 4**

Calibration Results: (Continued)

Calibration Range: 0-80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 82 g ; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.000000	0.000000	0.000000	0.0000067	2.00
0.001	0.001003	0.001000	0.000000	0.0000090	2.00
0.005	0.005002	0.005001	-0.000001	0.0000092	2.00
0.01	0.010003	0.010002	-0.000002	0.0000089	2.00
0.05	0.049996	0.050001	-0.000001	0.0000096	2.00
0.1	0.100011	0.100002	-0.000001	0.0000111	2.00
0.5	0.500016	0.500004	-0.000002	0.000014	2.00
1	1.000003	1.000005	-0.000005	0.000016	2.00
2	2.000023	2.000006	-0.000004	0.000017	2.00
5	5.000015	5.000006	-0.000005	0.000020	2.00
10	10.000009	10.000005	-0.000004	0.000026	2.00
20	20.000030	20.000007	-0.000004	0.000037	2.00
30	30.000039	30.000009	-0.000005	0.000050	2.00
50	50.000028	50.000008	-0.000005	0.000068	2.00
80	80.000067	80.000013	-0.000006	0.00011	2.00

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

2008 ต.สุขุมวิท 35 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2008 Soi 35, Asoke Road, Bang Yai Khwa Subdistrict, Bang Phai District, Bangkok 10110, Thailand
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545

เอกสารไม่ควบคุม

nfi.com

Calibration Report

Certificate No.: 2502226-002-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Resolution: 0.0001 g / 0.0001 g
Serial No.: C210685394
ID No.: UAE.WAO.010/2565
Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025 **Page 4 of 4**

Calibration Results: (Continued)

Calibration Range: >80-200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: >80 - 200 g ; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
90	90.00010	90.00002	-0.00001	0.00015	2.00
100	100.00006	100.00001	0.00000	0.00016	2.00
110	110.00007	110.00002	-0.00001	0.00017	2.00
120	120.00009	120.00002	-0.00001	0.00018	2.00
130	130.00010	130.00002	-0.00001	0.00019	2.00
140	140.00013	140.00002	-0.00001	0.00019	2.00
150	150.00009	150.00002	-0.00001	0.00021	2.00
160	160.00010	160.00002	-0.00001	0.00022	2.00
170	170.00012	170.00002	-0.00001	0.00023	2.00
200	200.00013	200.00002	-0.00001	0.00028	2.00

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

----- End -----

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

2008 ต.สุขุมวิท 35 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2008 Soi 35, Asoke Road, Bang Yai Khwa Subdistrict, Bang Phai District, Bangkok 10110, Thailand
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545

เอกสารไม่ควบคุม

nfi.com

Calibration Certificate

Certificate No.: 2402283-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhonong, Bangkok 10260

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Serial No.: C009071872

ID No.: UAE.WAO.012/2563

Order No.: 2402283

Operation No.: 2402283-001

Date of Receipt: 2 April 2024

Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Papawuttipong
Scientist

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

Date of Issue: 9 April 2024

The uncertainties are for a confidence probability of approximately 95%

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

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

2008 ต.สุขุมวิท 35 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2008 Soi 35, Asoke Road, Bang Yai Khwa Subdistrict, Bang Phai District, Bangkok 10110, Thailand
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545

เอกสารไม่ควบคุม

nfi.com

Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C09071872
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024 **Page 2 of 4**

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

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8005067572	TCS	M23040525	8 April 2024

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFLBTH 016/23	Quality Reborn	QR24-0343	9 February 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000052
80	0.000063
100	0.000048
200	0.000053

2. Off-Center Error:

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

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0002	100.0001	100.0002	99.9999	100.0001	100.0001	0.0003

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

2008 ฐานข้อมูลระบบนิเวศวิทยาและสิ่งแวดล้อม
2008 Soil 35, Aun Amarn Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66(0) 2422 8568 Fax : +66(0) 2422 8545



Handwritten signature

Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C09071872
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024 **Page 3 of 4**

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

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

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (+g)	Coverage Factor
Unloaded	0.000000	0.000000	0.000000	0.000000	2.00
0.001	0.001003	0.001001	-0.000001	0.000001	2.00
0.005	0.005003	0.004999	0.000001	0.000001	2.00
0.01	0.010003	0.010000	0.000000	0.000001	2.00
0.05	0.049996	0.050000	0.000000	0.000001	2.00
0.1	0.100011	0.100000	0.000001	0.000001	2.00
0.5	0.500016	0.500001	0.000001	0.000001	2.00
1	1.000003	1.000002	-0.000001	0.000001	2.00
2	2.000023	2.000001	0.000001	0.000001	2.00
5	5.000017	5.000002	0.000000	0.000001	2.00
10	10.000009	10.000000	0.000001	0.000001	2.00
20	20.000031	20.000002	0.000001	0.000001	2.00
30	30.000040	30.000003	0.000001	0.000001	2.00
50	50.000028	50.000004	-0.000001	0.000001	2.00
80	80.000068	80.000005	0.000002	0.000001	2.00

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

2008 ฐานข้อมูลระบบนิเวศวิทยาและสิ่งแวดล้อม
2008 Soil 35, Aun Amarn Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66(0) 2422 8568 Fax : +66(0) 2422 8545

Handwritten signature

Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C09071872
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024 **Page 4 of 4**

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 81 - 200 g; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (+g)	Coverage Factor
90	90.00010	90.00000	0.00010	0.00015	2.00
100	100.00006	100.00000	0.00006	0.00015	2.00
110	110.00007	110.00000	0.00007	0.00017	2.00
120	120.00009	120.00000	0.00009	0.00018	2.00
130	130.00010	130.00000	0.00010	0.00019	2.00
140	140.00014	140.00000	0.00014	0.00020	2.00
150	150.00009	150.00000	0.00009	0.00020	2.00
160	160.00010	160.00000	0.00010	0.00022	2.00
170	170.00012	170.00000	0.00012	0.00023	2.00
200	200.00016	200.00000	0.00016	0.00028	2.00

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

----- End -----

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

2008 ฐานข้อมูลระบบนิเวศวิทยาและสิ่งแวดล้อม
2008 Soil 35, Aun Amarn Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66(0) 2422 8568 Fax : +66(0) 2422 8545



Handwritten signature

Calibration Certificate

Certificate No.: 2502226-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhonong, Bangkok 10260

Date of Calibration: 20 March 2025 **Page 1 of 4**

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Serial No.: C09071872

ID No.: UAE.WAO.012/2563

Order No.: 2502226

Operation No.: 2502226-001

Date of Receipt: 19 March 2025

Date of Calibration: 20 March 2025

Calibrated by Mr.Yothin Charoensuk
Scientist

Approved by *Signature*
(Mr.Pheraphat Tuanjit)

Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 25 March 2025

The uncertainties are for a confidence probability of approximately 95%

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

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

2008 ฐานข้อมูลระบบนิเวศวิทยาและสิ่งแวดล้อม
2008 Soil 35, Aun Amarn Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66(0) 2422 8568 Fax : +66(0) 2422 8545



Handwritten signature

Calibration Report

Certificate No.: 2502226-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Resolution: 0.0001 g / 0.0001 g
Serial No.: C09071872
ID No.: UAE.WAO.012/2563
Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025 **Page 2 of 4**

Environment Condition: Ambient Temperature: 21.2 ± 0.6 °C Relative Humidity: 48 ± 3.5 %

Place of Calibration: 208 Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard **Model** **Serial No.** **Calibrated By** **Certificate No.** **Due Date**
Standard Weight Class E2 1mg to 200g BX05567572 TCS M24041005 19 April 2025

Instrument **Model** **Serial No.** **Calibrated By** **Certificate No.** **Due Date**
Thermo-Hygro Meter 608-H1 NFI.BTH 017/23 Quality Reborn QR25-0342 10 February 2026

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

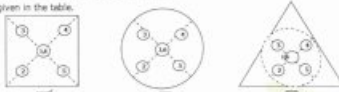
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000052
80	0.000042
100	0.000030
200	0.000000

2. Off-Center Error:

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

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0001	100.0001	100.0001	100.0001	100.0001	100.0002	0.0001

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

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2502226-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Resolution: 0.0001 g / 0.0001 g
Serial No.: C09071872
ID No.: UAE.WAO.012/2563
Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025 **Page 4 of 4**

Calibration Results: (Continued)

Calibration Range: >80 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: >80 - 200 g ; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
90	90.00010	90.0002	-0.0001	0.00015	2.00
100	100.00006	100.0001	0.0000	0.00016	2.00
110	110.00007	110.0001	0.0000	0.00017	2.00
120	120.00009	120.0002	-0.0001	0.00018	2.00
130	130.00010	130.0002	-0.0001	0.00019	2.00
140	140.00013	140.0002	-0.0001	0.00019	2.00
150	150.00009	150.0002	-0.0001	0.00021	2.00
160	160.00010	160.0002	-0.0001	0.00022	2.00
170	170.00012	170.0002	-0.0001	0.00023	2.00
200	200.00013	200.0002	-0.0001	0.00028	2.00

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

***** End *****

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

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2502226-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Resolution: 0.0001 g / 0.0001 g
Serial No.: C09071872
ID No.: UAE.WAO.012/2563
Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025 **Page 3 of 4**

Calibration Results: (Continued)

Calibration Range: 0-80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 82 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unloaded	0.000000	0.00000	0.00000	0.0000069	2.00
0.001	0.001003	0.00100	0.00000	0.0000262	2.00
0.005	0.005002	0.00500	0.00000	0.0000294	2.00
0.01	0.010003	0.01000	0.00000	0.0000291	2.00
0.05	0.049996	0.05000	0.00000	0.0000298	2.00
0.1	0.100011	0.10000	0.00001	0.000011	2.00
0.5	0.500016	0.50000	0.00002	0.000014	2.00
1	1.000003	1.00001	-0.00001	0.000016	2.00
2	2.000023	2.00005	-0.00003	0.000017	2.00
5	5.000015	5.00005	-0.00003	0.000021	2.00
10	10.00009	10.00005	-0.00004	0.000026	2.00
20	20.00030	20.00012	-0.00009	0.000037	2.00
30	30.00039	30.00012	-0.00008	0.000050	2.00
50	50.00028	50.00014	-0.00011	0.000068	2.00
80	80.00067	80.00020	-0.00013	0.00011	2.00

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

เอกสารไม่ควบคุม



Certificate of Calibration

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

Equipment : BOD Incubator
Manufacturer : ARCO
Model : UC4-1320
Serial No. : -
ID No. : UAE.WAO.002/2550
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 11 July 2024
Calibration Date : 11 July 2024
Ambient Temperature : (26 ± 1) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Tawatchai Pama
Approved by :
Approved Signatory
() Ponpan Palpim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 14 July 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



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

Cert. No.: 24TM1113
Page : 2 of 3

Procedure Used :-

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

Condition of this result of calibration

1. Reference standard instrument:-

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

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

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

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

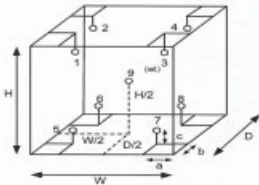
Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	29	32
REL.Humid. (%)	78	65
AC Supply (Volt)	233	234

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



Probe Installation Details :

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

Dimension of Chamber :

D = 0.62 m
W = 1.2 m
H = 1.2 m
Capacity = 0.89 m³



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

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

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

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.210	20.331	20.162	19.645	20.287	20.070	19.838	19.781	19.954	0.79

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

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2713-3000-29 FAX. 0-2719-9484



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

Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : ARCO

Model : UR-1320

Serial No. : -

ID No. : UAE.WAO.018/2551

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

Location : Lab Floor 2

Received Order : 01 April 2024

Calibration Date : 01 April 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Krisda Malee

Approved by :

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

Issue Date : 5 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

A 0065063



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

Cert. No.: 24TM587
Page : 2 of 3

Procedure Used :-

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

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

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

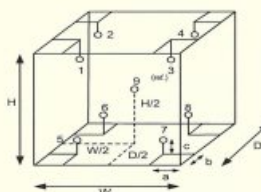
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	26
REL.Humid. (%)	48	49
AC Supply (Volt)	221	220



Probe Installation Details :

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

Dimension of Chamber :

D = 0.62 m
W = 1.2 m
H = 1.2 m
Capacity = 0.89 m³

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

เอกสารไม่ควบคุม

a 1209743



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

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

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

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.954	20.163	20.235	19.707	19.706	19.739	19.785	19.821	19.828	0.66

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

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

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

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

UUC* : Unit Under Calibration

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

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

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a 1209742



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

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

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5100
Serial No. : 11B 101863
ID No. : UAE.WAO.004/2554
Received Date : 20 February 2024
Test Date : 21 February 2024
Reference : 2402-0629DSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walalak Sirthean
Approved by :
Approved Signatory
() Pornthippa Tameysakul
() Uinnopphol Harachai
(✓) Saitip Meangmai
Issue Date : 22 February 2024

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

Condition of this result of calibration

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233621	110RC001	23MM405	16 July 2024

2. Standard Material :-

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

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

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

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

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

Cert.No.: 25TW29
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5100
Serial No. : 11B 101863
ID No. : UAE.WAO.004/2554
Received Date : 14 February 2025
Test Date : 17 February 2025
Reference : 2502-0473DSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walalak Sirthean
Approved by :
Approved Signatory
() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saitip Meangmai
Issue Date : 18 February 2025

เอกสารไม่ควบคุม

Cert.No.: 25TW29
Page.: 2 of 2

Certificate No. : HIT-2427-0942

Page : 1 of 2

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater

Meter Model : HIB39800-02 Serial No. : 04500052101

Tube Heater : 25 Vial Capacity Resolution : 0.1 °C

Temperature Range : (-10 to 160) °C Temperature of Reaction : 150 °C

Manufacturer : Hanna Instruments Made in : Romania

Condition As-Received : Used Product Reference : RE241152

Ambient Temperature : (25 ± 2) °C Relative Humidity : (50 ± 15) %RH

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

3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,
Phrakhanong, Bangkok 10260

Received date : 26 June 2024

Calibrate date : 1 July 2024

Issue date : 3 July 2024

Calibrated Location : Hanna Instruments (Thailand) Ltd.

Calibration Procedure : This calibrator was conducted by using in-house calibration procedure
CP-04 by using certified reference standard instruments.

Calibrated by : ☒ Mr. Pichit Petthong☐ Mr. Channarong Soinak

Approved by :

Mr. Anan Suwanchaisakul

Authorized Signatory



This certificate was certified only for the instrument we calibrated.

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

** This certificate may not be reproduced other than in full, except with the prior written **

approval of the head of Hanna Instrument (Thailand).

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Condition of this calibration result:

Reference Standard Instruments : This certification is traceable to the international unit of unit maintained through:

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MY44065265	WK2307-164-1	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HT-771SD	AL07155	24H41	Technology Promotion Association (Thailand-Japan).

Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor.

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	Uncertainty of Measurement (± °C)
25 Vial	150.0	149.8	0.48

Unit : °C

(1A)	(2A)	(3A)	(4A)	(5A)
149.574	149.873	149.861	149.748	149.878
(1B)	(2B)	(3B)	(4B)	(5B)
149.490	149.940	149.954	150.103	150.048
(1C)	(2C)	(3C)	(4C)	(5C)
149.625	150.036	150.080	150.015	149.580
(1D)	(2D)	(3D)	(4D)	(5D)
149.801	149.541	149.662	150.010	149.499
(1E)	(2E)	(3E)	(4E)	(5E)
149.563	149.611	149.569	149.831	149.762

Figure: Shows the location of the temperature source.

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

** End of certificate **

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Calibration Certificate

Certificate No.: 2500116-001-01

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

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

Page 1 of 3

Equipment: CHAMBER (Hot Air Oven)

Manufacturer: MEMMERT

Model: UF55

Serial No.: B216.1666

ID No.: UAE.WAO.027/2559

Order No.: 2500116

Operation No.: 2500116-001

Date of Receipt: 8 October 2024

Date of Calibration: 8 October 2024

Calibrated by Mr.Yothin Charoensuk Scientist

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

Date of Issue: 15 October 2024

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

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

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

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Calibration Report

Certificate No.: 2500116-001-01

Equipment: CHAMBER (Hot Air Oven)

Model: UF55 Serial No.: B216.1666

Resolution: 0.1 °C ID No.: UAE.WAO.027/2559

Manufacturer: MEMMERT

Date of Calibration: 8 October 2024

Page 2 of 3

Location: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Environment Condition: Ambient Temperature (30.3 ± 1) °C
Relative Humidity (55 ± 1) %
Line Voltage (230 ± 3) Volt

Condition of this results of Calibration:

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

2. Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY57003188	TE 670486-01	8 June 2025	NATIONAL FOOD INSTITUTE
	RTD	CHP201-209/RTD#201-209			

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

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

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

6. Condition of Calibrated item : Good

UUC Description :

Time of Record 1 Hour 9 Minute At 104.0,140.0 and 180.0 °C

Fresh air Damper - Open Position -

X Close Fan 40%

- Not Available

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

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

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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	77 16030001
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 (OneVeb) Conical Other
Spray Chamber	Cyclonic Single Pass (Cyclonic Double Pass) Other
Torch	Radial (Dual View) Other
Torch Type	One Piece (Semi Demountable) Fully Demountable 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. N/A
- ☒ 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. N/A
- ☒ Remove and clean instrument water inlet filter.

Agilent Water Recirculator

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

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 probe, 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	6969.9
Mn 257.610 nm SRBR	3915.0	7492.1	13017.9	31121.6
Al 396.152 nm SBR	9.9	10.7	9.9	21.1
K 766.491 nm SBR	6.7	29.1	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 ₉₅₅
Air Flow	P ₉₅₅
Water Flow	P ₉₅₅
Gas Flows	P ₉₅₅
RF Generator	P ₉₅₅
Camera Test	P ₉₅₅
Optics Test	P ₉₅₅
Nebulizer test	P ₉₅₅

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	231.41V	VAC
Mains Current	0.09A	A
Instrument Temperature	22.1	°C
RF Air Flow (sensor speed)	14.0	Hz
Plasma Exhaust Temperature	No measurement	63.9
Water Flow Oscillator	No measurement	1.34
Water Flow Detector	0.86	L/min
Water Inlet Temperature	19.7	°C
Polychromator Temperature	35.0	°C
CCD Temperature	-40.1	°C
Thermal Stabilizer	35.0	°C
Argon Supply Pressure	649.92	kPa
Purge Gas Supply Pressure*1	646.66	kPa
Option Gas Supply Pressure*1	—	kPa
Nebulizer Flow	No measurement	0.30
Nebulizer Back Pressure	No measurement	138.43
Plasma Gas Flow	No measurement	11.91
Auxiliary Gas Flow	No measurement	1.00
RF Power	No measurement	1204.9
RF Supply Current	No measurement	9.959
RF Supply Voltage	No measurement	204.41V

*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

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

Date Service Completed:

04 Nov 2024

Service Engineer Name:

Kanyakorn S.

Customer Name:

Aphorn Onkong

Service Engineer Signature:

Kanyakorn S.

Customer Signature:

Aphorn Onkong

Total number of pages in this document:

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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

Page 1 of 4

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Resolution Test

Pass

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	6.60
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 (493.408 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

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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	16911.7
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	6956460.4	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
Revision	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	25.44	
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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เอกสารไม่ควบคุม

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 (206.200 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	0.96
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 (206.200 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	11/5/2024 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 (208.158 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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เอกสารไม่ควบคุม

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	1903184.1	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 (208.200 nm)	≥ 234.0	SRBR	923.0	12282.3	172.1	
Zn (213.857 nm)	≥ 1743.0	SRBR	6398.3	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 (208.200 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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เอกสารไม่ควบคุม



Certificate of Calibration

Cert.No.: 25CH353
Page.: 1 of 3

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA0A0007
ID No. : UAE,EFM.002/2563(EFM,pH.02/63)
Condition As-Received: Used Item
Received Date : 18 March 2025
Calibration Date : 20 March 2025
Reference : 2503-0612WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

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

Calibrated by : Uthen Kankawi

Approved by :

Approved Signatory

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

Issue Date : 20 March 2025

The Uncertainties are for a confidence probability of approximately 95%

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

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	43160066	130RC092	24E1320	22 Apr 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.007	CPA chem	1066665	18 Jan 2027
pH 6.999	Hach Lenge GmbH	C03220	29 Oct 2026
pH 10.010	CPA chem	1066669	18 Jan 2026

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: HA0A0007	4.00	177.48	177.6	4.01	0.058	2.00
	7.00	0.00	0.3	6.98	0.058	2.00
	7.00	0.00	0.3	6.98	0.058	2.00
	10.00	-177.48	-177.1	10.01	0.058	2.00



Cert.No.: 25CH353
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor k
pH Electrode S/N.: 992H0385	4.007	4.00	150.1	0.0085	2.05
	6.999	7.00	-26.1	0.0095	2.00
	6.999	7.00	-26.7	0.011	2.05
	10.010	10.01	-202.4	0.010	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652
- Serial No. : 992H0385
Dimension of probe
- Length : 103 mm.
- Diameter : 16 mm.
- Immersion Depth : 90 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
15.0	15.006	15.0	-0.006	0.13	2.00
30.0	29.998	30.0	0.002	0.13	2.00
45.0	44.993	45.0	0.007	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

-00o-

Certificate of Calibration

Cert.No.: 25CH354
Page.: 1 of 3

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA9M0047
ID No. : UAE,EFM.005/2563 (EFM,pH.05/63)
Condition As-Received: Used Item
Received Date : 18 March 2025
Calibration Date : 20 March 2025
Reference : 2503-0612WSC-2
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

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

Calibrated by : Uthen Kankawi

Approved by :

Approved Signatory

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

Issue Date : 20 March 2025

The Uncertainties are for a confidence probability of approximately 95%

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



Cert.No.: 25CH354
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	43160066	130RC092	24E1320	22 Apr 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 Jul 2025

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.007	CPA chem	1066665	18 Jan 2027
pH 6.999	Hach Lenge GmbH	C03220	29 Oct 2026
pH 10.010	CPA chem	1066669	18 Jan 2026

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement	Coverage factor
	pH	mV	mV	pH	(\pm mV)	k
pH Meter S/N.: HA9M0047	4.00	177.48	177.7	4.01	0.058	2.00
	7.00	0.00	0.3	7.01	0.058	2.00
	7.00	0.00	0.3	7.01	0.058	2.00
	10.00	-177.48	-176.8	10.01	0.058	2.00



Cert.No.: 25CH354
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (\pm)	Coverage factor k
pH Electrode S/N.: -	4.007	4.01	168.5	0.011	2.13
	6.999	7.00	-5.9	0.012	2.09
	6.999	7.00	-6.1	0.011	2.07
	10.010	10.02	-176.7	0.010	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

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

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (\pm °C)	Coverage factor k
15.0	15.005	15.0	-0.005	0.13	2.00
30.0	30.007	30.0	-0.007	0.13	2.00
45.0	44.995	44.9	-0.095	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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



Certificate of Calibration

Cert.No.: 24CH724
Page.: 1 of 3

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA0A0006
ID No. : UAE EFM.006/2563(EFM.pH.06/63)
Condition As-Received: Used Item
Received Date : 18 June 2024
Calibration Date : 19 June 2024
Reference : 2406-0570WSC-2
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature : (25 \pm 2.5) °C
Relative Humidity : (50 \pm 15) %
Calibration Procedure : In - house method ;
- CP-CH5 by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by : Warakorn Lernagatrakul

Approved by :
Approved Signatory

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

Issue Date : 20 June 2024

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 24CH724
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

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

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	970851	25 Apr 2026
pH 6.986	CPA chem	970852	25 Apr 2025
pH 9.997	CPA chem	970853	25 Apr 2025

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement	Coverage factor
	pH	mV	mV	pH	(\pm mV)	k
pH Meter S/N.: HA0A0006	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.0	7.00	0.058	2.00
	7.00	0.00	0.0	7.00	0.058	2.00
	10.00	-177.48	-177.4	10.01	0.058	2.00



Cert.No.: 24CH724
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (\pm)	Coverage factor k
pH Electrode S/N.: Q92M0159	4.008	4.01	179.5	0.0085	2.05
	6.986	7.00	3.3	0.011	2.00
	6.986	7.01	3.9	0.0099	2.00
	9.997	10.01	-170.2	0.011	2.07

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652-10D
- Serial No. : Q92M0159

Dimension of probe

- Length : 103 mm.
- Diameter : 16 mm.
- Immersion Depth : 80 mm.

Calibration Point ($^{\circ}\text{C}$)	Standard Temperature ($^{\circ}\text{C}$)	UUC* Reading ($^{\circ}\text{C}$)	Error ($^{\circ}\text{C}$)	Uncertainty of measurement (\pm $^{\circ}\text{C}$)	Coverage factor k
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.003	30.0	-0.003	0.13	2.00
35.0	35.003	35.0	-0.003	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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Certificate of Calibration

Cert.No.: 24CH727
Page.: 1 of 3

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA0D0082
ID No. : UAE-EFM.072/2564(EFM.pH.05/64)
Condition As-Received: Used Item
Received Date : 18 June 2024
Calibration Date : 19 June 2024
Reference : 2406-0570WSC-5
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Ambient Temperature : (25 \pm 2.5) $^{\circ}\text{C}$
Relative Humidity : (50 \pm 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by : Warakorn Lemgagrakul

Approved by :
Approved Signatory

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

Issue Date : 20 June 2024

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 24CH727
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

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

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	970851	25 Apr 2026
pH 6.986	CPA chem	970852	25 Apr 2025
pH 9.997	CPA chem	970853	25 Apr 2025

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (\pm mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: HA0D0082	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.2	7.00	0.058	2.00
	7.00	0.00	0.2	7.00	0.058	2.00
	10.00	-177.48	-177.0	10.01	0.058	2.00



Cert.No.: 24CH727
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (\pm)	Coverage factor k
pH Electrode S/N.: Q9AA0036	4.008	4.01	179.9	0.0079	2.00
	6.986	7.00	4.6	0.0099	2.00
	6.986	7.00	3.2	0.0093	2.00
	9.997	10.01	-171.2	0.0092	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652-10D
- Serial No. : Q9AA0036

Dimension of probe

- Length : 103 mm.
- Diameter : 16 mm.
- Immersion Depth : 80 mm.


Calibration Point ($^{\circ}\text{C}$)	Standard Temperature ($^{\circ}\text{C}$)	UUC* Reading ($^{\circ}\text{C}$)	Error ($^{\circ}\text{C}$)	Uncertainty of measurement (\pm $^{\circ}\text{C}$)	Coverage factor k
25.0	25.001	25.0	-0.001	0.13	2.00
30.0	30.004	30.0	-0.004	0.13	2.00
35.0	35.002	35.0	-0.002	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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


MSC-TS-19-1703
CALIBRATION DATA

CERTIFICATE OF CALIBRATION

Certificate No. : SP25-019Page 1 of 5

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

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

Location of calibration : Instrument room (207)

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009


ID No. : UAE.WAT.020/2558


Received Date : 26 May 2025

Calibration Date : 26 May 2025

Issue Date : 29 May 2025

Condition Instrument : Good

Calibrated by : 
(Mr.Tanawut Rittidach)
Technical Manager

Approved by : 
(Ms.Chonticha Sangnern)
Quality Manager

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

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

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PM-108-02 R01 1/11/2021

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


MSC-TS-19-1703
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP25-019Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

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

Certified Reference Materials :

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

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 60 nm/min

Scan Interval of UUC : 0.15 nm.


Resolution of UUC : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

PM-108-02 R01 1/11/2021

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MSC-TS-19-1703
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP25-019Page 3 of 5

Calibration Results : Without adjustment


Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.0000	0.0000	0.0028	2.00
	0.5780	0.5739	0.0041	0.0031	2.00
	1.0484	1.0430	0.0054	0.0029	2.00
	2.1876	2.1876	0.0000	0.0084	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5595	0.5581	0.0014	0.0034	2.00
	1.0239	1.0219	0.0020	0.0035	2.00
	2.1230	2.1207	0.0023	0.0085	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5230	0.5190	0.0040	0.0029	2.00
	0.9633	0.9609	0.0024	0.0029	2.00
	1.9753	1.9719	0.0034	0.0079	2.00
546.1	0.0000	0.0000	0.0000	0.0028	2.00
	0.5181	0.5161	0.0020	0.0031	2.00
	1.0002	0.9979	0.0023	0.0033	2.00
	1.9973	2.0021	-0.0048	0.0102	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5517	0.5503	0.0014	0.0030	2.00
	1.0803	1.0808	-0.0005	0.0031	2.00
	2.0373	2.0324	0.0049	0.0105	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5591	0.5583	0.0008	0.0031	2.00
	1.0518	1.0513	0.0005	0.0030	2.00
	1.9274	1.9281	-0.0007	0.0102	2.00

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PM-108-02 R01 1/11/2021

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


MSC-TS-19-1703
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP25-019Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.0000	0.0000	0.0050	2.00
	0.7469	0.7488	-0.0019	0.0063	2.00
257	0.0000	0.0000	0.0000	0.0050	2.00
	0.8674	0.8663	0.0011	0.0067	2.00
313	0.0000	0.0000	0.0000	0.0050	2.00
	0.2919	0.2902	0.0017	0.0052	2.00
350	0.0000	0.0000	0.0000	0.0050	2.00
	0.6430	0.6428	0.0002	0.0063	2.00

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PM-108-02 R01 1/11/2021

REPORT OF CALIBRATION

Certificate No. : SP25-019

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	242.0	-0.28	0.18	2.00
279.45	279.5	-0.05	0.18	2.00
287.81	287.6	0.21	0.18	2.00
334.06	333.8	0.26	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	417.9	0.69	0.18	2.00
445.94	445.4	0.54	0.18	2.00
453.66	453.2	0.46	0.18	2.00
460.02	459.6	0.42	0.18	2.00
536.59	536.5	0.09	0.18	2.00
637.98	638.5	-0.52	0.18	2.00
431.38	430.7	0.68	0.18	2.00
472.50	472.3	0.20	0.18	2.00
513.47	513.5	-0.03	0.18	2.00
528.88	528.9	-0.02	0.18	2.00
573.17	573.8	-0.63	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	685.1	-0.70	0.18	2.00
740.72	741.1	-0.38	0.20	2.00
748.55	748.9	-0.35	0.18	2.00
807.03	807.1	-0.07	0.18	2.00
879.28	879.1	0.18	0.18	2.00

Remark : - UUC = Unit Under Calibration
- N/A = Not Available
- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k ,
which for a normal distribution corresponds to a coverage probability of approximately 95%
- End of Certificate -

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FM-708-02 R01 1/11/2021

CERTIFICATE OF CALIBRATION

Certificate No. : SP25-001

Page 1 of 5

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

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

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564

Received Date : 3 January 2025

Calibration Date : 3 January 2025

Issue Date : 8 January 2025

Condition Instrument : Good

Calibrated by : 
(Mr.Tanawut Rittidach)
Technical Manager

Approved by : 
(Ms.Chonthicha Sangngern)
Quality Manager

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

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FM-708-02 R01 1/11/2021

DQE Services

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

DQE

Services

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

REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C
Relative humidity 55 ± 20 %RH

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

Certified Reference Materials :

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

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

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FM-708-02 R01 1/11/2021

DQE Services

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

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

REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.578	0.0000	0.0031	2.00
	1.0484	1.045	0.0034	0.0029	2.00
	2.1876	2.192	-0.0044	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.560	-0.0005	0.0034	2.00
	1.0239	1.023	0.0009	0.0035	2.00
	2.1230	2.125	-0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.521	0.0020	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.977	-0.0017	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.518	0.0001	0.0031	2.00
	1.0002	0.998	0.0022	0.0033	2.00
	1.9973	1.993	0.0043	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.552	-0.0003	0.0030	2.00
	1.0803	1.079	0.0013	0.0030	2.00
	2.0373	2.032	0.0053	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.559	0.0001	0.0031	2.00
	1.0518	1.050	0.0018	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

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FM-708-02 R01 1/11/2021

REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.744	0.0029	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.863	0.0044	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.290	0.0019	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.640	0.0030	0.0055	2.00

REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.1	0.62	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.3	0.51	0.18	2.00
334.06	333.8	0.26	0.18	2.00
360.93	360.6	0.33	0.18	2.00
418.59	418.2	0.39	0.18	2.00
445.94	445.5	0.44	0.18	2.00
453.66	453.4	0.26	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.6	-0.01	0.18	2.00
637.98	637.7	0.28	0.18	2.00
431.38	431.1	0.28	0.18	2.00
472.50	472.3	0.20	0.18	2.00
513.47	513.4	0.07	0.18	2.00
528.88	528.9	-0.02	0.18	2.00
573.17	573.3	-0.13	0.18	2.00
585.35	585.1	0.25	0.20	2.00
684.40	684.5	-0.10	0.18	2.00
740.72	741.0	-0.28	0.20	2.00
748.55	748.8	-0.25	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.6	-0.32	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- End of Certificate -

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

ภาคผนวก ฎ

หนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท ยูโนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

ที่ อก ๐๓๑๐(๑)/ ๑ ๔ ๙ ๑



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒ ๔ กุมภาพันธ์ ๒๕๖๔

เรื่อง ยกเลิกบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูไนเต็ด แอมนาลีส์ต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

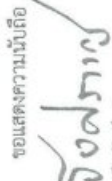
อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารเคมีของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๑๘ กุมภาพันธ์ ๒๕๖๔

ตามคำขอที่อ้างถึง บริษัท ยูไนเต็ด แอมนาลีส์ต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๔๔๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท
แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ขอยกเลิกบุคลากร ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้ยกเลิกเจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน
จำนวน ๓ ราย ได้แก่

- ๑) นายอภิสิทธิ์ ศรีคงแก้ว ทะเบียนเลขที่ ๖-๑๔๔๕-จ-๐๐๕๘
- ๒) นางสาวนันทิศา พรหมกาวยี่ ทะเบียนเลขที่ ๖-๑๔๔๕-จ-๐๑๗๐
- ๓) นายภูวดล เบ็ญมา ทะเบียนเลขที่ ๖-๑๔๔๕-จ-๐๑๔๘

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายธีรวัฒน์ อิศรางกูร ณ อยุธยา)
รองอธิบดี ปฏิบัติราชการแทน
อธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๔๙

ไปรษณีย์อิเล็กทรอนิกส์ sarabang@dlw.mail.go.th



สำนักงาน
ด้านถูกต้อง



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



ที่ อก ๐๓๑๐(๑)/ ๑ ๐ ๘ ๙



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๐ ๗ กุมภาพันธ์ ๒๕๖๔

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท ยูไนเต็ด แอมนาลีส์ต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารเคมีของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๓ ธันวาคม ๒๕๖๓

๑. รายชื่อผู้ควบคุมห้องปฏิบัติการวิเคราะห์เอกชน จำนวน ๔๐ ราย
๒. รายชื่อเจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน จำนวน ๑๔๑ ราย
๓. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม

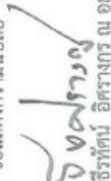
ตามคำขอที่อ้างถึง บริษัท ยูไนเต็ด แอมนาลีส์ต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด ขอต่ออายุ
หนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๔๔๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑
ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท ยูไนเต็ด แอมนาลีส์ต์ แอนด์ เอ็นจิเนียริง
คอนซัลแตนท์ จำกัด ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

- ก. ผู้ควบคุมห้องปฏิบัติการวิเคราะห์เอกชน จำนวน ๔๐ ราย ตามสิ่งที่ส่งมาด้วย ๑
- ข. เจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน จำนวน ๑๔๑ ราย ตามสิ่งที่ส่งมาด้วย ๒
- ค. ขอบข่ายสารเคมีที่รับขึ้นทะเบียนให้วิเคราะห์ในน้ำ/น้ำเสีย น้ำใต้ดิน อากาศเสีย
สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว และดิน ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๒ กุมภาพันธ์ ๒๕๗๒ หากประสงค์จะต่ออายุหนังสือ
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำต่ออายุกรมโรงงาน
อุตสาหกรรมภายใน ๖๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายธีรวัฒน์ อิศรางกูร ณ อยุธยา)



กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๔๙

ไปรษณีย์อิเล็กทรอนิกส์ sarabang@dlw.mail.go.th



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



เอกสารแนบท้ายหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท ยูโนเด็ค เอนเนอจีสติกส์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๔๕

ที่ ออ ๐๓๑๐(๑)/ ๑ ๐ ๘ ๙ ลงวันที่ ๐๓ กุมภาพันธ์ ๒๕๖๕

ก. ผู้ควบคุมห้องปฏิบัติการวิเคราะห์เอกชน จำนวน ๔๐ ราย

- ๑) นางสาวกชวรรณ ภักธีรกุล ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๐๑
- ๒) นายมงคล นิยมพลี ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๐๒
- ๓) นางสาวนันทา บุญไชย ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๐๓
- ๔) นางปิยะพัชร สุทมนัสวงษ์ ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๐๔
- ๕) นางสาวเบญจวรรณ วิริโยทัย ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๐๖
- ๖) นายพรรัตน์ วงศ์อนุรักษชัย ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๐๗
- ๗) นางสาววิวรรณ บุญลา ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๐๘
- ๘) นายสุวิทย์ จอดนอก ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๐๙
- ๙) นางสาวโชติภา สมบูรณ์ ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๑๐
- ๑๐) นางสาวบุษกร เลิศกานมาศ ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๑๑
- ๑๑) นางสาววิไลลักษณ์ ศรีสุข ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๑๒
- ๑๒) นายศิลา บรรจงใจรักษ์ ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๑๔
- ๑๓) นายปฏิกรณ์ คณนา ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๑๕
- ๑๔) นายธีรวัฒน์ ขมมัง ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๑๖
- ๑๕) นางสาวศิริพร ศรีประดิษฐ์ ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๑๗
- ๑๖) นางสาวศิริตรี ธีรัง ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๑๘
- ๑๗) นางสาวพรพรรณ อูรารักษ์ ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๑๙
- ๑๘) นายพงษ์ค พานิชเลิศอาไฟ ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๐
- ๑๙) นายธีรวัฒน์ แดงสวัสดิ์ ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๑
- ๒๐) นายเอกรัตน์ ปะคะคามินทร์ ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๒
- ๒๑) นางสาวนิศรัตน์ ศรีสกุลสิทธิ์ไชย ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๓
- ๒๒) นางสาวเจตจิรินทร์ ทำสะอาด ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๔
- ๒๓) นางสาวสุวรรณ คงทอง ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๕
- ๒๔) นางสาวกรรณ พัฒองจัน ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๖
- ๒๕) นายวิรุฬ โหมแก้ว ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๗
- ๒๖) นายวัชรพงษ์ เทพดนตรี ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๘
- ๒๗) นายอนุศาสน์ สายดี ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๙
- ๒๘) นายกรวิทย์ เอื้อศิริสกุล ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๓๐
- ๒๙) นายสุพธีระ อรุณจันทร์ ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๓๓
- ๓๐) นางสาวทัศนีย์ อ่อนคำ ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๓๔
- ๓๑) นางพรพรรณ กอนสิน ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๓๕
- ๓๒) นายศุภณัฐ คุณอนมากุล UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๓๖
- ๓๓) นางสาวศิริภาพร หมอมนร ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๓๗
- ๓๔) นางศิวานัส ชำนิล ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๓๘
- ๓๕) นางสาวพรณิภา ธีระจินดาชล ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๓๙

จากนี้

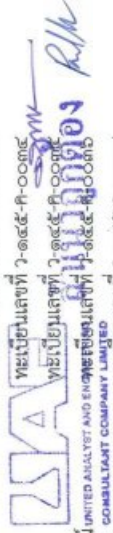
๓๖) นายนาเคนทร์...

- ๓๖) นายนาเคนทร์ พันธุ์วิชาติกุล ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๔๐
- ๓๗) นายกานต์พงศ์ บุญพวง ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๔๑
- ๓๘) นางสาวธรรมา แก้วชื่อนอก ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๔๒
- ๓๙) นางสาวสริน ไทยเพ็ญศรีพัฒนกุล ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๔๓
- ๔๐) นางมานิดา แยมโย ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๔๔

จากนี้



UAAE
UNITE ANALYST AND ENGINEERING
CONSULTANT COMPANY LIMITED



UAAE
UNITE ANALYST AND ENGINEERING
CONSULTANT COMPANY LIMITED

เอกสารแนบท้ายหนังสือตอบรับชี้ทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท ยูนิเทค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๕๕

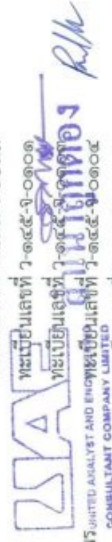
ที่ อภ ๐๓๑๐(๑)/ ๑ ๐ ๘ ๘ ลงวันที่ ๐๗ กุมภาพันธ์ ๒๕๖๕

ข. เจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน จำนวน ๑๕๑ ราย

๑) นายสุทัศน์ พันสิงห์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๐๑
๒) นายพีรณัฐ เจริญผล	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๐๓
๓) นางสาววิไลลักษณ์ ไกลสง	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๐๔
๔) นายสมชาติ อุมนันท์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๐๕
๕) นางสาวปรมาภรณ์ ทองแก้ว	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๐๖
๖) นางสาวกัลยา สมพงษ์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๐๗
๗) นางสาวรณิ สายบุญเรือน	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๑๐
๘) นายกฤษฎพงษ์ นามทิพย์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๑๑
๙) นางสาวอาภรณ์ อ่อนคง	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๑๒
๑๐) นายกิตติศักดิ์ ทรงจำรัส	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๑๓
๑๑) นางสาวอภิญรินทร์ บุญคง	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๑๔
๑๒) นางสาวพรพิมล แวนทอง	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๑๕
๑๓) นายอภิวิชญ์ ท่วงที	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๑๗
๑๔) นายมานิตย์ ปานโชติ	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๑๘
๑๕) นายทศพร ธนะพิรุณห์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๑๙
๑๖) นางสาวกัญญาณี โขธา	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๒๐
๑๗) นางสาวภาวณีย์ สุทธิ	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๒๑
๑๘) นางสาวอมรณีย์ อภิพัทธ์ปภา	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๒๒
๑๙) นายศิริพัชร จงคงเกียรติ	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๒๓
๒๐) นางสาวสุภาวดี อินทาสรี	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๒๔
๒๑) นายพงษ์เทพ เหล่าจักร	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๒๕
๒๒) นายขวัญชัย พันทุกซ์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๒๖
๒๓) นางสาวพัชริศา คีตติคำล	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๒๗
๒๔) นางสาวเมกวิภา เสือคำจันทร์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๒๘
๒๕) นายพีระพัฒน์ บุญฤทธิศิลป์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๒๙
๒๖) นายพัชวาลย์ เลื่อนล่อง	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๓๐
๒๗) นายภานุญ์ อนุธรรมรัตน์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๓๑
๒๘) นายกันนิกร ระโส	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๓๒
๒๙) นายปริญญา กลมเกลียว	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๓๓
๓๐) นายธีรวัจน์ มาตรโพธิ์ศรี	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๓๔
๓๑) นายบุญฤทธิพงษ์ ก้อนสิน	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๓๕
๓๒) นายพรพรพุด ไวสฤกษ์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๓๖
๓๓) นายอติเดช แสงจันทร์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๓๗
๓๔) ว่าที่ร้อยตรีเมธีพงศ์ เมืองชัย	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๓๘
๓๕) นายอนันท์ เลิศประเสริฐ	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๓๙



๓๖) นางสาวนิภาพร จันทเขตต์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๔๗
๓๗) นายรณภพ ภูตระกูลพัฒนา	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๔๘
๓๘) นายสมพงษ์ สกลไทย	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๔๙
๓๙) นายสุริยัน นิธิจิตพงษ์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๕๐
๔๐) นายอัญญา ชนศิริ	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๕๑
๔๑) นายเอกวุฒิ แสนใจ	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๕๒
๔๒) นายสุชสิทธิ์ บุญเสียง	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๕๓
๔๓) นายธนเดช ทวนเสนาะ	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๕๔
๔๔) นายอภิสิทธิ์ ศรีคงแก้ว	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๕๕
๔๕) ว่าที่ร้อยตรีอุทัย แก้วงามสุข	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๕๖
๔๖) นางสาวนารินทร์ สานนท์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๕๗
๔๗) นายศุภกร รินวงศ์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๕๘
๔๘) นางสาวจินตสุภา เปี่ยมศรี	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๕๙
๔๙) นางสาวนรนาถ กมลบุรณ์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๖๐
๕๐) นางสาวอารียา ทราชมัย	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๖๑
๕๑) นายจิรวัฒน์ สุขเกษม	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๖๒
๕๒) นายกิตติพงษ์ สอนชัยภูมิ	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๖๓
๕๓) นายจุฬพล สวณพชร	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๖๔
๕๔) นางสาวพัชราภรณ์ แสงฟ้า	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๖๕
๕๕) นายรัตนชัย เหล่ามา	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๖๖
๕๖) นายอิทธิพงษ์ ศรีเดช	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๖๗
๕๗) นางสาวกรรณิการ์ ลำลิทา	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๖๘
๕๘) นางสาวณัฐชา พรหมศิริ	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๖๙
๕๙) นายณสิทธิ์ ศรีพิมพ์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๗๐
๖๐) นางสาวลักขิกา จันทรสุน	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๗๑
๖๑) นายศักดิ์อนันต์ นุ่มมิม	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๗๒
๖๒) นายวรพงษ์ นมจันทร์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๗๓
๖๓) นางสาวนภา มาคะมาตร์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๗๔
๖๔) นายณัฐชัย พรหมอารักษ์	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๗๕
๖๕) นายณรินทร์ พานแก้ว	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๗๖
๖๖) นายปรัชญาพล โลภา	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๗๗
๖๗) นายวัชรินทร์ แสนงาม	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๗๘
๖๘) นายอาทิตย์ อุดมผล	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๗๙
๖๙) นายอิทธิเดช ใจบุญ	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๘๐
๗๐) นายณิรัตน์ พงษ์ศรีธรรมพร	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๘๑
๗๑) นายณัฐวุฒิ เอมกลิ่นบัว	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๘๒
๗๒) นางสาวนันทา หาหมื่นเมือง	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๘๓
๗๓) นางสาวพิณวรรณ สิมมา	ทะเบียนเลขที่ ๖-๑๕๕-จ-๐๐๘๔



๓๔) นายนิพนธ์วัฒน์ วงศ์คำ
 ๓๕) นายประสิทธิ์ยุทธ์ เล็กอง
 ๓๖) นางสาวณิษฐา ลาภิต
 ๓๗) นางสาวภาพร ชื่นมุกข์
 ๓๘) นางสาวบุญญา มอญคุณ
 ๓๙) นายอมรพล อมรลักษณ์
 ๔๐) นางสาวศรีเพชร ทองขาว
 ๔๑) นางสาวณิษฐา กรุฑาภิกรสร
 ๔๒) นางสาววิมลวรรณ คำตัน
 ๔๓) นายคุณานนท์ ฤทธคณานนท์
 ๔๔) นายชาญณรงค์ อ้าลอย
 ๔๕) นางสาวจิตมาส ศรีวรรณ
 ๔๖) นายสุจิต โพธิ์เงิน
 ๔๗) นายเจษฎา ช่วยเติกร
 ๔๘) นายจรต เหมะจุลิน
 ๔๙) นายสรโชค หล้าโท
 ๕๐) นายชัย บัวสด
 ๕๑) นางสาวธยา ประสานศรี
 ๕๒) นายมงคล เมียมนิยม
 ๕๓) นายศุภกร สมนศรี
 ๕๔) นายคณพล ศิลานนท์
 ๕๕) นายไชยชัย พุ่มสว
 ๕๖) นายธีรวัฒน์ ธรรมสุวรรณ
 ๕๗) นายโพธิพงษ์ ชะขุนทด
 ๕๘) นางสาวณัฐกตา พลนิกรกิจ
 ๕๙) นางสาวณัฏพร ทองบุรณ์
 ๖๐) นางสาวพรจิตา จรณัติยุทธ
 ๖๑) นางสาวเพ็ญพิชชา รอดทอง
 ๖๒) นางสาวณัฏชา แสงสว่าง
 ๖๓) นายกรติ สืออาจ
 ๖๔) นายณัฏพร คงศรี
 ๖๕) นางสาวสุภัทสร่า เอี่ยมเงิน
 ๖๖) นางสาวพรณิพัทธา อะโนนัม
 ๖๗) นายอนันต์ นูตอ
 ๖๘) นางสาวพณิพล ประชาพันธ์
 ๖๙) นายวิวัฒน์ บุญยง
 ๗๐) นางสาวณัฐชา แก้วภาพ
 ๗๑) นายสิทธิพล พร้อมพ้อชัยบุญ
 ๗๒) นางสาวนันทิชา กลิ่นหนู

ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๑๑
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๑๒
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๑๓
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๑๔
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๑๕
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๑๖
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๑๗
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๑๘
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๑๙
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 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๒๗
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 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๓๓
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๓๔
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๓๕
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๓๖
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๓๗
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 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๓๙
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 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๔๒
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๔๓
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๔๔
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๔๕
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๔๖
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๔๗
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๔๘
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๔๙
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๕๐
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๕๑
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๕๒
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๕๓
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๕๔
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๕๕
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๕๖
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๕๗
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๕๘
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๕๙
 ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๑๖๐

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 ๑๑๙) นางสาวปวีณา แคนกนบ
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 ๑๒๑) นางสาวกมลชนก ปุ่มคำ
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 ๑๔๑) นายอนุสร พลสำโรง

เอกสารแนบท้ายหนังสือต่ออายุรั้งขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์ออกชน

บริษัท ยูนิเคิล แอนนาลิซิส แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๕๕

ที่ ออ ๐๓๐๐(๑) ๓ ๐ ๘ ๙ ลงวันที่ ๐๗ กุมภาพันธ์ ๒๕๖๘

ขอข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๕๗ รายการ

นับวันเสีย จำนวน 46 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
2	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
3	Barium	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
4	α -BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
5	β -BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
6	δ -BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
7	γ -BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
8	Biochemical Oxygen Demand	1) 5-Day BOD Test, Azide Modification Method ⁽⁴⁾ 2) 5-Day BOD Test, Membrane Electrode Method ⁽⁴⁾
9	Cadmium	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
10	Chemical Oxygen Demand	1) Closed Reflux, Titrimetric Method ⁽⁴⁾ 2) Closed Reflux, Colorimetric Method ⁽⁴⁾ 3) Open Reflux, Titrimetric Method ⁽⁴⁾
11	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
12	Chromium	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
13	Color	ADMI Weighted-Ordinate Spectrophotometric Method ⁽⁴⁾
14	Copper	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
15	Cyanide	1) Distillation, Colorimetric Method ⁽⁴⁾ 2) Total Cyanide after Distillation, by Flow Injection Analysis Method ⁽⁴⁾
16	o,p'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
17	4,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
18	4,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
19	4,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
20	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
21	Endosulfan I	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
22	Endosulfan II	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
23	Endosulfan sulfate	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
24	Endrin	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾

25 Endrin aldehyde...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
25	Endrin aldehyde	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
26	Formaldehyde	Distillation, Colorimetric Method ⁽²⁾
27	Free Chlorine	1) Iodometric Method ⁽⁴⁾ 2) DPD Ferrous Titrimetric Method ⁽⁴⁾
28	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
29	Heptachlor Epoxide	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
30	Hexavalent Chromium	Colorimetric Method ⁽⁴⁾
31	Lead	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
32	Manganese	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
33	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽⁴⁾
34	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
35	Nickel	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
36	Oil & Grease	1) Liquid-Liquid, Partition-Gravimetric Method ⁽⁴⁾ 2) Soxhlet Extraction Method ⁽⁴⁾
37	pH	Electrometric Method ⁽⁴⁾
38	Phenols	1) Distillation, Chloroform Extraction Method ⁽⁴⁾ 2) Distillation, Direct Photometric Method ⁽⁴⁾
39	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
40	Sulfide	1) Iodometric Method ⁽⁴⁾ 2) Methylene Blue Method ⁽⁴⁾
41	Temperature	Laboratory and Field Methods ⁽⁴⁾
42	Total Dissolved Solids	Dried at 180 °C ⁽⁴⁾
43	Total Kjeldahl Nitrogen	Semi-Micro-Kjeldahl Method ⁽⁴⁾
44	Total Suspended Solids	Dried from 103 to 105 °C ⁽⁴⁾
45	Trivalent Chromium	1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method, Calculation ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method, Calculation ⁽⁴⁾
46	Zinc	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

น้ำได้ดื่ม...

แนบได้ฉบับ จำนวน 126 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
2	Acetone	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
3	Aldrin	2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
4	Anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
5	Antimony	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
6	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
7	Atrazine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
8	Barium	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
9	Benz(a)anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
10	Benzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
11	Benzo(b)fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
12	Benzo(k)fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
13	Benzoic acid	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
14	Benzo(a)pyrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
15	Benzo(g,h,i)perylene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
16	Beryllium	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
17	Bis(2-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
18	Bis(2-ethylhexyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
19	Bromodichloromethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
20	Bromoform	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
21	Butanol	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
22	Butyl benzyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
23	Cadmium	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾
24	Carbazole	3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
25	Carbon disulfide	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
26	Carbon tetrachloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
27	Chlordane	1) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

ลำดับ	สารเคมี	วิธีวิเคราะห์
29	Chlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(a)
30	Chlorodibromomethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(a)
31	Chloroform	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(a)
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
33	Chromium	1) Digestion, Direct Air-Acetylene Flame Method ^(a) 2) Digestion, Inductively Coupled Plasma Method ^(a)
34	Chromium (III)	1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation ^(a) 2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ^(a)
35	Chromium (VI)	Colorimetric Method ^(a)
36	Chrysene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
37	Cyanide	Distillation, Colorimetric Method ^(a)
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
39	DDD	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
40	DDE	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
41	DDT	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
42	Dibenz(a,h)anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)

43 Di-n-butyl phthalate...

ลำดับ	สารเคมี	วิธีวิเคราะห์
43	Di-n-butyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
44	1,2-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(a)
45	1,3-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(a)
46	1,4-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(a)
47	3,3'-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
48	1,1-Dichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(a)
49	1,2-Dichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(a)
50	1,1-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(a)
51	cis-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(a)
52	trans-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(a)
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
54	1,2-Dichloropropane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(a)
55	1,3-Dichloropropane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(a)
56	1,3-Dichloropropene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(a)
57	Dieldrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
58	Diethyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)

61 2,4-Dinitrotoluene...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
63	Di-n-Octyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
64	Endosulfan	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
65	Endrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
66	Ethylbenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(a)
67	Fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
68	Fluorene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
69	Heptachlor	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
70	Heptachlor epoxide	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
71	Hexachlorobenzene	1) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
72	Hexachloro-1,3-butadiene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(a)
73	n-Hexane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(a)

ฉบับที่ 2

74 α -HCH...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
74	α -HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
75	β -HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
76	γ -HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
77	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
79	Indeno(1,2,3-cd)pyrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
81	Lead	1) Digestion, Direct Air-Acetylene Flame Method ^(a) 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^(a)
82	Manganese	3) Digestion, Inductively Coupled Plasma Method ^(a) 1) Digestion, Direct Air-Acetylene Flame Method ^(a) 2) Digestion, Inductively Coupled Plasma Method ^(a)
83	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(a)
84	Methanol	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(a)
85	Methoxychlor	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(a)
86	Methyl bromide	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^(a)

ฉบับที่ 2

87 Methylene chloride...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
87	Methylene chloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
88	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
89	2-Methylnaphthalene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
90	Methyl tert-butyl ether	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
91	Naphthalene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
92	Nickel	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
93	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
95	N-Nitrosodi-n-propylamine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
96	Polychlorinated Biphenyls	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
- PCB 1016		
- PCB 1221		
- PCB 1232		
- PCB-1242		
- PCB-1248		
- PCB-1254		
- PCB-1260		
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
98	pH	Electrometric Method ⁽⁴⁾
99	Phenanthrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
100	Phenol	1) Distillation, Chloroform Extraction Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
101	Pyrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
102	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
103	Silver	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
104	Styrene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
105	1,1,2,2-Tetrachloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
106	Tetrachloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
107	Toluene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
108	Toxaphene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
109	TPH (C ₅ - C ₈)	1) Purge and Trap, Gas Chromatographic Method ^(12,22) 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,27)
110	TPH (C ₈ - C ₁₆)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(9,22)
111	TPH (C ₁₆ - C ₃₅)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(9,22)
112	1,2,4-Trichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
113	1,1,1-Trichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
114	1,1,2-Trichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
115	Trichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

ลำดับ	สารเคมี	วิธีวิเคราะห์
116	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
117	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
118	1,3,5-Trimethylbenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
119	Vanadium	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
120	Vinyl acetate	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
121	Vinyl chloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
122	m-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
123	o-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
124	p-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
125	Xylene (Total)	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
126	Zinc	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

อากาศเสีย (ปล่อยระบาย) จำนวน 25 รายการ

ลำดับ	สารเคมี	วิธีวิเคราะห์
1	Antimony	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
2	Arsenic	1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
3	Cadmium	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
4	Carbon Monoxide	Instrumental Analyzer Method ⁽⁵⁾
5	Chlorine	Isokinetic Sampling, Ion Chromatographic Method ⁽⁵⁾
6	Chromium	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽⁵⁾

Chromium (ค่า)

ลำดับ	สารเคมี	วิธีวิเคราะห์
6	Chromium (ค่า)	2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
7	Cobalt	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
8	Copper	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
9	Cresol	Absorption Sampling, Gas Chromatographic Method ⁽⁵⁾
10	Dioxins/Furans	Isokinetic Sampling ⁽⁵⁾
11	Hydrogen Chloride	Isokinetic Sampling, Ion Chromatographic Method ⁽⁵⁾
12	Hydrogen Fluoride	Isokinetic Sampling, Ion Chromatographic Method ⁽⁵⁾
13	Hydrogen Sulfide	Absorption Sampling, Iodometric Method ⁽⁵⁾
14	Lead	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
15	Manganese	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
16	Mercury	Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽⁵⁾
17	Nickel	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
18	Opacity	Ringelmann's Method ⁽¹⁾
19	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfonic acid Method ⁽⁵⁾ 2) Instrumental Analyzer Method ⁽⁵⁾
20	Selenium	1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
21	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method ⁽⁵⁾ 2) Instrumental Analyzer Method ⁽⁵⁾
22	Sulfuric Acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method ⁽⁵⁾

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
23	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method ⁽⁵⁾
24	Vanadium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
25	Xylene	1) Bag Sampling, Gas Chromatographic Method ⁽⁵⁾ 2) Adsorption Sampling, Gas Chromatographic Method ⁽⁵⁾

สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 35 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(3,9,23) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23)
2	Antimony	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(3,6,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
3	Arsenic	1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(3,6,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(3,6,14) 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,16) 4) Digestion, Inductively Coupled Plasma Method ^(7,14)
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(3,6,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(3,6,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
6	Cadmium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(3,6,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(3,6,14) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 4) Digestion, Inductively Coupled Plasma Method ^(7,14)
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(3,9,23) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23)

ตาม

8 Chromium...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
8	Chromium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(3,6,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(3,6,14) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 4) Digestion, Inductively Coupled Plasma Method ^(7,14)
9	Chromium (III)	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation ^(3,6,15,17) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation ^(3,6,14,17) 3) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,15,17) 4) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,14,17)
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method ^(3,17) 2) Alkaline Digestion, Colorimetric Method ^(8,17)
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(3,6,14)
12	Copper	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(3,6,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(3,6,14) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 4) Digestion, Inductively Coupled Plasma Method ^(7,14)
13	2,4-D	1) Waste Extraction, Gas Chromatographic Method ^(3,26) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23)
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(3,9,23) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23)

ตาม

15 DDE...

ลำดับ	สารเคมี	วิธีวิเคราะห์
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(3.9.23) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10.23)
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(3.9.23) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10.23)
17	Dieldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(3.9.23) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10.23)
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(3.9.23) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10.23)
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(3.9.23) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10.23)
20	Lead	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(3.6.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(3.6.14) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7.15) 4) Digestion, Inductively Coupled Plasma Method ^(7.14)
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(3.9.23) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10.23)
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(3.19) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(3.6.14) 3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁹⁾ 4) Digestion, Inductively Coupled Plasma Method ^(7.14)

Signature: *[Signature]*
Date: *[Date]*

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ลำดับ	สารเคมี	วิธีวิเคราะห์
22	Mercury (ต่อ)	5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ⁽²⁰⁾
23	Methoxychlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(3.9.23) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10.23)
24	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(3.6.14) 2) Digestion, Inductively Coupled Plasma Method ^(7.14)
25	Nickel	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(3.6.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(3.6.14) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7.15) 4) Digestion, Inductively Coupled Plasma Method ^(7.14)
26	Polychlorinated Biphenyls - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5'-Trichlorobiphenyl - 2,4',5'-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4,6'-Pentachlorobiphenyl	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(3.9.24) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10.24)

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สิ่งแวดล้อม

ลำดับ	สารเคมี	วิธีวิเคราะห์
27	Polychlorinated Biphenyls(คอป) - 2,2',3,4,4',5'- Hexachlorobiphenyl - 2,2',3,4,5,5'- Hexachlorobiphenyl - 2,2',3,5,5',6'- Hexachlorobiphenyl - 2,2',4,4',5,5'- Hexachlorobiphenyl - 2,2',3,3',4,4',5'- Heptachlorobiphenyl - 2,2',3,4,4',5,5'- Heptachlorobiphenyl - 2,2',3,4,4',5',6'- Heptachlorobiphenyl - 2,2',3,4',5,5',6'- Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6'- Nonachlorobiphenyl Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(3,9,28) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) Electrometric Method ^(31,32) 1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(3,6,21) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(3,6,14) 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,21) 4) Digestion, Inductively Coupled Plasma Method ^(7,14) 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(3,6,21) 2) Digestion, Inductively Coupled Plasma Method ^(7,14) 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(3,6,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
28	pH	
29	Selenium	
30	Silver	
31	Thallium	

32 Toxaphene...

ลำดับ	สารเคมี	วิธีวิเคราะห์
32	Toxaphene	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(3,9,23) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 1) Waste Extraction, Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(3,12,27) 2) Waste Extraction, Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(3,11,27) 3) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27) 4) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(11,27) 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(3,6,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,14) 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(3,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(3,6,14) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 4) Digestion, Inductively Coupled Plasma Method ^(7,14)
33	Trichloroethylene	
34	Vanadium	
35	Zinc	

125 รายการ

 125 รายการ

ลำดับ	สารเคมี	วิธีวิเคราะห์
1	Acenaphthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27) 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23)
2	Acetone	
3	Aldrin	
4	Anthracene	

Anthracene (คอป)...

ลำดับ	สารเคมี	วิธีวิเคราะห์
4	Anthracene (๓๖)	2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
5	Antimony	Digestion, Inductively Coupled Plasma Method ^(7,14)
6	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,14)
7	Atrazine	2) Digestion, Inductively Coupled Plasma Method ^(7,14)
8	Barium	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
9	Benz(a)anthracene	Digestion, Inductively Coupled Plasma Method ^(7,14)
10	Benzene	1) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
11	Benzo(b)fluoranthene	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27)
12	Benzo(k)fluoranthene	2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
13	Benzoic acid	1) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
14	Benzo(a)pyrene	1) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
15	Benzo(g,h,i)perylene	2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
16	Beryllium	1) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)

17 Bis(2-chloroethyl)ether...

ลำดับ	สารเคมี	วิธีวิเคราะห์
17	Bis(2-chloroethyl)ether	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
18	Bis(2-ethylhexyl)phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27)
20	Bromoform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27)
21	Butanol	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27)
22	Butyl benzyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
23	Cadmium	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15)
24	Carbazole	2) Digestion, Inductively Coupled Plasma Method ^(7,14)
25	Carbon disulfide	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27)
27	Chlordane	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27)
28	p-Chloroaniline	2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
29	Chlorobenzene	1) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
30	Chlorodibromomethane	2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
31	Chloroform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27)
32	2-Chlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)

33 Chromium...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
33	Chromium	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 2) Digestion, Inductively Coupled Plasma Method ^(7,16)
34	Chromium (III)	1) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,15,17) 2) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,14,17) Alkaline Digestion, Colorimetric Method ^(8,17)
35	Chromium (VI)	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,25) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
36	Chrysene	Extraction, Distillation, Colorimetric Method ^(29,30) Ultrasonic Extraction, Gas Chromatographic Method ⁽²⁶⁾
37	Cyanide	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
38	2,4-D	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
39	DDD	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
40	DDE	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
41	DDT	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
42	Dibenz(a,h)anthracene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,25) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
43	Di-n-butyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27)
44	1,2-Dichlorobenzene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27)
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27)
47	3,3'-Dichlorobenzidine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
48	1,1-Dichloroethane	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
49	1,2-Dichloroethane	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
50	1,1-Dichloroethylene	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
51	cis-1,2-Dichloroethylene	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
52	trans-1,2-Dichloroethylene	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
53	2,4-Dichlorophenol	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
54	1,2-Dichloropropane	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
55	1,3-Dichloropropane	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
56	1,3-Dichloropropene	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
57	Dieldrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)

ลำดับ	สารเคมี	วิธีการหาค่า
58	Diethyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
59	2,4-Dimethylphenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
60	2,4-Dinitrophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
61	2,4-Dinitrotoluene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
62	2,6-Dinitrotoluene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
63	Di-n-Octyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
64	Endosulfan	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
65	Endrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
66	Ethylbenzene	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
67	Fluoranthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,25) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
68	Fluorene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,25) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
69	Heptachlor	1) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,23)
70	Heptachlor epoxide	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23)

ลำดับ	สารพิษ	วิธีการหาค่า
70	Heptachlor epoxide (คอก)	2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
71	Hexachlorobenzene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27)
73	n-Hexane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27)
74	α -HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
75	β -HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
76	γ -HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
77	Hexachlorocyclopentadiene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
78	Hexachloroethane	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
79	Indeno(1,2,3-cd)pyrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,25) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
80	Isporphone	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
81	Lead	1) Digestion, Flame Atomic Absorption Spectrometric Method ⁽¹³⁾ 2) Digestion, Inductively Coupled Plasma Method ^(7,14)
82	Manganese	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 2) Digestion, Inductively Coupled Plasma Method ^(7,14)

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
83	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹¹⁹⁾ 2) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ⁽²⁰⁾
84	Methanol	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27)
85	Methoxychlor	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
86	Methyl bromide	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27)
87	Methylene chloride	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(11,27)
88	2-Methylphenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
89	2-Methylnaphthalene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
90	Methyl tert-butyl ether	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,27)
91	Naphthalene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,25) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
92	Nickel	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 2) Digestion, Inductively Coupled Plasma Method ^(7,16)
93	Nitrobenzene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
94	N-Nitrosodiphenylamine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
95	N-Nitrosodi-n-propylamine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28)
96	Polychlorinated Biphenyls - Aroclor 1016	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24)

ลำดับ	สารเคมี	วิธีการหาค่า
96	Polychlorinated Biphenyls(ข้อ) - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 Polychlorinated Biphenyls - 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5-Trichlorobiphenyl - 2,4',5-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'- Pentachlorobiphenyl - 2,2',4,5,5'- Pentachlorobiphenyl - 2,3,3',4',6- Pentachlorobiphenyl - 2,2',3,4,4',5'- Hexachlorobiphenyl - 2,2',3,4,5,5'- Hexachlorobiphenyl - 2,2',3,5,5',6- Hexachlorobiphenyl - 2,2',4,4',5,5'- Hexachlorobiphenyl - 2,2',3,3',4',5- Heptachlorobiphenyl - 2,2',3,4,4',5,5'- Heptachlorobiphenyl - 2,2',3,4,4',5',6- Heptachlorobiphenyl - 2,2',3,4',5,5',6- Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6- Nonachlorobiphenyl	2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) Ultrasonic Extraction, Gas Chromatographic Method ^(10,28)

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ลำดับ	สารเคมี	วิธีวิเคราะห์
97	Pentachlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10.28)
98	Phenanthrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10.23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10.28)
99	Phenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10.28)
100	Pyrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10.23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10.28)
101	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7.21) 2) Digestion, Inductively Coupled Plasma Method ^(7.14)
102	Silver	Digestion, Inductively Coupled Plasma Method ^(7.14)
103	Styrene	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.27) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(11.27)
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.27)
105	Tetrachloroethylene	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.27) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(11.27)
106	Toluene	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.27) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(11.27)
107	Toxaphene	Ultrasonic Extraction, Gas Chromatographic Method ^(10.23)
108	TPH (C ₅ -C ₈)	1) Purge and Trap, Gas Chromatographic Method ^(13.27) 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.27)
109	TPH (C ₈ -C ₁₆)	Spectrometric Method ^(10.22)
110	TPH (C ₁₅ -C ₃₅)	Ultrasonic Extraction, Gas Chromatographic Method ^(10.22) Ultrasonic Extraction, Gas Chromatographic Method ^(10.22)

111 1,2,4-Trichlorobenzene...

ลำดับ	สารเคมี	วิธีวิเคราะห์
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.27)
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.27)
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.27)
114	Trichloroethylene	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.27) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(11.27)
115	2,4,5-Trichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10.28)
116	2,4,6-Trichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10.28)
117	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.27)
118	Vanadium	Digestion, Inductively Coupled Plasma Method ^(7.14)
119	Vinyl acetate	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.27)
120	Vinyl chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.27)
121	m-Xylene	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.27) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(11.27)
122	o-Xylene	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.27) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(11.27)
123	p-Xylene	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.27) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(11.27)
124	Xylene (Total)	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.27) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(11.27)

125 Zinc...

ลำดับ	สารสพิษ	วิธีวิเคราะห์
125	Zinc	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 2) Digestion, Inductively Coupled Plasma Method ^(7,14) ตาม

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