

ภาคผนวก จ

เอกสารรับรองการสอบเทียบเครื่องมือการตรวจวัด

และวิเคราะห์

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)	Andersen Instruments, Inc.	G25A 1901	Jiranaatee Associates Co., Ltd.	COF-002-66	14 Jul 23	13 Jul 25	-
2	U-Tube Manometer	Total Suspended Particulate (TSP)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	24P1251	11 Apr 24	10 Apr 25	-
3	Aneroid Barometer	Total Suspended Particulate (TSP)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24P1369	22 Apr 24	21 Apr 25	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24H753	10 Apr 24	9 Apr 25	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778107	UAE Consultant Co.,Ltd.	26092024	26 Sep 24	25 Sep 25	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778108	UAE Consultant Co.,Ltd.	04112024	4 Oct 24	3 Oct 25	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM22387037	UAE Consultant Co.,Ltd.	04102024	4 Oct 24	3 Oct 25	-
8	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05N91E15A0014	6 Jun 23	6 Jun 31	-
9	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920017	UAE Consultant Co.,Ltd.	15062024	15 May 24	14 May 25	-
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920014	UAE Consultant Co.,Ltd.	04092024	4 Sep 24	3 Sep 25	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387067	UAE Consultant Co.,Ltd.	15052024	15 May 24	14 May 25	-
12	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05N91E15A0014	6 Jun 23	6 Jun 31	-
13	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2112DR0065	Thai Meteorological Department	097/24	22 Feb 24	21 Feb 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
Ambient									
14	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2311DR0037	Thai Meteorological Department	123/24	13 Mar 24	12 Mar 25	-
15	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0105	Thai Meteorological Department	120/24	13 Mar 24	12 Mar 25	-
16	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL200 21091	Innovative Instrument Co.,Ltd.	24-ACT-068	17 May 24	16 May 25	-
17	Sound Level Meter	$L_{Aeq} 1 \text{ hour}^*$ $L_{Aeq} 24 \text{ hr}^*$ L_{Amax}^* L_{A90}	Larson Davis	LxT1 0007308	Electrical And Electronics Institute Foundation For Industrial Development	CP20240322EA	22 Aug 24	21 Aug 25	-
18	Sound Level Meter	$L_{Aeq} 1 \text{ hour}^*$ $L_{Aeq} 24 \text{ hr}^*$ L_{Amax}^* L_{A90}	Larson Davis	LxT1 0007309	Electrical And Electronics Institute Foundation For Industrial Development	CP202340287EA	2 Aug 24	1 Aug 25	-
19	Sound Level Meter	$L_{Aeq} 1 \text{ hour}^*$ $L_{Aeq} 24 \text{ hr}^*$ L_{Amax}^* L_{A90}	Larson Davis	LxT1 0007310	Electrical And Electronics Institute Foundation For Industrial Development	CP20240289EA	5 Aug 24	4 Aug 25	-
20	Sound Level Meter	$L_{Aeq} 1 \text{ hour}^*$ $L_{Aeq} 24 \text{ hr}^*$ L_{Amax}^* L_{A90}	Larson Davis	LxT1 0007312	Electrical And Electronics Institute Foundation For Industrial Development	CP20240288EA	5 Aug 24	4 Aug 25	-
21	Sound Level Meter	$L_{Aeq} 1 \text{ hour}^*$ $L_{Aeq} 24 \text{ hr}^*$ L_{Amax}^* L_{A90}	Larson Davis	LxT1 0007313	Innovative Instrument Co.,Ltd.	24-SLM-039	8 Feb 24	7 Feb 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
Stack									
1	Pre-Test Console	Total Suspended Particulate Sodium Hydroxide Chromium Phosphoric Acid Hydrogen Chloride	Apex Instruments, USA.	XC-572-V 1701019	Envi Equipment Service Co., Ltd.	E24-060048	18 Jun 24	17 Jun 25	-
2	Pre-Test Console	Total Suspended Particulate Sodium Hydroxide Chromium Phosphoric Acid Hydrogen Chloride	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 61658806/0419	Entech Industrial Solutio Co., Ltd.	G 670175	8 Mar 24	7 Mar 25	-
4	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide Carbon Monoxide	Testo	Testo 350 61658816/0419	Entech Industrial Solutio Co., Ltd.	G 670125	23 Feb 24	22 Feb 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 HA1L0035	Technology Promotion Association (Thailand-Japan)	24CH320	14 Mar 24	13 Mar 25	-
2	Conductivity Meter	Conductivity	YSI	Pro 30 22F103994	Technology Promotion Association (Thailand-Japan)	24CH326	14 Mar 24	13 Mar 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	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPQ020022	Innovative Instrument Co.,Ltd.	24-TPM-369	15 Aug 24	14 Aug 25	-
2	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPQ020023	Innovative Instrument Co.,Ltd.	24-TPM-349	6 Aug 24	5 Aug 25	-
3	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPQ020024	Innovative Instrument Co.,Ltd.	24-TPM-148	21 Mar 24	20 Mar 25	-
4	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPQ020025	Innovative Instrument Co.,Ltd.	24-TPM-152	21 Apr 24	20 Apr 25	-
5	Primary Flow Calibrator	Calibrate personal pump	TSL Inc	4146 41462317033	Innovative Instrument Co., Ltd.	24-AFM-101	24 May 24	23 May 25	-
6	Aneroid Barometer	Total Dust Respirable Dust Zinc Oxide Fume Chromium Fume Sodium Hydroxide Phosphoric Acid Hydrogen Chloride Oil Mist Toluene Xylene Acetone Chromium	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24P1370	22 Apr 24	21 Apr 25	-
7	Digital Thermo - Hygrometer	Total Dust Respirable Dust Zinc Oxide Fume Chromium Fume Sodium Hydroxide	Digicon	TH-02 395034173	Technology Promotion Association (Thailand-Japan)	24H716	10 Apr 24	9 Apr 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									
		Phosphoric Acid Hydrogen Chloride Oil Mist Toluene Xylene Acetone Chromium							
8	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6171	Innovative Instrument Co.,Ltd.	24-ACT-086	25 Jun 24	24 Jun 25	-
9	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 91926	Innovative Instrument Co.,Ltd.	24-NDM-016	25 Jan 24	24 Jan 25	-
10	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 91928	Innovative Instrument Co.,Ltd.	24-NDM-014	24 Jan 24	23 Jan 25	-
11	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 106063	Innovative Instrument Co.,Ltd.	24-NDM-077	21 Mar 24	20 Mar 25	-
12	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 106069	Innovative Instrument Co.,Ltd.	24-NDM-018	25 Jan 24	24 Jan 25	-
13	Sound Level Meter	$L_{Aeq} 8 \text{ hr}^1$ L_{Amax}	Rion, Japan	NL-42 00558212	Sithipom Associates Co., Ltd.	ACL24100	29 Jan 24	28 Jan 25	-
14	Sound Level Meter	$L_{Aeq} 8 \text{ hr}^1$ L_{Amax}	Rion, Japan	NL-42 00208876	Sithipom Associates Co., Ltd.	ACL24047	18 Jan 24	17 Jan 25	-
15	Sound Level Meter	$L_{Aeq} 8 \text{ hr}^1$ L_{Amax}	Rion, Japan	NL-42 00408979	Sithipom Associates Co., Ltd.	ACL24049	18 Jan 24	17 Jan 25	-
16	Sound Level Meter	$L_{Aeq} 8 \text{ hr}^1$ L_{Amax}	Rion, Japan	NL-42 00408980	Sithipom Associates Co., Ltd.	ACL24050	18 Jan 24	17 Jan 25	-
17	Sound Level Meter	$L_{Aeq} 8 \text{ hr}^1$ L_{Amax}	Rion, Japan	NL-42 00408981	Sithipom Associates Co., Ltd.	ACL24098	29 Jan 24	28 Jan 25	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Workplace									
18	Sound Level Meter	$L_{Aeq} 8 \text{ hrs}$ L_{Amax}	Rion, Japan	NL-42 00408982	Sithiporn Associates Co., Ltd.	ACL24051	18 Jan 24	17 Jan 25	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Workplace									
1	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPT060014	Innovative Instrument Co.,Ltd.	24-TPM-248	3 Jun 24	2 Jun 25	-
2	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 34 TEX040013	Innovative Instrument Co.,Ltd.	24-TPM-347	6 Aug 24	5 Aug 25	-
3	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 34 TEX040015	Innovative Instrument Co.,Ltd.	24-TPM-313	9 Jul 24	8 Jul 25	-
4	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPQ020025	Innovative Instrument Co.,Ltd.	24-TPM-152	21 Apr 24	20 Apr 25	-
5	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPQ020024	Innovative Instrument Co.,Ltd.	24-TPM-148	21 Mar 24	20 Mar 25	-
6	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 32 TPT060013	Innovative Instrument Co.,Ltd.	24-TPM-043	23 Jan 24	22 Jan 25	-
7	Thermal Environment Monitor	Heat Meter	Quest Technologies, Inc	QuesTemp 34 TEG100075	Innovative Instrument Co.,Ltd.	24-TPM-047	23 Jan 24	22 Jan 25	-
8	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35 44783	Innovative Instrument Co.,Ltd.	24-ACT-088	25 Jun 24	24 Jun 25	-
9	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 91924	Innovative Instrument Co.,Ltd.	24-NDM-015	25 Jan 24	24 Jan 25	-
10	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 117688	Innovative Instrument Co.,Ltd.	24-NDM-110	26 Apr 24	25 Apr 25	-
11	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 91925	Innovative Instrument Co.,Ltd.	24-NDM-013	24 Jan 24	23 Jan 25	-
12	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 143224	Innovative Instrument Co.,Ltd.	24-NDM-172	15 Jul 24	14 Jul 25	-
13	Sound Level Meter	$L_{Aeq} 8 \text{ hrs}$ L_{Amax}	Rion, Japan	NL-42 00558208	Sithiporn Associates Co., Ltd.	ACL24099	29 Jan 24	28 Jan 25	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Workplace									
14	Sound Level Meter	$L_{Aeq} 8\text{ hrs}, L_{Amax}$	Rion, Japan	NL-42 00609500	Sithiporn Associates Co., Ltd.	ACL24058	18 Jan 24	17 Jan 25	-
15	Sound Level Meter	$L_{Aeq} 8\text{ hrs}, L_{Amax}$	Rion, Japan	NL-42 00408981	Sithiporn Associates Co., Ltd.	ACL24098	29 Jan 24	28 Jan 25	-
16	Sound Level Meter	$L_{Aeq} 8\text{ hrs}, L_{Amax}$	Rion, Japan	NL-42 00321441	Sithiporn Associates Co., Ltd.	ACL24156	30 May 24	29 May 25	-
17	Sound Level Meter	$L_{Aeq} 8\text{ hrs}, L_{Amax}$	Rion, Japan	NL-42 01010783	Sithiporn Associates Co., Ltd.	ACL24167	6 Jun 24	5 Jun 25	-
18	Sound Level Meter	$L_{Aeq} 8\text{ hrs}, L_{Amax}$	Rion, Japan	NL-42 00408980	Sithiporn Associates Co., Ltd.	ACL24050	18 Jan 24	17 Jan 25	-

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Certificate of Calibration

Certificate No.: 24P1369
Page: 1 of 2

Equipment: Aneroid Barometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.013/2547

Condition As-Received: Used Item

Received Date: 05 April 2024

Calibration Date: 22 April 2024

Reference: 2404-0243WSC

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

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1007 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-P10, using " DKD-R 6-1 ; Calibration of Pressure Gauges " as a guidelines.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DPI142	1422505046	MP-0094-23	03 May 2024

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

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

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khnkaew
Issue Date : 23 April 2024

Approved Signatory :
[] Pholinee Prabpaipal
[] Sura Suwanasri
[✓] Attapol Panurach

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Cert.No.: 24P1369
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)	718.40	729.71	740.61	751.07	761.07	773.05	786.91
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0	780.0
Error (mmHg)	1.60	0.29	-0.61	-1.07	-1.97	-3.05	-6.91

Decreasing Pressure

Applied Pressure (mmHg)	786.91	772.99	761.71	750.69	740.13	729.35	718.44
UUC* Indication (mmHg)	780.0	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-6.91	-2.99	-1.71	-0.69	-0.13	0.65	1.56

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.: 24H753
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.127/2550

Condition As-Received: Used Item

Received Date: 05 April 2024

Calibration Date: 10 April 2024

to 18 April 2024

Reference: 2404-0247WSC

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

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

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

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Chilled Mirror Hygrometer	Dew Master	44730	21656	02 Aug 2024
2) Handheld Thermometer With Sensor	1521	A5A339	231238	16 Oct 2024

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

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

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

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

Calibrated by : Chakrit Waewwanjua
Issue Date : 18 April 2024

Approved Signatory :
[] Chakrit Waewwanjua
[✓] Viporn Tantayawutti
[] Unnopphol Harachai

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Cert.No.: 24H753
Page.: 2 of 2

Result of Calibration: Without Adjustment

Function: Humidity Measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	43	2.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	78	-2.0	1.8

Result of Calibration: Without Adjustment

Function: Temperature Measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.014	20.0	-0.014	0.72
25.033	25.0	-0.033	0.72
30.010	30.0	-0.010	0.72
35.027	34.5	-0.527	0.72
40.013	39.5	-0.513	0.72

UUC* : Unit Under Calibration

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

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MULTI-POINT GAS TEST REPORT

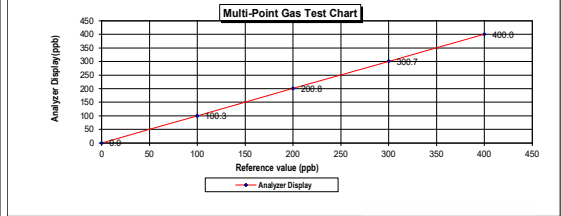
Test Date : Sep 26, 2024

Equipment : Gas Analyzer (NO_x) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201778107

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	42.89	PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO)	46.77	PPM	Model : 146i
Methane (CH ₄)	-	PPM	Serial Number : 1180540071
Carbon Monoxide (CO)	965.9		
Cylinder No. :	EB0159156		
Expiration Date :	Nov 6, 2026		

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.3	0.30	0.30	0.30
Level 3	40.00%	200.0	200.8	0.80	0.40	0.40
Level 4	60.00%	300.0	300.7	0.70	0.23	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.19



Calculate by
Sachan C
26 9 2567

Approve by
Sachan C
26 Sep 2024

MULTI-POINT GAS TEST REPORT

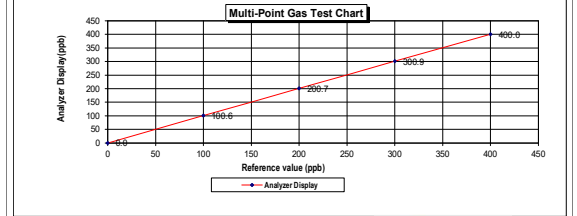
Test Date : Oct 4, 2024

Equipment : Gas Analyzer (NO_x) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201778108

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	42.89	PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO)	46.77	PPM	Model : 146i
Methane (CH ₄)	-	PPM	Serial Number : 1180540071
Carbon Monoxide (CO)	965.9		
Cylinder No. :	EB0159156		
Expiration Date :	Nov 6, 2026		

Multi-point gas test data

Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	0.60	0.60	0.60
Level 3	40.00%	200.0	0.70	0.35	0.35
Level 4	60.00%	300.0	0.90	0.30	0.30
Level 5	80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%)		0.25



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4 Oct 2024

MULTI-POINT GAS TEST REPORT

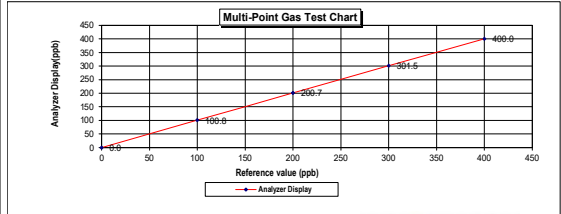
Test Date : Oct 4, 2024

Equipment : Gas Analyzer (NO_x) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM22387037

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	42.89	PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO)	46.77	PPM	Model : 146i
Methane (CH ₄)	-	PPM	Serial Number : 1180540071
Carbon Monoxide (CO)	965.9		
Cylinder No. :	EB0159156		
Expiration Date :	Nov 6, 2026		

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.8	0.80	0.79	0.79
Level 3	40.00%	200.0	200.7	0.70	0.35	0.35
Level 4	60.00%	300.0	301.5	1.50	0.50	0.50
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.33



Calculate by
Sachan C
11 10 2567

Approve by
Sachan C
11 Oct 2024

CERTIFICATE OF ANALYSIS
Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)
LTD.
Part Number: E09A91E15A0914
Cylinder Number: EB0162121
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12023
Gas Code: CO, CO₂, NO, NO_x, SO₂, BALN
Reference Number: 160-402772205-1
Cylinder Volume: 144.0 CF
Cylinder Pressure: 2016 PSIG
Valve Outlet: 660
Certification Date: Jul 06, 2023
Expiration Date: Jul 06, 2031

Certification performed in accordance with EPA Traceability Protocol for Analytical and Certification of Reference Gas Standards (May 2012) document EPA 8200-1-0201, using the assay procedures listed. Analytical methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this certification. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do not cite this cylinder below 100 ppb, i.e. 0.1 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Date
NO _x	100.0 PPM	100.4 PPM	G1	\pm 0.9% NIST Traceable	06/27/2023, 07/06/2023
NITRIC OXIDE	100.0 PPM	100.2 PPM	G1	\pm 0.9% NIST Traceable	06/27/2023, 07/06/2023
SULFUR DIOXIDE	100.0 PPM	100.0 PPM	G1	\pm 1.4% NIST Traceable	06/27/2023, 07/06/2023
CARBON MONOXIDE	200.0 PPM	199.2 PPM	G1	\pm 0.3% NIST Traceable	06/28/2023
CARBON DIOXIDE	8,000 %	7,982 %	G1	\pm 1.2% NIST Traceable	06/27/2023
NITROGEN	Balance				

Type	Lot ID	Cylinder No.	Concentration	Uncertainty	Expiration Date
GAWS	1040260R	CG743484	99.36 PPM NITRIC OXIDE/NITROGEN	\pm 0.4%	Jan 04, 2027
PRM	CG218101	APR1414548	100.19 PPM NITRIC OXIDE/NITROGEN	\pm 0.3%	Feb 26, 2025
GAWS	2023040225	CG743481	99.02 PPM NITRIC OXIDE/NITROGEN	\pm 0.4%	Apr 26, 2031
PRM	12409	D013680	15.01 PPM NITROGEN DIOXIDE/AIR	\pm 1.5%	Feb 17, 2023
GAWS	1040030303	EB0130037	9.993 PPM NITROGEN DIOXIDE/NITROGEN	\pm 1.6%	Sep 29, 2025
NITRM	100102-02	KAL003803	87.69 PPM SULFUR DIOXIDE/NITROGEN	\pm 0.9%	Nov 01, 2027
CO	200001	CG745602	246.47 PPM CARBON MONOXIDE/NITROGEN	\pm 0.3%	Dec 09, 2029
NITRM	130908-02	CG411730	13.359 % CARBON DIOXIDE/NITROGEN	\pm 0.9%	May 14, 2025

The GWS, NTRM, PRM, or RDM listed above is only in reference to the GMS used in the assay and not part of the analysis.

Instrument/Make/Model	Analytical Principle	Last Multi-point Calibration
Nissel ISO FTIR AUP2010245 C02	FTIR	Jun 15, 2023
SIEMENS ULTRAMATE N1-C4-180	NDIR	Jun 14, 2023
Nissel ISO FTIR AUP2010245 NO	FTIR	Jun 29, 2023
Nissel ISO FTIR AUP2010245 NO ₂	FTIR	Jun 15, 2023
Nissel ISO FTIR AUP2010245 SO ₂	FTIR	Jun 06, 2023

Approved for Release

MULTI-POINT GAS TEST REPORT

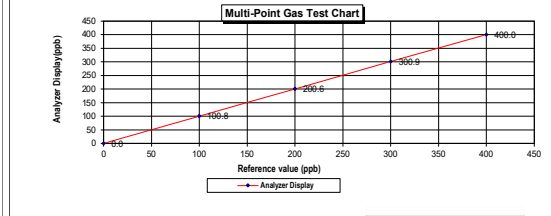
Test Date : Sep 4, 2024

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920017

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	42.89	PPM	Manufacturer : Thermo SCIENTIFIC
Nitric Oxide (NO)	46.77	PPM	Model : 146i
Methane (CH ₄)	-	PPM	Serial Number : 1180540071
Carbon Monoxide (CO)	965.9		
Cylinder No. :	EB01159156		
Expiration Date :	Nov 06, 2026		

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.00	0.00	0.00
Level 2 20,00%	100.0	0.80	0.79	0.79
Level 3 40,00%	200.0	0.60	0.30	0.30
Level 4 60,00%	300.0	0.90	0.30	0.30
Level 5 80,00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb		Average Difference (%)		
:Acceptable Limit \pm 5%		0.28		



Calculate by
4 9 2567

Approve by
4 Sep 2024

MULTI-POINT GAS TEST REPORT

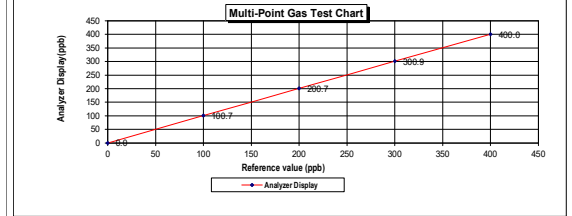
Test Date : Sep 4, 2024

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920014

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	42.89	PPM	Manufacturer : Thermo SCIENTIFIC
Nitric Oxide (NO)	46.77	PPM	Model : 146i
Methane (CH ₄)	-	PPM	Serial Number : 1180540071
Carbon Monoxide (CO)	965.9		
Cylinder No. :	EB01159156		
Expiration Date :	Nov 06, 2026		

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.00	0.00	0.00
Level 2 20,00%	100.0	0.70	0.70	0.70
Level 3 40,00%	200.0	0.70	0.35	0.35
Level 4 60,00%	300.0	0.90	0.30	0.30
Level 5 80,00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb		Average Difference (%)		
:Acceptable Limit \pm 5%		0.27		



Calculate by
4 9 2567

Approve by
4 Sep 2024

MULTI-POINT GAS TEST REPORT

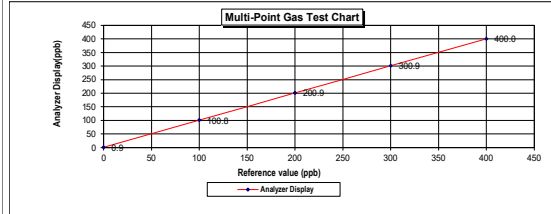
Test Date : May 15, 2024

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387067

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

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.9	0.90	0.90
Level 2 20,00%	100.0	0.80	0.79	0.79
Level 3 40,00%	200.0	0.90	0.45	0.45
Level 4 60,00%	300.0	0.90	0.30	0.30
Level 5 80,00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb		Average Difference (%)		
:Acceptable Limit \pm 5%		0.49		



Calculate by
15 05 2567

Approve by
15 May 2024

THAI METEOROLOGICAL DEPARTMENT
3153 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2884, 8-2399-6469
Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 22 February, 2024

Certification No. 097/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2112DR0065

Wind Sensor 2112DT0065

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangkok, Prachinong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.8 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Airt Plotting Board

: Micromanometer Theodor Friedrichs FD14 Serial No. 5010119 : HOCK 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 Friedrichs : Dry No.8390/94 Wet No. 8388/94

: Iwata, Iwata G45 Serial No. C2848057 : Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PPS30 No. K-936001

Calibrated by : Natchaporn

Mr. Watchapol Subwat

Mechanical Engineer

Signed : Mr. Pitsak Promru

Sub-Standard Instrument

Mechanical Engineer

(Authorized Signatory)

for the Chief

Sub-Standard Instrument



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-6469

The Result of Calibration

Certification No. 097/24

22 February, 2024

Page : 2 of 5

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	2.9	0.12
5.00	-	-	-	4.9	0.10
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

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

Calibrated by:
Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-6469

The Result of Calibration

Certification No. 097/24

22 February, 2024

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
1010.84	1011	-0.16
1010.60	1011	-0.40
1011.71	1011	0.71
1012.17	1012	0.17
1012.31	1012	0.31
1012.25	1012	0.25
1012.79	1013	-0.21
1012.95	1012	0.95
1013.52	1014	-0.48
1014.16	1014	0.16
1015.79	1016	-0.21
1016.02	1016	0.02
1015.86	1016	-0.14
1015.69	1016	0.69
1011.51	1012	-0.49
1011.80	1012	-0.20
1012.06	1012	0.06
1012.81	1013	-0.19
1013.22	1013	0.22
1013.49	1014	-0.51

Average 0.03

Calibrated by:
Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-6469

The Result of Calibration

Certification No. 097/24

22 February, 2024

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
758.19	758	0.19
758.01	758	0.01
758.84	758	0.84
758.19	759	0.19
759.29	759	0.29
759.25	759	0.25
759.62	759	0.62
759.77	760	-0.23
760.25	760	0.20
760.68	760	0.68
761.90	762	-0.10
762.06	762	0.06
761.96	762	-0.04
761.83	762	-0.17
758.69	759	-0.31
758.91	759	-0.09
758.11	759	0.11
759.67	760	-0.33
759.98	760	-0.02
760.16	760	0.16

Average 0.12

Calibrated by:
Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-6469

The Result of Calibration

Certification No. 097/24

22 February, 2024

Page : 5 of 5

Standard	Temperature Sensor Reading	
	Reading	Correction
Temp. °C	°C	°C
45.2	45	0.2
30.3	30	0.3
15.8	16	-0.2

Calibrated by:
Mr. Watchapol 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 : 13 March, 2024 Certification No. 123/24
Page : 1 of 3

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver : 2311DR0037
Wind Sensor : 2112DT0102

Customer : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsak 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature : 25.1 °C Barometric Pressure : 1013.1 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Airt Plotting Board

: Micromanometer : Theodor Friedrichs FC014 Serial No. 3010119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731041460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-850-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120829566)

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

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8399/94

: Itek, Itek-045 Serial No. 03848057 : Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type BF6220-No. V1220015
Digital Barometer Vaisala Type PTB330-No. #320001

Calibrated by : Watchapol

Signed : Mr. Pirotee Promrat

Authorized Signatory

for the Chief

Sub-Standard Instruments

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

13 March, 2024 Certification No. 123/24
Page : 2 of 5

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacuum inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	6.9	0.14
9.02	-	-	-	9.0	0.02
11.02	-	-	-	10.9	0.12
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Wind Airt Plotting Board.	
US DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by : Watchapol

Mr. Watchapol Subwat
Mechanical Engineer

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

13 March, 2024 Certification No. 123/24
Page : 3 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mmHg
1009.59	1009	0.59
1009.45	1009	0.45
1010.10	1010	0.10
1010.94	1011	-0.06
1011.46	1011	0.46
1011.84	1012	-0.16
1012.06	1012	0.06
1013.04	1013	0.04
1013.18	1013	0.18
1012.69	1013	-0.11
1013.20	1013	0.20
1013.44	1014	-0.56
1013.81	1014	-0.19
1014.19	1014	0.19
1015.96	1016	-0.04
1016.23	1016	0.23
1015.64	1016	-0.36
1016.29	1016	0.29
1012.87	1013	-0.13
1013.89	1013	0.89

Average

0.09

Calibrated by : Watchapol
Mr. Watchapol 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

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

Standard Barometer Pressure	Tested Barometer Pressure	Correction mmHg
757.25	757	0.25
757.15	757	0.15
757.64	758	-0.36
758.27	758	0.27
758.66	759	-0.34
758.84	759	-0.06
758.11	759	0.11
758.84	760	-0.16
758.95	760	-0.05
759.73	760	-0.27
759.96	760	-0.04
760.14	760	0.14
760.42	760	0.42
760.70	761	-0.30
762.03	762	0.03
762.24	762	0.24
761.79	762	-0.21
761.46	761	0.46
759.71	760	-0.29
760.28	760	0.28

Average

0.06

Calibrated by : Watchapol
Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT
4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2884, 0-2399-0469

The Result of Calibration

Certification No. 123/24

13 March, 2024

Page : 5 of 8

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

Calibrated by:

Handwritten signature

Mr. Wacharapol Subwat
Mechanical Engineer



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Certificate of Calibration

WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (ISO 17025) and is within manufacturer's specification at the time when the calibration is done.

Client: Envi Service Co., Ltd.

Serial No.: 2205070109

Calibration Date: 2022/9/14

Calibration Expiry Date: 2023/9/13

The Result of Calibration

Velocity				
Measured Value(m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.1	1.0	0.1	0.5-1.1	Pass
2.0	2.0	0.0	1.8-2.2	Pass
5.1	5.0	0.1	4.7-5.5	Pass
7.0	7.0	0.0	6.2-8.0	Pass
10.1	10.0	0.1	9.5-10.5	Pass
19.7	20.0	0.3	18.0-21.0	Pass

Wind Direction				
Measured Value	Actual Value	Deviation	Tolerance	Result
46°	45°	1	42-48	Pass
195°	195°	0	132-158	Pass
226°	225°	1	222-228	Pass
316°	315°	1	312-318	Pass
358°	0°	1	357-0	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
22.6°C	22.5°C	0.1	21.5-23.5	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
1005	1005	0	1003-1019	Pass

Environment conditions :

Air temperature: 22 °C
Relative humidity: 35 %
Static pressure: 102.2 kPa

Performed by:

Certified by Head of Engineering



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4F-5, No. 307, 2nd Sec., Heping E. Rd., Xuan-Dai, Taipei City 106, Taiwan

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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7109 MOO 10, KHU BUNTHAKORN 11 TAMBON BANG KARD
AMPHOE BANG PHU, PHU SAMUT PRAKANG PROVINCE 10140 THAILAND
TEL: 1600-2116-5000 FAX: 1600-2116-7140



Page 1 of 2

Certificate of Calibration

Customer

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

Certificate No : 24-ACT-068
Request No : Req-2024-1025

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : LARSON DAVIS
Model : CAL200
Serial Number : 21091
ID : UAEEFM0472566

Class : 1
Range : 94 ~ 114 dB / 1000 Hz
Inspection Status : Used

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 kPa)
Received Date : 8 May 2024
Calibration Date : 17 May 2024
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

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

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

Note

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

Calibrated By :

Handwritten signature

Mr. Noppadol Luangan
Service Calibration Engineer

Approved By :

Handwritten signature

Mr. Poch Mathavorn
Calibration Engineer Supervisor

Issue Date : 17 May 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. Head Office
7109 MOO 10, KHU BUNTHAKORN 11 TAMBON BANG KARD
AMPHOE BANG PHU, PHU SAMUT PRAKANG PROVINCE 10140 THAILAND
TEL: 1600-2116-5000 FAX: 1600-2116-7140

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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7109 MOO 10, KHU BUNTHAKORN 11 TAMBON BANG KARD
AMPHOE BANG PHU, PHU SAMUT PRAKANG PROVINCE 10140 THAILAND
TEL: 1600-2116-5000 FAX: 1600-2116-7140



Page 2 of 2

Certificate No : 24-ACT-068

Request No : Req-2024-1025

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Deviated value	Measured	Deviated value		
94 dB / 1000 Hz	93.91	-0.09	-	-	0.13	0.25
114 dB / 1000 Hz	113.90	-0.10	-	-	0.13	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Deviated value	Measured (Hz)	Deviated value		
94 dB / 1000 Hz	999.91	0.01	-	-	0.01	0.70
114 dB / 1000 Hz	999.91	0.01	-	-	0.01	0.70

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

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)	Deviated value	Measured (%)	Deviated value		
94 dB / 1000 Hz	0.03	-	-	-	0.40	2.5
114 dB / 1000 Hz	0.24	-	-	-	0.40	2.5

Note :

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

*Acceptance limit was IEC 60942:2017 Class 1

*The calibration results exclude the calibration pressure correction

*The calibration results exclude the microphone volume correction

End of Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the
INNOVATIVE INSTRUMENT CO., LTD. Head Office
7109 MOO 10, KHU BUNTHAKORN 11 TAMBON BANG KARD
AMPHOE BANG PHU, PHU SAMUT PRAKANG PROVINCE 10140 THAILAND
TEL: 1600-2116-5000 FAX: 1600-2116-7140

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ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

975 Moo 4, Bangpoo Industrial Estate, Soi 8, Sukhumvit Road km 37,
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Certificate No.: CP20240322EA
Operation No.: CP2024080293

Certificate of Calibration

Equipment: Sound Level Meter

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

Model/Type: LxT1 (Meter), 377B02 (Microphone), PRMLxT1 (Preamplifier)

Serial No.: 0007308 (Meter), 345238 (Microphone), 077643 (Preamplifier)

ID No.: UAE.EFM.040/2566

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

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

Received Date: 9 August 2024

Calibrated Date: 22 - 26 August 2024

Issued Date: 28 August 2024

Calibrated by: Ms. Juntaporn Kunhakorn

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

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F-CAL-004 Ed.1



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240322EA

Calibration Report

Equipment: Sound Level Meter

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

Model/Type: LxT1 (Meter), 377B02 (Microphone), PRMLxT1 (Preamplifier)

Serial No.: 0007308 (Meter), 345238 (Microphone), 077643 (Preamplifier)

ID No.: UAE.EFM.040/2566

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Pressure: (101.3 ± 1.5) kPa

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

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5) Pressure humidity and Temperature Transmitter	PTU301	L3950483	CL1-P240023	24 March 2025
6) Pressure humidity and Temperature Transmitter	PTU301	L3950484	CD20240142EA	12 June 2025
7) Performance Audio Analyzer	U89038	MY56510003	CL1-P240030	11 April 2025
			CD20240143EA	12 June 2025
			CB20240035EB	13 February 2025
			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	Measured value	Deviation	Acceptance limits
Acoustic Signal (dB)	(dB)	(dB)	(dB)
-	-	-	-

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F-CAL-005 Ed.1



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240322EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value
(dB)
29.4

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	29.0
C-weighting	28.9
Z-weighting	35.5

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

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance Limits (dB)
125	0.2	0.1	0.2	±1.0
1000	0.3	0.3	0.3	±0.7
8000	-0.6	-0.5	-0.5	+1.5; -2.5

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

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F-CAL-005 Ed.1



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240322EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Function : 6. Long-Term Stability

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

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

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

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

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F-CAL-005 Ed.1



Certificate No.: CP20240322EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

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

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance Limits (dB)
Fast	200	135.9	-0.1	±0.5
	2	118.8	-0.2	+1.0 ; -1.5
	0.25	109.6	-0.4	+1.0 ; -3.0
Slow	200	129.5	-0.1	±0.5
	2	109.8	-0.2	+1.0 ; -3.0
	0.25	110.0	0.0	+1.0 ; -1.5
LAE	200	130.0	0.0	±0.5
	2	110.0	0.0	+1.0 ; -1.5
	0.25	100.8	-0.2	+1.0 ; -3.0

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance Limits (dB)
Complete cycle	135.4	134.8	-0.6	±2.0
Positive half cycle	134.4	134.0	-0.4	±1.0
Negative half cycle	134.4	134.1	-0.3	±1.0

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Certificate No.: CP20240322EA

Calibration Report

Function : 10. Overload Indication

Measured value (dB)		Deviated value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
143.0	142.8	-0.2	±1.5

Function : 11. High-Level Stability

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

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

Uncertainty of measurement

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

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

-- End of Report --

เอกสารไม่ควบคุม



Certificate No.: CP20240287EA

Operation No.: CP2024070250

Certificate of Calibration

Equipment: Sound Level Meter

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

Model/Type: LxT1 (Meter), 377B02 (Microphone), PRMLxT1 (Preamplifier)

Serial No.: 0007309 (Meter), 345239 (Microphone), 077644 (Preamplifier)

ID No.: UAE.FFM.041/2566

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: 2 - 5 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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Certificate No.: CP20240287EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)
Model/Type: LxT1 (Meter), 377B02 (Microphone), PRMLxT1 (Preamplifier)
Serial No.: 0007309 (Meter), 345239 (Microphone), 077644 (Preamplifier)
ID No.: UAE.FFM.041/2566
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-

IEC 61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5) Pressure humidity and Temperature Transmitter	PTU301	L3950483	CL1-P240023 CD20240142EA	24 March 2025 12 June 2025
6) Pressure humidity and Temperature Transmitter	PTU301	L3950484	CL1-P240030 CD20240143EA	11 April 2025 12 June 2025
7) Performance Audio Analyzer	U89038	MY56510003	CB20240035EB CK20230072EA	13 February 2025 13 September 2024

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

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

- Reference standards instrument for Acoustic function
 - National Institute of Metrology (Thailand)
- Reference standards instrument for Electrical function
 - National Institute of Metrology (Thailand)
 - Electrical and Electronics Institute; NSC Accredited Calibration No.01119

Result of Calibration:

Function : 1. Indication at the calibration check frequency

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

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Certificate No.: CP20240287EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
30.5

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	29.5
C-weighting	29.5
Z-weighting	35.5

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

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

Deviation from various Frequency Weighting Response Curve				
Frequency (Hz)	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.4	0.3	0.4	±1.0
1000	0.1	0.1	0.1	±0.7
8000	-1.6	-1.6	-1.6	+1.5; -2.5

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

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Certificate No.: CP20240287EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Function : 6. Long-Term Stability

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

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

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

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

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Certificate No.: CP20240287EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

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

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	136.0	0.0	±0.5
	2	118.9	-0.1	+1.0; -1.5
	0.25	109.8	-0.2	+1.0; -3.0
Slow	200	129.5	-0.1	±0.5
	2	109.9	-0.1	+1.0; -3.0
	200	130.0	0.0	±0.5
LAE	2	110.1	0.1	+1.0; -1.5
	0.25	101.0	0.0	+1.0; -3.0

Function : 9. Peak C sound level

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

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Certificate No.: CP20240287EA

Calibration Report

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
144.3	144.2	-0.1	±1.5

Function : 11. High-Level Stability

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

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

Uncertainty of measurement

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

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

-- End of Report --

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ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

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



Certificate No.: CP20240289EA
Operation No.: CP2024070252

Certificate of Calibration

Equipment: Sound Level Meter

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

Model/Type: LxT1 (Meter), 377B02 (Microphone), PRMLxT1 (Preamplifier)

Serial No.: 0007310 (Meter), 345240 (Microphone), 077645 (Preamplifier)

ID No.: UAE.EFM.042/2566

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 Kunhakorn

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

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F-CAL-004 Ed.1



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240289EA

Calibration Report

Equipment: Sound Level Meter

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

Model/Type: LxT1 (Meter), 377B02 (Microphone), PRMLxT1 (Preamplifier)

Serial No.: 0007310 (Meter), 345240 (Microphone), 077645 (Preamplifier)

ID No.: UAE.EFM.042/2566

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Pressure: (101.3 ± 1.5) kPa

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

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5) Pressure humidity and Temperature Transmitter	PTU301	L3950483	CL1-P240023	24 March 2025
6) Pressure humidity and Temperature Transmitter	PTU301	L3950484	CD20240142EA	12 June 2025
			CL1-P240030	11 April 2025
			CD20240143EA	12 June 2025
7) Performance Audio Analyzer	U89038	MY56510003	CB20240035EB	13 February 2025
			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	Measured value	Deviation	Acceptance limits
Acoustic Signal (dB)	(dB)	(dB)	(dB)
-	-	-	-

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F-CAL-005 Ed.1



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240289EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value
(dB)
30.3

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value
(dB)	(dB)
A-weighting	30.1
C-weighting	30.0
Z-weighting	35.7

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	0.2	0.3	±1.0
1000	0.2	0.2	0.2	±0.7
8000	-0.2	-0.1	-0.1	+1.5; -2.5

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

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เอกสารไม่ควบคุม

F-CAL-005 Ed.1



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240289EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Function : 6. Long-Term Stability

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

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

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

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

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เอกสารไม่ควบคุม

F-CAL-005 Ed.1



Certificate No.: CP20240289EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

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

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance Limits (dB)
Fast	200	135.9	-0.1	±0.5
	2	118.8	-0.2	+1.0 ; -1.5
	0.25	109.8	-0.2	+1.0 ; -3.0
Slow	200	129.5	-0.1	±0.5
	2	109.9	-0.1	+1.0 ; -3.0
	0.25	130.0	0.0	±0.5
LAE	200	110.0	0.0	+1.0 ; -1.5
	2	110.9	-0.1	+1.0 ; -3.0
	0.25	100.9	-0.1	+1.0 ; -3.0

Function : 9. Peak C sound level

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

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Certificate No.: CP20240289EA

Calibration Report

Function : 10. Overload Indication

Measured value (dB)		Deviated value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
144.3	144.2	-0.1	±1.5

Function : 11. High-Level Stability

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

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

Uncertainty of measurement

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

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

-- End of Report --

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Certificate No.: CP20240288EA

Operation No.: CP2024070251

Certificate of Calibration

Equipment: Sound Level Meter

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

Model/Type: LxT1 (Meter), 377B02 (Microphone), PRMLxT1 (Preamplifier)

Serial No.: 0007312 (Meter), 345818 (Microphone), 077647 (Preamplifier)

ID No.: UAE.EFM.044/2566

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.

เอกสารไม่ควบคุม



Certificate No.: CP20240288EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)
Model/Type: LxT1 (Meter), 377B02 (Microphone), PRMLxT1 (Preamplifier)
Serial No.: 0007312 (Meter), 345818 (Microphone), 077647 (Preamplifier)
ID No.: UAE.EFM.044/2566
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-

IEC 61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5) Pressure humidity and Temperature Transmitter	PTU301	L3950483	CL1-P240023 CD20240142EA	24 March 2025 12 June 2025
6) Pressure humidity and Temperature Transmitter	PTU301	L3950484	CL1-P240030 CD20240143EA	11 April 2025 12 June 2025
7) Performance Audio Analyzer	U89038	MY56510003	CB20240035EB CK20230072EA	13 February 2025 13 September 2024

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

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

- Reference standards instrument for Acoustic function
 - National Institute of Metrology (Thailand)
- Reference standards instrument for Electrical function
 - National Institute of Metrology (Thailand)
 - Electrical and Electronics Institute; NSC Accredited Calibration No.01119

Result of Calibration:

Function : 1. Indication at the calibration check frequency

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

เอกสารไม่ควบคุม



Certificate No.: CP20240288EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
28.5

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	28.4
C-weighting	28.3
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.

Deviation from various Frequency Weighting Response Curve				
Frequency (Hz)	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.2	0.1	0.1	±1.0
1000	0.0	0.0	0.0	±0.7
8000	-0.9	-0.9	-0.8	+1.5; -2.5

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

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Certificate No.: CP20240288EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Function : 6. Long-Term Stability

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

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

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

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

เอกสารไม่ควบคุม



Certificate No.: CP20240288EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.1	0.1	±0.8
39.0	39.3	0.3	±0.8

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	136.0	0.0	±0.5
	2	118.8	-0.2	+1.0; -1.5
	0.25	109.7	-0.3	+1.0; -3.0
Slow	200	129.5	-0.1	±0.5
	2	109.9	-0.1	+1.0; -3.0
	200	130.0	0.0	±0.5
LAE	2	110.0	0.0	+1.0; -1.5
	0.25	100.9	-0.1	+1.0; -3.0

Function : 9. Peak C sound level

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

เอกสารไม่ควบคุม



Certificate No.: CP20240288EA

Calibration Report

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
142.4	142.3	-0.1	±1.5

Function : 11. High-Level Stability

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

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

Uncertainty of measurement

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

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

-- End of Report --

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 24-SLM-039
Address : 81 Soi Udonnok 41, Sukhumvit Road, Bangkok, Phrakong, Bangkok Request No : Req-2024-0278
10160

Unit Under Calibration Details

Measurement Item : Sound Level Meter Microphone Class : 1
Manufacturer : Larson Davis Microphone Model : 377802
Model : LA11 Microphone S/N : 345819
Serial Number : 0007313 Pre-amplifier Model : PRMLA11
ID : UALFPM4352566 Pre-amplifier S/N : 877648
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 February 2024
Calibrated Date : 8 February 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	21 August 2024	GRAS
Multi-frequency Calibration	Quest	Quest-cal	BTAM00234	26 July 2024	TSI
Audio Generator	Swamik	Suar401	121	9 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. Naphan Lungsart
Service Calibration Engineer

Approved By : 

Mr. Pait Mahavorn
Calibration Engineer Supervisor

Issue Date : 8 February 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
ISO 17025:2017 Rev.02 Issue date 11/11/23

Certificate No : 24-SLM-039

Request No : Req-2024-0278

1. Indication at the calibration check frequency

UUC Setting	Nominal Level	Before Adjust		After Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
FAST / A / 37-139 Calibrator Setting 1000 Hz 114 dB		113.78	113.7	-0.08	113.8	0.02	0.20

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

2. Self-generated noise, Microphone installed

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST / 37-139		
UUC Weighting		
A	28.9	0.10

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

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST / 37-139		
UUC Weighting		
A	28.7	0.10
C	28.6	0.10
Z	32.6	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)
	A	C	Z		
FAST / 37-139					
STD Setting	(dB)	(dB)	(dB)		
125 Hz	0.0	0.1	0.1	0.60	1.0
1000 Hz	0.0	0.0	0.0	0.60	0.7
4000 Hz	0.2	0.2	0.2	0.60	1.0
8000 Hz	-0.1	-0.1	0.0	0.70	+1.5 -2.5

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ISO 17025:2017 Rev.02 Issue date 11/11/23

Certificate No : 24-SLM-039

Request No : Req-2024-0278

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A (dB)	C (dB)	Z (dB)		
FAST / 37-139					
STD Setting					
63 Hz	-0.2	-0.1	-0.1	0.20	1.0
125 Hz	-0.1	0.0	-0.1		1.0
250 Hz	-0.1	-0.1	-0.1		1.0
500 Hz	-0.1	0.0	-0.1		1.0
1000 Hz	0.0	0.0	0.0		0.7
2000 Hz	0.0	0.0	0.0		1.0
4000 Hz	0.0	0.0	0.0		1.0
8000 Hz	-0.1	-0.1	0.0	+1.5, -2.5	+1.5, -2.5
16000 Hz	-0.1	-0.1	-0.1		

6. Frequency and time weightings at 1 kHz

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

UUC Setting	STD 37-139 / A	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
UUC Time Response					
Fast	114.00	114.0	0.0	0.20	0.10
Slow	114.00	114.0	0.0		0.10
Log	114.00	114.0	0.0		0.10

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ISO 17025:2017 Rev.02 Issue date 11/11/23

Certificate No : 24-SLM-039

Request No : Req-2024-0278

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting	Anticipated REF	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
FAST / A / 37-139					
STD dB					
120.00	120	120.0	0.0	0.30	0.0
114.00	114	114.0	0.0		0.0
125.00	125	125.0	0.0		0.0
124.00	124	124.0	0.0		0.0
119.00	119	119.0	0.0		0.0
114.00	114	114.0	0.0		0.0
109.00	109	109.0	0.0		0.0
104.00	104	104.0	0.0		0.0
99.00	99	99.9	-0.1		0.0
94.00	94	93.9	-0.1		0.0
89.00	89	89.9	-0.1		0.0
84.00	84	83.9	-0.1		0.0
79.00	79	78.9	-0.1		0.0
74.00	74	73.9	-0.1		0.0
69.00	69	68.9	-0.1		0.0
64.00	64	63.9	-0.1		0.0
59.00	59	58.9	-0.1		0.0
54.00	54	53.9	-0.1		0.0
49.00	49	48.9	-0.1		0.0
44.00	44	44.1	0.1		0.0
39.00	39	39.4	0.4		0.0
34.00	34	34.3	0.3		0.0
29.00	29	29.6	0.6		0.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
ISO 17025:2017 Rev.02 Issue date 11/11/23

Certificate No : 24-SLM-039
Request No : Req-2024-0278

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		REF	UUC		
FAST / A	(dB)	(dB)	(dB)	0.50	0.5
UUC Range	(dB)	(dB)	(dB)		
25-139	42.30	42.5	0.2	0.5	0.5
	134	134.0	0.0		

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
			Ref	UUC		
A / 35-139	Timeburst (ms)	(dB)	(dB)	(dB)	0.20	0.5
Fast	200	135.0	135.0	0.0		
	2	118.0	117.9	-0.1		
	0.25	109.0	108.7	-0.3		
Slow	200	128.6	128.5	-0.1		
	2	109.0	108.9	-0.1		
	0.25	100.0	99.9	-0.1		
SEL	200	129.0	129.0	0.0		
	2	109.0	109.1	+0.1		
	0.25	100.0	99.9	-0.1		

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		REF	UUC		
FAST / C / 95-142	(dB)	(dB)	(dB)	0.20	2.0
STD Setting	(dB)	(dB)	(dB)		
Complete cycle	137.4	136.7	-0.70		
Positive half cycle	136.4	136.1	-0.30		
Negative half cycle	136.4	136.1	-0.30	1.0	1.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuer.
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Certificate No : 24-SLM-039
Request No : Req-2024-0278

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	UUC	0.20	1.5
STD Setting	(dB)		
Positive one-half cycle	144.1		
Negative one-half cycle	143.9		
Deviated	0.2	0.10	1.5
	0.2		

13. High Level Stability

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

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 kHz	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 BS-61072-1:2013

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuer.
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Enviro-Service-Service
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.: E24-060048
Page.: 1 of 6

CERTIFICATE OF CALIBRATION

Customer : United Analyst and Engineering Consultant Co., Ltd.
Address : 81 Soi Udonsook 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Description of Equipment : Console meter
Manufacturer : Apex Instrument
Model Number : XC-872-V
Serial Number : 1701019
ID/Control No. : UAE.EFM 013/2560
Environment Conditions : Temperature (25 \pm 2) °C
Humidity (50 \pm 15) % RH
Cal. Date : 18/06/2024
Issue Date : 18/06/2024

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. Manu Fuchong)

Technical Manager

เอกสารไม่ควบคุม

Enviro-Service-Service
EES

Certificate No. : E24-060048
Page : 2 of 6

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-872-V	Date	18/06/2024	Std Temp	293 K
Console Serial Number	1701019	Time	10:00 AM	Std Press	760 mm Hg
Calibration Reference No.	SK25EX	Calibration Reference No.	SK24-060018	Kc	0.386
DGM Model Number	00002028	Barometric Pressure	755.91 mmHg	Console Leak Check	PASS
DGM Serial Number		Calibration Meter Gamma	1.001		

Calibration Data									
Run Time	Metering Console				Calibration Meter				
	DGM	Volume	Volume	Outlet	Outlet	Volume	Volume	Outlet	Outlet
Elapsed	Office	Initial	Final	Temp	Temp	Initial	Final	Temp	Temp
(Q)	(Pa)	(V _{std})	(V _{std})	(t _{std})	(t _{std})	(V _{std})	(V _{std})	(t _{std})	(t _{std})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
11.82	13.0	2802.112	2802.252	32	32	222.61382	222.17160	29	29
11.85	13.0	2802.252	2802.392	32	32	222.17160	222.30948	29	29
8.42	26.0	2802.399	2802.539	32	32	222.31644	222.45472	29	29
8.43	26.0	2802.539	2802.679	32	32	222.45472	222.59264	29	29
13.80	40.0	2802.686	2802.866	32	32	222.59970	222.87558	28	28
13.78	40.0	2802.866	2803.246	32	32	222.87558	223.15024	27	27
10.52	70.0	2803.261	2803.541	33	33	223.16476	223.43840	27	27
10.33	70.0	2803.541	2803.821	33	33	223.43840	223.71148	27	27
9.00	90.0	2803.835	2804.115	33	33	223.72450	223.99668	27	27
9.00	90.0	2804.115	2804.395	33	33	223.99668	224.26896	27	27

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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-872-V	Date	Time	18/06/2024	10:00 AM	Std Temp	293 K
Console Serial Number	1701019	Calibration Reference No.	SER24-060018			Std Press	760 mm Hg
DGM Model Number	SK25EX	Barometric Pressure	755.91 mmHg			Ki	0.386
DGM Serial Number	00002028	Calibration Meter Gamma	1.001			Console Leak Check	PASS

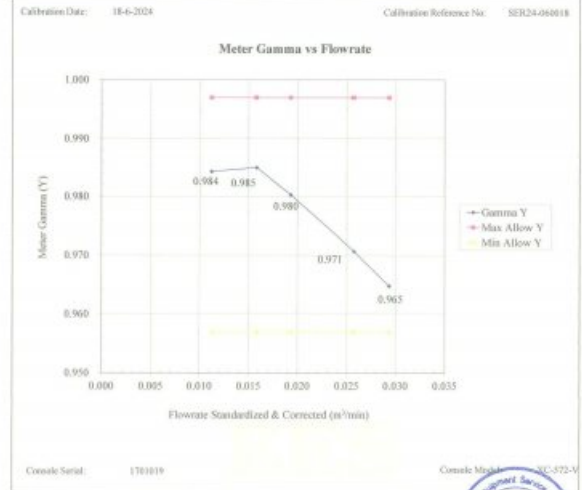
Calibration Data Results									
Standardized Data				Dry Gas Meter					
		Calibration Factor		Flowrate					
Dry Gas Meter	Calibration Meter	Value	Variation	Std & Corr	Flowrate	Std & Corr	Flowrate	Variation	
(V _{meas})	(Q _{std})	(V _{meas})	(Q _{std})	(V)	(ΔV)	(Q _{meas})	(ΔH _g)	(ΔH _g)	
m ³	m ³ /min	m ³	m ³ /min			m ³ /min	mm H ₂ O		
0.135	0.011	0.133	0.011	0.984	0.007	0.011	44.706	-1.370	
0.135	0.011	0.133	0.011	0.985	0.008	0.011	44.893	-1.182	
0.135	0.016	0.134	0.016	0.986	0.009	0.016	45.148	-0.928	
0.135	0.016	0.133	0.016	0.984	0.007	0.016	45.564	-0.512	
0.272	0.020	0.267	0.019	0.982	0.005	0.019	46.883	0.808	
0.273	0.020	0.267	0.019	0.978	0.001	0.019	47.030	0.954	
0.274	0.027	0.266	0.026	0.972	-0.005	0.026	46.723	0.648	
0.274	0.027	0.266	0.026	0.970	-0.007	0.026	47.067	0.991	
0.274	0.030	0.265	0.029	0.965	-0.012	0.029	46.388	0.513	
0.274	0.030	0.265	0.029	0.965	-0.012	0.029	46.354	0.279	
		0.977	Y Average				46.075	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).



เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions				Factors/Conversions	
Console Model Number	XC-872-V	Date	Time	18/06/2024	10:00 AM	Std Temp	293 K
Console Serial Number	1701019	Calibration Reference No.	SER24-060018			Std Press	760 mm Hg
DGM Model Number	SK25EX	Barometric Pressure	755.91 mmHg			Ki	0.386
DGM Serial Number	00002028	Calibration Meter Gamma	1.001			Console Leak Check	PASS



เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions				Factors/Conversions	
Console Model Number	XC-872-V	Date	Time	18/06/2024	10:00 AM	Std Temp	293 K
Console Serial Number	1701019	Calibration Reference No.	SER24-060018			Std Press	760 mm Hg
DGM Model Number	SK25EX	Barometric Pressure	755.91 mmHg			Ki	0.386
DGM Serial Number	00002028	Calibration Meter Gamma	1.001			Console Leak Check	PASS



เอกสารไม่ควบคุม

THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	XC-872-V	Date	Time
Console Serial Number	1701019	18/06/2024	00:20 PM
DGM Model Number	SK25EX	Calibration Reference No.	SER24-060018
DGM Serial Number	00002028	Reference Thermometer	DIGICON
Meter Box Model Number	JENCO 765 KF	Serial Number	183169105
Meter Box Serial Number	JC 19777		

Results										
Console Thermocouple Simulator										
Meter Box Channel Temperature Reading (°C)										
Channel and test point	-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	93.0	149.0	257.0	368.0	477.0	587.0	806.0
Aux	-17.0	25.0	38.0	93.0	149.0					
Probe	-17.0	25.0	38.0	93.0	149.0					
Filter	-17.0	25.0	38.0	93.0	149.0					
Oven	-17.0	25.0	38.0	93.0	149.0					
Exit	-17.0	25.0	38.0							

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



เอกสารไม่ควบคุม

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. : UAEANV 212/2551
Environment Conditions : Temperature (25 ± 2) °C
Humidity (50 ± 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 Puchud)

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			K1	0.386
DGM Serial Number	00003580	Calibration Meter Gamma	1.001			Console Leak Check	PASS

Calibration Data									
Run Time		Metering Console				Calibration Meter			
Elapsed	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
(Q)	(Pa)	(V _{in})	(V _{out})	(t _{in})	(t _{out})	(V _{wt})	(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	1166.277	1166.417	24	24	249.83548	249.97320	25	25
11.87	13.0	1166.417	1166.557	23	23	249.97320	250.11036	25	25
8.47	26.0	1166.565	1166.705	23	23	250.11794	250.25472	25	25
8.43	26.0	1166.705	1166.845	23	23	250.25472	250.39116	25	25
13.70	40.0	1166.856	1167.136	24	24	250.39676	250.67384	25	25
13.63	40.0	1167.136	1167.416	24	24	250.67384	250.94928	25	25
10.27	70.0	1167.428	1167.708	25	25	250.95446	251.23044	25	25
10.23	70.0	1167.708	1167.988	26	26	251.23044	251.50574	25	25
8.98	90.0	1167.988	1168.268	26	26	251.51066	251.78586	24	24
8.95	90.0	1168.268	1168.548	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

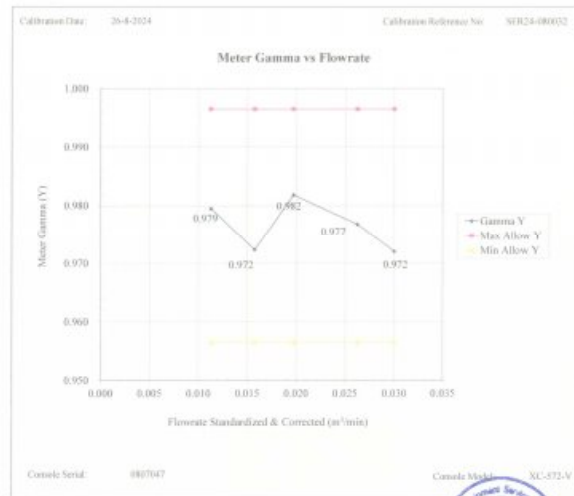
Meter Console Information		Calibration Conditions			Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	26/08/2024	01:10 PM	Std Temp	293 K
Console Serial Number	0807047	Calibration Reference No.	SER24-080032			Std Press	760 mm Hg
DGM Model Number	SK25EX	Barometric Pressure	755.91 mmHg			K1	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 _{out})	(Q _{out})	(V _{wout})	(Q _{wout})	Value	Variation	(Q _{std&corr})	(ΔH _g)	(ΔH _g)	Variation
m ³	m ³ /min	m ³	m ³ /min	(Y)	(ΔY)	m ³ /min	mm H ₂ O	(ΔH _g)	(ΔH _g)
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	46.289	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	0.249	
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	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.

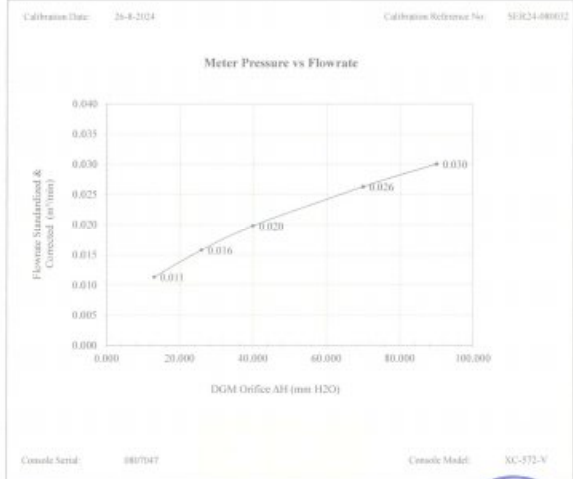
เอกสารไม่ควบคุม

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			K1	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
Console Serial Number	0807047	Calibration Reference No.	SER24-080032		
DGM Model Number	SK25EX	Barometric Pressure	755.91 mmHg		
DGM Serial Number	00003580	Calibration Meter Gamma	1.001		
		Std Temp	293	K	
		Std Press	760	mm Hg	
		Kc	0.386		
		Console Leak Check	PASS		



THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	XC-572-V	Date	Time
Console Serial Number	0807047	26/08/2024	03:10 PM
DGM Model Number	SK25EX	Calibration Reference No.	SER24-080032
DGM Serial Number	00003080	Reference Thermometer	DIGICON
Meter Box Model Number	JENCO 765 KF	Serial Number	183169105
Meter Box Serial Number	JC 19778		

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	-17.0 25.0 38.0 92.0 147.0 256.0 368.0 485.0 590.0 814.0 1036.0
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
Probe	+ 3.0 °C
Filter	+ 3.0 °C
Meter	+ 3.0 °C
Exit	+ 2.0 °C



Instrument description	1	Flux Gas Analyzer
Instrument model	1	Testo 350 New
Instrument serial no.	1	60723967/609
Control unit serial no.	1	03064673/609
ID no. or control no.	1	UAE.EPM.0277/2359
Manufacturer	2	Testo SE & Co. KGAA
Probe description	1	-
Probe model	1	-
Probe serial no.	1	-
Customer name	1	UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Customer address	1	81 SOI UDOMSUKH1, SUKHUMVIT ROAD, BANGCHAK PRAKONGH BANGKOK 10260

Total pages of certificate	1	2 Pages
Receiving no.	1	1-243478
Receiving date	1	06-Sep-24
Parameter of calibration	1	Gas Calibration (Oxygen 2.50, 10.04, 21.02 % vol, Carbon Monoxide 80.18, 302, 1007 ppm, Nitrogen Dioxide 30.66, 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	1	Used
Ambient condition	1	All of the Measurement were carried out the stabilized laboratory
	1	Temperature : 23 ± 0.5 °C
	1	Humidity : 55 ± 15 %RH
Calibration place	1	17/121 Soi Ngernwongwan 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. WS-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 are not valid and the results relate only to the items listed/calibrated. The calibration certificate documents are traceable to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 13-Sep-24

Mr. Ewanee Khondoung
Calibration Technician

Mrs. Nongluck Wongattien
Technical Manager

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	Norit	18-Nov-26
Oxygen (O2) 21.02 % Vol	CG-0041-22	Norit	10-Feb-27
Carbon monoxide (CO) 80.18 ppm	CG-0002-24	Norit	11-Jan-29
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1007 ppm	1870/24	Linde	17-Jul-26
Nitrogen Dioxide (NO2) 30.66 ppm	2632/24	Linde	06-Sep-26
Nitrogen Dioxide (NO2) 81.32 ppm	3546/23	Linde	14-Jan-26
Nitrogen Dioxide (NO2) 201.9 ppm	1976/23	Linde	17-Jul-25
Nitric Oxide (NO) 30.01 ppm	CG-0014-23	Norit	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	1907/22	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)	30.66	32.9	2.56	8.0
NO2 (ppm)	81.32	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

Instrument description : Flux Gas Analyzer
Instrument model : Testo 350 New
Instrument serial no. : 60723907/609
Control unit serial no. : 03064673/609
ID no. or control no. : UAE.EFM.027/2359
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 UDOMSUKH1,SUKHUMVIT ROAD,BANGCHAK PRAKARNONG BANGKOK 10260

Total pages of certificate : 2 Pages
Receiving no. : L-243478
Receiving date : 06-Sep-24
Parameter of calibration : Gas Calibration(Degren 2.50,18.04,21.02 %vol, Carbon Monoxide 80.16,302,1007 ppm, Nitrogen Dioxide 30.68,81.32,261.9 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 was carried out the stabilized laboratory
Temperature : 23 ± 0.5 °C
Humidity : 55 ± 15 %RH
Calibration place : 17/121 Soi Ngernwongwan 47 Yaek 48, Tsongasonghong, Laksi, Bangkok 10210
Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WS-CL-38-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

Kumsehrip
Mr. Kwanchai Khondoung
Calibration Technician

Wittan
Mrs. Nongluck Wongsettee
Technical Manager

FM-CL-09-C Rev.8

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Issued Date:24/02/25

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Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.56 % Vol	3412/23	Linde	27-Aug-27
Oxygen (O ₂) 10.04 % Vol	CG-0153-21	Nant	18-Nov-26
Oxygen (O ₂) 21.02 % Vol	CG-0041-22	Nant	10-Feb-27
Carbon monoxide (CO) 80.18 ppm	CG-0002-24	Nant	11-Jan-29
Carbon monoxide (CO) 302 ppm	1913/23	Linde	16-Jun-25
Carbon monoxide (CO) 1007 ppm	1870/24	Linde	17-Jun-26
Nitrogen Dioxide (NO ₂) 30.68 ppm	2632/24	Linde	06-Sep-26
Nitrogen Dioxide (NO ₂) 81.32 ppm	3546/23	Linde	14-Jan-26
Nitrogen Dioxide (NO ₂) 261.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide (NO) 30.01 ppm	CG-0014-23	Nant	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 (SO ₂) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO ₂) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO ₂) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 22.9 °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 (1σ)
O ₂ (%Vol)	2.50	2.47	-0.03	0.15
O ₂ (%Vol)	10.04	10.11	0.07	0.20
O ₂ (%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
NO ₂ (ppm)	30.68	32.9	2.26	8.0
NO ₂ (ppm)	81.32	80.2	-1.12	8.0
NO ₂ (ppm)	261.9	204.2	-57.7	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
SO ₂ (ppm)	50.36	51	0.64	6.0
SO ₂ (ppm)	100.8	100	-0.8	6.0
SO ₂ (ppm)	600.8	596	-4.8	13

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

End of Report

FM-CL-09-C Rev.8

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Issued Date:25/02/25

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



Cert.No.: 24CH320
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA1L0035
ID No. : UAE.EFM.011/2505(EFM.pH.01/05)
Condition As-Received: Used Item
Received Date : 12 March 2024
Calibration Date : 14 March 2024
Reference : 2403-0386WVC-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-CH6 by comparison with temperature standard

Calibrated by : Warakorn Lernagatrakul

Approved by : *Saithip*
Approved Signatory

() Pornthippa Tameyakul
() Unnopphol Harachai
(✓) Saithip Meangmai

Issue Date : 15 March 2024

The uncertainties are for a confidence probability of approximately 95%

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A 0064530



Cert.No.: 24CH320
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 the International System of Unit maintained through:-
- Technology Promotion Association (Thailand-Japan)

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANS-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	940102	27 Nov 2025
pH 6.986	CPA chem	940104	02 Nov 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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
			mV	pH		
pH Meter S/N.: HA1L0035	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.1	7.01	0.058	2.00
	7.00	0.00	0.1	7.01	0.058	2.00
	10.00	-177.48	-177.4	10.01	0.058	2.00

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a 1206343



Cert.No.: 24CH320
Page.: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

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	170.9	0.0071	2.00
	6.986	7.00	-4.0	0.0099	2.00
	6.986	7.01	-4.2	0.0099	2.00
	9.997	10.01	-178.3	0.0092	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 ($^{\circ}\text{C}$)	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	25.003	25.0	-0.003	0.13	2.00
30.0	30.003	30.0	-0.003	0.13	2.00
35.0	35.004	35.0	-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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๑ 1206344



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL: 0-2717-3886-29 FAX: 0-2719-9484



Cert.No.: 24CH326
Page.: 1 of 3

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : YSI
Model : Pro 30
Serial No. : 22F103994
ID No. : UAE EFM.066/2566 (EFM SCT.02/66)
Condition As-Received: Used Item
Received Date : 12 March 2024
Calibration Date : 14 March 2024
Reference : 2403-0387WSC-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-CH6 by direct measurement with certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by : Walaiak Sirinthean

Approved by :

() Pornthippa Tameyakul
() Unnopphol Harachai
(✓) Sathip Meangmai

Sathip
Approved Signatory

Issue Date : 15 March 2024

The Uncertainties are for a confidence probability of approximately 95%

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๑ 0064535



Cert.No.: 24CH326
Page.: 2 of 3

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	9549224	130RC003	231435	10 Apr 2024
2) Ref. Std. Thermometer	4982054	110RC044	231908	26 July 2024

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

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 $\mu\text{S/cm}$	CPA Chem	940111	02 Nov 2024
12 880 mS/cm	CPA Chem	913597	14 July 2024

- Control Conductivity calibration solution temperature by Water bath (25 \pm 0.1) $^{\circ}\text{C}$

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1413.0 $\mu\text{S/cm}$

Conductivity Electrode Serial No.: 23A100616

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
1413.0 $\mu\text{S/cm}$	1370 $\mu\text{S/cm}$	1413 $\mu\text{S/cm}$	9.2 $\mu\text{S/cm}$	2.00
12 880 mS/cm	12.37 mS/cm	12.87 mS/cm	0.086 mS/cm	2.00

Remark : - UUC* = Unit Under Calibration

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๑ 1207034



Cert.No.: 24CH326
Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

This equipment was connected with Temperature Probe;

- Model : Pro 30 COND-T
- Serial No. : 23A100616

Dimension of probe:

- Length : 94 mm
- Diameter : 2.5 mm
- Immersion Depth : 90 mm

Calibration Result : Without adjustment

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	24.999	25.0	0.001	0.13	2.00
30.0	30.000	30.0	0.000	0.13	2.00
35.0	35.000	35.0	0.000	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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๑ 1207035

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

459-459/1 Sirinthorn Road, Bangbunmu, Bangkok, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24047
Job No. : VC67AC0034
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAJ	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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Cert. No. : ACL24047
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Pages : 3 of 8

Summary of Measurement Result :

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

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Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
18.0

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

Frequency Weighting	Measured value (dB)
A - weight	14.8
C - weight	20.6
Flat	26.4

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	0.3	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.2	0.2	0.2	± 5.0

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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Cert. No. : ACL24047
Job No. : VC67AC0034
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	43.9	-0.1	±1.1
39.0	38.9	-0.1	±1.1
34.0	34.0	0.0	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.8	-0.2	±1.1

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Cert. No. : ACL24047
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Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

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CALIBRATION LABORATORY

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Cert. No. : ACL24047
Job No. : VC67AC0034
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

เอกสารไม่ควบคุม

INNOVATIVE INSTRUMENT CALIBRATION LAB

INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
719 MOO 11, SOI BUNTPAKKORN 11 TAMBON BANG KAO,
AMPHOE BANG PHI SAMUT PRAKAN PROVINCE 10640 THAILAND
TEL: 080-2116-5600-1 FAX: 0666-2116-7140



Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Name : 81 Soi Udomrak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Address : 10260
Certificate No : 24-TPM-168
Request No : Req-2024-1602
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : IM
Model : QT-32
Serial Number : TP0601002
Resolution : 0.1 °C
ID Number : UAE-FPM-005/2559
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 : 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: GUNGO-GUNGO, Model: GT11, RTD100, SN: 000000017, ID: 02-TPM4
Which was calibrated on 1 March 2024, Calibration Certificate No. : QR24-0478

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

Note

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

Approved By :
Mr. Noppadon Luangrat
Technical Manager
Issue Date : 19 August 2024

เอกสารไม่ควบคุม



Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 24-TPM-349

Request No : Req-2024-1402

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
WET	20.011	20.0	0.0	0.13
	25.011	25.1	+0.1	0.13
	30.011	30.0	0.0	0.13
	35.017	35.1	+0.1	0.13
	40.017	40.0	0.0	0.13
	45.016	45.1	+0.1	0.13
	50.040	50.1	+0.1	0.13
	60.045	60.1	+0.1	0.13
DRY	20.012	20.0	0.0	0.13
	25.010	25.1	+0.1	0.13
	30.011	30.0	0.0	0.13
	35.015	35.2	+0.2	0.13
	40.017	40.0	0.0	0.13
	45.016	45.1	+0.1	0.13
	50.040	50.1	+0.1	0.13
	60.045	60.1	+0.1	0.13
GL GLOBE	20.012	20.0	0.0	0.13
	25.010	25.0	0.0	0.13
	30.014	30.0	0.0	0.13
	35.015	35.2	+0.2	0.13
	40.016	40.0	0.0	0.13
	45.016	45.2	+0.2	0.13
	50.040	50.1	+0.1	0.13
	60.045	60.1	+0.1	0.13

End of Certificate

Calibrated By :

Mr. Sirichok Jongsakulnont

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

PM-709-TPM-01 Rev.01 Issue date 13/02/20

เอกสารไม่ควบคุม



Certificate of Calibration

Certificate No : 24-TPM-349

Request No : Req-2024-1421

Page : 1/2

Customer

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

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : 3M
Model : QT-32
Serial Number : TPQ03023
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: 0000057, ID: 82-TPM Which was calibrated on 1 March 2024, Calibration Certificate No : QR24-0478

Traceability

This Certificate is traceable to SI Unit through Quality Ruben Co., Ltd., NSC-ONSIC 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. Nopphon Luangrat

Technical Manager

6 August 2024

Issue Date :

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

เอกสารไม่ควบคุม

PM-709-TPM-01 Rev.01 Issue date 13/02/20



Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 24-TPM-348

Request No : Req-2024-1421

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
WET	20.016	20.0	-0.1	0.13
	25.013	24.9	-0.1	0.13
	30.014	29.9	-0.1	0.13
	35.017	34.9	-0.1	0.13
	40.016	39.9	-0.1	0.13
	45.016	44.9	-0.1	0.13
	50.042	49.9	-0.1	0.13
	60.047	59.9	-0.1	0.13
DRY	20.012	19.9	-0.1	0.13
	25.014	24.9	-0.1	0.13
	30.017	29.9	-0.1	0.13
	35.016	34.9	-0.1	0.13
	40.017	39.9	-0.1	0.13
	45.041	44.9	-0.1	0.13
	50.045	49.9	-0.1	0.13
	60.046	59.9	-0.1	0.13
GL GLOBE	20.011	20.0	-0.1	0.13
	25.011	24.9	-0.1	0.13
	30.014	29.9	-0.1	0.13
	35.017	34.9	-0.1	0.13
	40.019	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 Jongsakulnont

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

เอกสารไม่ควบคุม

PM-709-TPM-01 Rev.01 Issue date 13/02/20



Certificate of Calibration

Certificate No : 24-TPM-348

Request No : Req-2024-0540

Page : 1/2

Customer

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

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-32
Serial Number : TPQ03024
Resolution : 0.1 °C
ID Number : UAE.EFM.007.2559
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 : 5 March 2024
Calibrated Date : 21 March 2024
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard

Digital Thermometer with Sensor, Manufacturer: GINGO GINGO, Model: GT11-RTD100, SN: 0200077, ID: AR-TPM Which was calibrated on 27 October 2023, Calibration Certificate No : QR23-2574

Traceability

This Certificate is traceable to SI Unit through Quality Ruben Co., Ltd., NSC-ONSIC 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. Nopphon Luangrat

Technical Manager

21 March 2024

Issue Date :

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

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PM-709-TPM-01 Rev.01 Issue date 13/02/20



Calibration Note

USC Adjustment : ☒ Non Adjust

Certificate No : 24-TPM-148

Request No : Req-2024-0540

Page : 2/2

Result of Calibration :

USC Sensor	Standard Temperature (°C)	USC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.003	20.0	0.0	0.13
	25.003	25.0	0.0	0.13
	30.003	30.0	0.0	0.13
	35.006	35.0	0.0	0.13
	40.009	40.0	0.0	0.13
	45.041	45.0	0.0	0.13
	50.044	50.0	0.0	0.13
	60.047	60.0	0.0	0.13
DRY	20.002	19.9	-0.1	0.13
	25.003	24.9	-0.1	0.13
	30.004	29.9	-0.1	0.13
	35.006	35.0	0.0	0.13
	40.009	40.0	0.0	0.13
	45.008	45.0	0.0	0.13
	50.043	50.0	0.0	0.13
	60.047	60.0	0.0	0.13
GL-OBE	20.001	19.9	-0.1	0.13
	25.003	24.9	-0.1	0.13
	30.004	29.9	-0.1	0.13
	35.007	35.0	0.0	0.13
	40.008	40.0	0.0	0.13
	45.041	45.0	0.0	0.13
	50.044	50.0	0.0	0.13
	60.046	60.0	0.0	0.13

End of Certificate

Calibrated By :

Mr. Sirinuch Ingpholadornat

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

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Certificate of Calibration

Certificate No : 24-TPM-152

Request No : Req-2024-0542

Page : 1/2

Customer

Name : UNITED ANALYST AND ENGINEERING

CONSULTANT CO.,LTD.

Address : 81 Soi Udomrak 41, Sukhumvit Road, Bangkok,

Prakong, Bangkok 10260

Unit Under Calibration Details

Calibration Parameter : Temperature

Instrument Name : Thermal Environment Monitor

Manufacturer : TSI QUEST

Model : QT-32

Serial Number : TPQK0023

Resolution : 0.1 °C

ID Number : UAE-IFM-006-2559

Range Calibration : 20 °C to 60 °C

Type of Sensor : RTD

Sensor Diameter (mm) : 6.5

Calibration Position (mm) : 67.5

Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 15 %RH

Received Date : 5 March 2024

Calibrated Date : 21 March 2024

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

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO GINGO, Model: GT11-RTD100, SN:

12866877, ID: AR-TPM Which was calibrated on 27 October 2023, Calibration Certificate No.: QR23-

2574

Traceability : This Certificate is traceable to SI Unit through Quality Roben 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. Neppadon Luangrat

Technical Manager

Issue Date :

21 March 2024

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

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Calibration Note

USC Adjustment : ☒ Non Adjust

Certificate No : 24-TPM-152

Request No : Req-2024-0542

Page : 2/2

Result of Calibration :

USC Sensor	Standard Temperature (°C)	USC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.009	20.1	-0.1	0.13
	25.003	25.1	-0.1	0.13
	30.002	30.1	-0.1	0.13
	35.006	35.1	-0.1	0.13
	40.008	40.2	-0.2	0.13
	45.041	45.2	-0.2	0.13
	50.044	50.2	-0.2	0.13
	60.047	60.2	-0.2	0.13
DRY	20.001	20.0	0.0	0.13
	25.003	25.0	0.0	0.13
	30.004	30.0	0.0	0.13
	35.006	35.0	0.0	0.13
	40.009	40.1	-0.1	0.13
	45.008	45.1	-0.1	0.13
	50.043	50.1	-0.1	0.13
	60.047	60.1	-0.1	0.13
GL-OBE	20.002	20.1	-0.1	0.13
	25.003	25.1	-0.1	0.13
	30.004	30.1	-0.1	0.13
	35.007	35.1	-0.1	0.13
	40.008	40.1	-0.1	0.13
	45.041	45.2	-0.2	0.13
	50.044	50.2	-0.2	0.13
	60.046	60.2	-0.2	0.13

End of Certificate

Calibrated By :

Mr. Sirinuch Ingpholadornat

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

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Certificate of Calibration

Certificate No : 24-AFM-101

Request No : Req-2024-1062

Customer

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

Address : 81 Soi Udomrak 41, Sukhumvit Road, Bangkok, Prakanong,

Bangkok 10260

Unit Under Calibration Details

Measurement Item : Air Flow Meter

Manufacturer : TSI

Model : 4146

Serial Number : 41462517053

ID : UAE-IFM-099-2566

Score Model : -

Score Serial Number : -

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 13 May 2024

Calibration Date : 24 May 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	Sensodyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	18031011003	Sensodyne	12 July 2024
Temperature meter	GT 11	08000057	Qcchem	1 March 2023
Pressure meter	CPG2400	41000KDU-651862	TPA	9 November 2024

Traceability : This Certificate is traceable to SI Unit through Sensodyne A2LA Accreditation No. 3943.01

Note

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

Calibration By :

Mr. Neppadon Luangrat

Service Calibration Engineer

Approved By :

Mr. Puat Mathavorn

Calibration Engineer Supervisor

Issue Date :

24 May 2024

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

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ISO-TPM-AFM-01 Rev 00 Issue date 01/07/19

Certificate No : 24-AFM-101
Request No : Req-2024-082

Result of Calibration :

Temperature (°C)	Pressure (kPa)	STD (kPa)	UUC (kPa)	Error (kPa)	Uncertainty (kPa)
23.00	100.65	0.020	0.020	0.000	0.0013
23.10	100.69	0.050	0.050	0.000	0.0033
23.00	100.68	0.100	0.100	0.000	0.0028
23.10	100.65	0.201	0.200	-0.001	0.0056
23.00	100.64	0.502	0.500	-0.002	0.0073
23.10	100.62	1.008	1.021	0.013	0.0118
23.10	100.60	1.681	1.700	0.019	0.024
23.10	100.69	1.989	2.014	0.025	0.029
23.00	100.72	2.948	3.000	0.052	0.042
24.10	100.66	3.930	4.000	0.070	0.056
24.10	100.99	4.917	5.000	0.083	0.070

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

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

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

* Indicates non accredited

End of Certificate

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Certificate of Calibration

Certificate No. : 24P1370
Page : 1 of 2

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

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

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

Ambient Temperature: (23 ± 2) °C

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

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1007 mbar

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

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DPI142	1422505046	MP-0094-23	03 May 2024
2.This instrument was installed in vertical orientation and center of the dial was used as the reference level.				
3.This result of calibration was made on requested at the point specified by customer.				
4.Scale and conversion factor is 1 kPa = 7.50062 mmHg				
5.This result of calibration instrument was in absolute pressure.				
6.This instrument was used clean air as pressure media.				
7.The certificate is valid only to the item calibrated on date and place of calibration.				
8.This Certification is traceable to the International System of Unit maintained through:-				
-National Institute of Metrology Thailand (NIMT)				

Calibrated by : Suksan Khankaw
Issue Date : 23 April 2024

Approved Signatory :
[] Phalinee Prabpaijal
[] Sura Suwanan
[✓] Attapol Panurach

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

Result of calibration: Without adjustment
Function: Absolute Pressure Measurement

Range: 720 mmHg to 770 mmHg
Scale Interval: 1 mmHg (The Fifth Estimate)

Increasing Pressure

Applied Pressure (mmHg)	715.75	726.88	738.53	749.84	761.99	774.19
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0
Error (mmHg)	4.25	3.12	1.47	0.16	-1.99	-4.19

Decreasing Pressure

Applied Pressure (mmHg)	774.19	761.85	749.40	738.00	726.53	715.75
UUC* Indication (mmHg)	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-4.19	-1.85	0.60	2.00	3.47	4.25

The uncertainty of measurement was ± 0.24 mmHg

* UUC = Unit Under Calibration

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

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Certificate of Calibration

Certificate No. : 24P1370
Page : 1 of 2

Equipment : Digital Thermo-Hygrometer
Manufacturer: Digicon
Model : TH-02
Serial No. : 385034173
ID No. : UAE.EPA.162/2595

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 As-Received: Used Item
Received Date: 05 April 2024
Calibration Date: 10 April 2024
to 11 April 2024

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

Ambient Temperature: (26 ± 3) °C

Relative Humidity: (50 ± 20) %

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

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

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Chilled Mirror Hygrometer	Dew Master	44730	21656	02 Aug 2024
2) Handheld Thermometer With Sensor	1521	ASA339	231238	16 Oct 2024

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

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

-Thunder Scientific Corporation, NVLAB Accreditation No. Calibration 200942-0
-Technology Promotion Association (Thailand-Japan), NSG-ONSAC Accredited No. Calibration 0008

Calibrated by : Viporn Tantayawatt
Issue Date : 17 April 2024

Approved Signatory :
[✓] Chakrit Watanawarun
[] Viporn Tantayawatt
[] Unnaphong Hanchai

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Cert. No.: 24H716
Page: 2 of 2

Result of Calibration: Without Adjustment
Function: Humidity Measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	41	0.9	1.3
25.0	50.1	50	-0.1	1.6
25.0	60.0	58	-2.0	1.6
25.0	70.2	66	-4.2	1.6

Result of Calibration: Without Adjustment
Function: Temperature Measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.996	20.3	0.302	0.42
25.031	25.6	0.569	0.42
30.045	30.2	0.155	0.42
40.023	39.8	-0.123	0.42

UUC*: Unit Under Calibration

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

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a 1210371

Certificate of Calibration

Customer: UNITED ANALYST AND ENGINEERING
Name: CONSULTANT CO.LTD.
Address: 81 Soi 13somak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260

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

Unit Under Calibration Details
Measurement Item: Acoustic Calibrator Class: 2
Manufacturer: LARSON DAVIS Range: 94, 114 dB / 1000 Hz
Model: CAL150 Instrument Status: Used
Serial Number: 6171
ID: UAE.EFM.117/2502

Calibration Environment and Details

Temperature: (23 ±2 °C)
Humidity: (50 ±20 %RH)
Barometric Pressure: (1013 ±10.0 hPa)
Received Date: 20 June 2024
Calibration Date: 25 June 2024

Location of Calibration: LAB 1 Acoustic

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

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

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

Note

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

Calibrated By: Mr. Noppadon Luangart
Service Calibration Engineer

Approved By: Mr. Paet Mathavorn
Calibration Engineer Supervisor

Issue Date: 25 June 2024

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

PM-100-ACT-02 Rev 03 Issue date 3/6/24

Certificate No.: 24-ACT-086

Request No.: Req-2024-1364

Sound pressure level

Calibration Results: Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 2 (± dB)	Result
	Measured	Deviated value	Measured	Deviated value			
94 dB / 1000 Hz	95.99	-0.01	-	-	0.13	0.40	Pass
114 dB / 1000 Hz	114.02	0.02	-	-	0.14	0.40	Pass

Frequency of Sound pressure level

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

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

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

Note:

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

- Acceptance limit was IEC 60942:2017 Class 1

- The calibration results exclude the calibration process correction

- The calibration results exclude the microphone volume correction

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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 body.
PM-100-ACT-02 Rev 03 Issue date 3/6/24

Certificate No.: 24-ACT-086

Request No.: Req-2024-1364

Decision Rule for Statements of Conformity

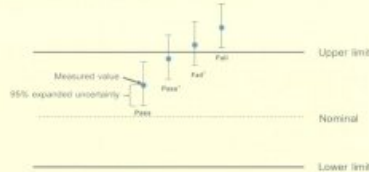
The standard decision rule employed for the statements of conformity to each calibration result will be applied using IEC 60942:2017. Guidelines on the Reporting of Compliance with Specification as following Fig. and statements:

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

Pass² - The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

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

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



End of Calibration

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

เอกสารไม่ควบคุม

PM-100-ACT-02 Rev 03 Issue date 3/6/24

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 : 24-NDM-016
Request No : Req-2023-2681

Unit Under Calibration Details

Measurement Item : Noise Dominator
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 91926
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV27
Microphone S/N : 94392
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 : 21 December 2023
Calibrated Date : 25 January 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
Multi-frequency Calibrator	Quest	Questral	EF A060234	25 July 2024	TISI
Standard Microphone	GRAS	40AN	180273	21 August 2024	GRAS
Signal Generator	Sigsbee	Sigsbee	121	9 October 2024	WK Electric
Timer	EXTech	-	65-AC7	21 March 2024	TPA

Note

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

Calibrated By : 
Mr. Naphon Luanpan
Service Calibration Engineer

Approved By : 
Mr. Pachi Mahaveon
Calibration Engineer Supervisor
Issue Date : 25 January 2024

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

เอกสารไม่ควบคุม

Certificate No : 24-NDM-016
Request No : Req-2023-2681

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref (Pa ² /s)	UUC (Pa ² /s)	Error (%)		
FAST / A / 55-140 Calibrator Setting	60	60	(Pa ² /s)	(Pa ² /s)	(%)	3.1	-21, +26
1000 Hz 114 dB	120	120	3.18	3.13	-1.6	3.1	-21, +26

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY (± dB)	Tolerances Limit (± dB)
	A	C		
FAST / 55-140 STD Setting	(dB)	(dB)	(± dB)	(± dB)
90 Hz	0.0	0.0	0.40	2.0
125 Hz	-0.1	0.0	0.40	1.5
250 Hz	-0.3	-0.2	0.40	1.5
500 Hz	-0.1	0.0	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.5	0.5	0.40	2.0
4000 Hz	2.4	2.4	0.40	3.0
8000 Hz	-2.9	-2.9	0.40	5.0

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เอกสารไม่ควบคุม

Certificate No : 24-NDM-016
Request No : Req-2023-2681

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)	80.0	80.0	80.0	100.0	110.0	114.0	120.0	130.0	140.0
1000 Hz	Level A (dB)	54.9	80.2	80.1	100.0	110.0	114.0	120.0	130.0	140.0
Error (dB)	-0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8000 Hz	Ref (dB)	88.9	88.9	108.9	112.9	118.9	128.9	138.9	148.9	158.9
Level A (dB)	89.0	88.9	108.9	112.9	118.9	128.9	138.9	148.9	158.9	168.9
Error (dB)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
63 Hz	Ref (dB)	87.8	87.8	107.8	111.8	117.8	127.8	137.8	147.8	157.8
Level A (dB)	87.8	87.8	107.8	111.8	117.8	127.8	137.8	147.8	157.8	167.8
Error (dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tolerances Limit (dB)	1.0									
UNCERTAINTY (dB)	0.3									

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref (Pa ² /s)	UUC (Pa ² /s)	Error (%)		
FAST / A / 55-140 Calibrator Setting	60	60	(Pa ² /s)	(Pa ² /s)	(%)		
1000 Hz 110 dB	27	27	0.30	0.30	0.00		
1000 Hz 115 dB	45	45	0.50	0.51	+2.00		
1000 Hz 119 dB	80	80	1.00	1.01	+1.00	5.6	-21, +26
1000 Hz 119 dB	180	180	2.00	2.02	+1.00		
1000 Hz 120 dB	36	36	4.00	3.94	-1.50		
1000 Hz 120 dB	72	72	8.00	8.05	+0.63		
1000 Hz 120 dB	90	90	10.00	9.90	-1.00		
1000 Hz 120 dB	180	180	20.00	19.76	-1.20	5.6	-21, +26
1000 Hz 120 dB	360	360	40.00	39.42	-1.45		
1000 Hz 120 dB	720	720	80.00	80.49	+0.61		

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

เอกสารไม่ควบคุม

Certificate No : 24-NDM-016
Request No : Req-2023-2681

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref (Pa ² /s)	UUC (Pa ² /s)	Error (%)		
FAST / A / 55-140 Calibrator Setting	60	60	(Pa ² /s)	(Pa ² /s)	(%)	0.052	-1.29 - +0.41
4000 Hz 95 dB	2846	2846	1.00	0.98	-0.02	0.052	-1.29 - +0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref (Pa ² /s)	UUC (Pa ² /s)	Error (%)		
FAST / A / 55-140 Calibrator Setting	60	60	(Pa ² /s)	(Pa ² /s)	(%)		
Burst 1 ms, 95 dB	2846	2846	1.00	0.98	-2.00		-21 - +26
Burst 1 ms, 100 dB	900	900	1.00	0.98	-2.00	5.6	-29 - +41
Burst 1 ms, 108 dB	143	143	1.00	0.99	-1.00		-29 - +41

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement		UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref (Pa ² /s)	Different (%)		
FAST / A / 55-140 Calibrator Setting	60	60	(Pa ² /s)	(%)		
Continuous Rectangle +		29	10.13			
Continuous Rectangle -			10.37	-2.27	3.7	-21 - +26

* Indicates non accredited

End of Certificate

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

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

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

Certificate No : 24-NDM-014
Request No : Req-2023-2679

Unit Under Calibration Details

Measurement item : Noise Distmeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 9928
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV27
Microphone S/N : 9681
Pre-amplifier Model : -
Pre-amplifier S/N : -
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50-54RH ± 20 %RH
Barometric Pressure : 1013 kPa ± 10 kPa
Received Date : 21 December 2023
Calibrated Date : 24 January 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
Mid-frequency Calibrator	Quest	Questral	EF699234	25 July 2024	TIS
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Size Generator	Svante	Sva401	131	9 October 2024	WK Electric
Timer	EXTECH	-	05-ACT	21 March 2024	TPA

Note

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

Calibrated By : 
Mr. Nopphon Luang
Service Calibration Engineer

Approved By : 
Mr. Pich Mahavorn
Calibration Engineer Supervisor
Issue Date : 24 January 2024

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

เอกสารไม่ควบคุม

Certificate No : 24-NDM-014
Request No : Req-2023-2679

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit
	Ref	UUC	Ref (Pa ² /s)	UUC (Pa ² /s)	Error		
FAST / A / 55-140 Calibrator Setting	00	00					
1000 Hz 114 dB	120	120	3.18	3.20	+0.6	3.1	-21, +26

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY (± dB)	Tolerances Limit (± dB)
	A	C		
FAST / 55-140 STD Setting	(dB)	(dB)	(± dB)	(± dB)
943 Hz	-0.1	-0.2	0.40	2.0
125 Hz	0.4	0.5	0.40	1.5
250 Hz	0.1	0.1	0.40	1.5
500 Hz	0.1	0.1	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.1	0.0	0.40	2.0
4000 Hz	2.5	2.5	0.40	3.0
8000 Hz	-3.0	-3.0	0.40	5.0

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เอกสารไม่ควบคุม

Certificate No : 24-NDM-014
Request No : Req-2023-2679

3. Linearity of response to steady signals

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

UUC Setting	FAST / A / High									
	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	124.0	120.0	140.0
1000 Hz	Level A	(dB)	55.4	80.1	90.1	100.0	110.0	114.0	120.0	140.0
	Error	(dB)	0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Ref	(dB)	88.9	89.9	108.9	112.9	118.9	120.9	130.9	139.9
8000 Hz	Level A	(dB)	89.0	99.0	108.9	112.9	118.9	120.9	129.9	139.8
	Error	(dB)	0.1	0.1	0.0	0.0	0.0	0.0	0.0	-0.1
	Ref	(dB)	87.6	99.9	109.9	113.9	118.9	120.9	130.9	135.9
63 Hz	Level A	(dB)	87.6	99.9	109.9	113.9	118.9	120.9	130.9	135.9
	Error	(dB)	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
	Ref	(dB)	87.6	99.9	109.9	113.9	118.9	120.9	130.9	135.9
Tolerances Limit		(dB)	1.0							
UNCERTAINTY		(dB)	0.3							

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref (Pa ² /s)	UUC (Pa ² /s)	Error (%)		
FAST / A / 55-140 Calibrator Setting	00	00					
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 119 dB	45	45	0.50	0.50	0.00		
1000 Hz 119 dB	90	90	1.00	0.99	-1.00		
1000 Hz 119 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	-21, +26
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		

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เอกสารไม่ควบคุม

Certificate No : 24-NDM-014
Request No : Req-2023-2679

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref (Pa ² /s)	UUC (Pa ² /s)	Error (%)		
FAST / A / 55-140 Calibrator Setting	00	00					
4000 Hz 95 dB	2846	2846	1.00	0.98	-0.02	0.02	-0.20 - +0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref (Pa ² /s)	UUC (Pa ² /s)	Error (%)		
FAST / A / 55-140 Calibrator Setting	00	00					
Burst 1 ms, 95 dB	2846	2846	1.00	0.98	-2.00	5.6	-21 - +26
Burst 1 ms, 100 dB	900	900	1.00	0.98	-2.00		-29 - +41
Burst 1 ms, 105 dB	143	143	1.00	0.99	-1.00		-29 - +41

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement		UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref (Pa ² /s)	Different (%)		
FAST / A / 55-140 Calibrator Setting	00	00				
Continuous Rectangle +	29		10.13	0.00	3.7	-21 - +26
Continuous Rectangle -			10.13			

* Indicates non accredited

End of Certificate

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

เอกสารไม่ควบคุม

Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 24-NDM-077
Address : 81 Soi Udonnab 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260 Request No : Req-2024-0530

Unit Under Calibration Details

Measurement Item : Noise Character Microphone Class : 2
Manufacturer : SVANTEK Microphone Model : SV 208
Model : SV 1040S Microphone SN : 190702
Serial Number : 100603 Preamplifier Model : -
ID : UAE15M1002504 Preamplifier SN : -
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 2024
Calibrated Date : 21 March 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	Questral	EFM00234	25 July 2024	TSE
Standard Microphone	GRAS	40AN	198271	21 August 2024	GRAS
Signal Generator	Svantech	SignalH	131	9 October 2024	WK Hysteris
Timer	EXTICH	-	05-ACT	21 March 2024	IPA

Note

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

Calibrated By : 
Mr. Nopadon Luangman
Service Calibration Engineer

Approved By : 
Mr. Pook Mahasarak
Calibration Engineer Supervisor

Issue Date : 21 March 2024

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

Certificate No : 24-NDM-077
Request No : Req-2024-0530

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	60	60	(Pa ² /s)	(Pa ² /s)	(%)	(%)	(%)
1000 Hz (114 dB)	120	120	1.18	1.20	+0.6	3.1	-21, +28

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

2. Frequency weightings

UUC Setting		Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
FAST / 60-140		A	C	(± dB)	
STD Setting		(dB)	(dB)		
*63 Hz		0.0	0.3	0.40	2.0
125 Hz		0.1	0.3	0.40	1.5
250 Hz		0.2	0.3	0.40	1.5
500 Hz		0.1	0.3	0.40	1.5
1000 Hz		0.0	0.0	0.40	-
2000 Hz		-0.4	-0.3	0.40	2.0
4000 Hz		0.6	0.6	0.40	3.0
8000 Hz		-1.4	-1.3	0.40	5.0

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เอกสารไม่ควมคุม

Certificate No : 24-NDM-077
Request No : Req-2024-0530

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	120.0	130.0	140.0
1000 Hz	Ref	(dB)	39.9	60.2	80.4	100.1	110.0	114.0	120.0	140.0
	Level A	(dB)	39.9	60.2	80.4	100.1	110.0	114.0	120.0	140.0
	Error	(dB)	-0.1	0.2	0.2	0.1	0.0	0.0	0.0	0.0
8000 Hz	Ref	(dB)	88.5	88.8	108.0	112.0	118.0	120.0	138.0	138.0
	Level A	(dB)	88.5	88.8	108.0	112.0	118.0	120.0	138.0	138.0
	Error	(dB)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
63 Hz	Ref	(dB)	87.8	88.8	108.0	112.0	118.0	120.0	138.0	138.0
	Level A	(dB)	87.8	88.8	108.0	112.0	118.0	120.0	138.0	138.0
	Error	(dB)	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Tolerances Limit		(± dB)	± 0.5							
UNCERTAINTY		(± dB)	0.3							

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
	Ref	UUC	Ref	UUC	Error		
FAST / A / 60-140	60	60	(Pa ² /s)	(Pa ² /s)	(%)	(%)	(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +28
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	-21, +28
1000 Hz 120 dB	90	90	10.00	9.80	-2.00		
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 the owner.
เอกสารไม่ควมคุม

Certificate No : 24-NDM-077
Request No : Req-2024-0530

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
	Ref	UUC	Ref	UUC	Error		
FAST / A / 60-140	60	60	(Pa ² /s)	(Pa ² /s)	(%)	(%)	(%)
Calibrator Setting	60	60	1.00	0.98	-0.02	0.052	-4.28 - -0.41
4000 Hz 95 dB	2846	2846	1.00	0.98	-0.02	0.052	-4.28 - -0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
	Ref	UUC	Ref	UUC	Error		
FAST / A / 60-140	60	60	(Pa ² /s)	(Pa ² /s)	(%)	(%)	(%)
Burst 1 ms, 95 dB	2846	2846	1.00	0.98	-2.00	5.6	-21, +28
Burst 1 ms, 100 dB	569	569	1.00	0.98	-2.00		-29, +41
Burst 1 ms, 108 dB	143	143	1.00	0.99	-1.00		-29, +41

5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 60-140	UUC	UUC	Difference			
Calibrator Setting	60	(Pa ² /s)	(%)	(%)	(%)	
Continuous Rectangle +	28	10.13	0.00	3.7	-21, +28	
Continuous Rectangle -		10.13				

* Indicates non accredited

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 owner.
เอกสารไม่ควมคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sakharu Road, Banghak, Prakhong, Bangkok 10260

Certificate No : 24-NDM-018
Request No : Req-2023-2689

Unit Under Calibration Details

Measurement Item : Noise Dominator
Manufacturer : SVANTEK
Model : SV 104S
Serial Number : 106009
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 211S
Microphone S/N : 106312
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 56 %RH ± 20 %RH
Barometric Pressure : 1013 kPa ± 10 hPa
Received Date : 21 December 2023
Calibrated Date : 25 January 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
Multi-frequency Calibrator	Quest	Questcal	EFAB00234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Signal Generator	Svante	Scope1	131	9 October 2024	WK Electric
Timer	EXTECH	-	05-ACT	21 March 2024	TPA

Note

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

Calibrated By : 
Mr. Noppadol Luangtan
Service Calibration Engineer

Approved By : 
Mr. Pachi Mahavorn
Calibration Engineer Supervisor
Issue Date : 25 January 2024

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

Certificate No : 24-NDM-018
Request No : Req-2023-2689

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref (Pa ² /s)	UUC (Pa ² /s)	Error (%)		
Calibrator Setting	60	60					
1000 Hz 114 dB	120	120	3.18	3.11	-1.6	3.1	-21 ~ +26

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY (± dB)	Tolerances Limit (± dB)
	A	C		
FAST / A / 60-140	(dB)	(dB)	(± dB)	(± dB)
STD Setting				
90 Hz	0.1	0.1	0.40	2.0
125 Hz	0.3	0.4	0.40	1.5
250 Hz	0.0	0.1	0.40	1.5
500 Hz	0.0	0.0	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.5	0.5	0.40	2.0
4000 Hz	2.4	2.4	0.40	3.0
8000 Hz	-2.8	-2.8	0.40	5.0

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

Certificate No : 24-NDM-018
Request No : Req-2023-2689

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)	80.0	80.1	90.1	100.0	110.0	114.0	120.0	129.9
	Error	(dB)	0.0	0.1	0.1	0.0	0.0	0.0	0.0	-0.1
	Ref	(dB)	88.9	88.9	108.9	112.9	118.9	128.9	138.9	
8000 Hz	Level A	(dB)	89.0	88.9	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	87.8	107.8	111.8	117.8	127.8	137.8	
63 Hz	Level A	(dB)	87.8	87.8	107.8	111.8	117.8	127.8	137.8	
	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							

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref (Pa ² /s)	UUC (Pa ² /s)	Error (%)		
FAST / A / 60-140	60	60					
Calibrator Setting							
1000 Hz 119 dB	27	27	6.30	6.38	0.08		
1000 Hz 119 dB	45	45	6.50	6.50	0.00		
1000 Hz 119 dB	90	90	3.00	6.99	-1.00	5.6	-21 ~ +26
1000 Hz 119 dB	180	180	2.00	1.98	-1.00		
1000 Hz 120 dB	36	36	4.00	4.03	-0.75		
1000 Hz 120 dB	72	72	3.00	3.05	-0.60		
1000 Hz 120 dB	90	90	10.00	10.13	-1.30		
1000 Hz 120 dB	180	180	20.00	20.22	-1.10	5.6	-21 ~ +26
1000 Hz 120 dB	360	360	40.00	40.34	-0.85		
1000 Hz 120 dB	720	720	80.00	80.49	-0.61		

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

Certificate No : 24-NDM-018
Request No : Req-2023-2689

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (Pa ² /s)
	Ref	UUC	Ref (Pa ² /s)	UUC (Pa ² /s)	Error (%)		
FAST / A / 60-140	60	60					
Calibrator Setting							
4000 Hz 95 dB	2846	2846	1.00	0.98	-0.02	0.02	-0.28 ~ -0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref (Pa ² /s)	UUC (Pa ² /s)	Error (%)		
FAST / A / 60-140	60	60					
Calibrator Setting							
Burst 1 ms, 95 dB	2846	2846	1.00	0.98	-2.00		-21 ~ +26
Burst 1 ms, 100 dB	900	900	1.00	0.98	-2.00	5.6	-29 ~ +41
Burst 1 ms, 105 dB	143	143	1.00	0.99	-1.00		

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement		UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	UUC (Pa ² /s)	Different (%)		
FAST / A / 60-140	60	60				
Calibrator Setting						
Continuous Rectangle +			10.11			
Continuous Rectangle -	28		10.11	0.00	3.7	-21 ~ +26

* Indicates non accredited

End of Certificate

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

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Pre-amplifier NH-24
Serial No.: 00538212 / 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 : 18 JANUARY 2024
Calibration Date : 29-30 JANUARY 2024
Date of Issue : 02 FEBRUARY 2024

Calibrated by : Nathakorn Pivatsophon

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

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

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

เอกสารไม่ควบคุม

Summary of Measurement Result :

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

เอกสารไม่ควบคุม

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.7

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

Frequency Weighting	Measured value (dB)
A-weight	13.4
C-weight	19.3
Flat	25.0

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-weights	Acceptance Limits
125	0.2	0.2	0.2	±1.5
1000	0.0	0.0	0.0	±1.0
8000	1.0	1.1	1.1	±5.0

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

459-459/1 Sirinthorn Road, Bangbunmu, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24100
Job No. : VC67AC0057
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	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	± 0.2

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

459-459/1 Sirinthorn Road, Bangbunmu, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24100
Job No. : VC67AC0057
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	± 1.5
136.0	136.0	0.0	± 1.5
135.0	135.0	0.0	± 1.5
134.0	134.0	0.0	± 1.5
133.0	133.0	0.0	± 1.5
132.0	132.0	0.0	± 1.5
131.0	131.0	0.0	± 1.5
129.0	129.0	0.0	± 1.5
124.0	124.0	0.0	± 1.5
119.0	119.0	0.0	± 1.5
114.0	114.0	0.0	± 1.5
109.0	109.0	0.0	± 1.5
104.0	104.0	0.0	± 1.5
99.0	99.0	0.0	± 1.5
94.0	94.0	0.0	± 1.5
89.0	89.0	0.0	± 1.5
84.0	84.0	0.0	± 1.5
79.0	79.0	0.0	± 1.5
74.0	74.0	0.0	± 1.5
69.0	69.0	0.0	± 1.5
64.0	64.0	0.0	± 1.5
59.0	59.0	0.0	± 1.5
54.0	54.0	0.0	± 1.5
49.0	49.0	0.0	± 1.5
44.0	44.0	0.0	± 1.5
39.0	39.0	0.0	± 1.5
34.0	34.0	0.0	± 1.5
30.0	30.1	0.1	± 1.5
29.0	29.1	0.1	± 1.5
28.0	28.2	0.2	± 1.5
27.0	27.2	0.2	± 1.5
26.0	26.3	0.3	± 1.5
25.0	25.3	0.3	± 1.5

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

459-459/1 Sirinthorn Road, Bangbunmu, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24100
Job No. : VC67AC0057
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	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	133.0	133.0	0.0	±3.0
One	136.4	135.9	-0.5	±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

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

459-459/1 Sirinthorn Road, Bangbunmu, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24100
Job No. : VC67AC0057
Pages : 8 of 8

11. Overload indication

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

Cert. No. : ACL24047
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00208876 / 157966 / 90321
ID No. : UAE.EFM.005/2564

Condition As Found : GOOD

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

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

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

Calibrated by : Nuthakorn Pitsutpaisan

Approved by : 
(Thanakul Petchurai)

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เอกสารไม่ควบคุม

Cert. No. : ACL24049
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00408979 / 156122 / 90424
ID No. : UAE.EFM.006/2564

Condition As Found : GOOD

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

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

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

Calibrated by : Nuthakorn Pitsutpaisan

Approved by : 
(Thanakul Petchurai)

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

เอกสารไม่ควบคุม

Cert. No. : ACL24049
Job No. : VC67AC0034
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100134	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

เอกสารไม่ควบคุม

Cert. No. : ACL24049
Job No. : VC67AC0034
Pages : 3 of 8

Summary of Measurement Result :

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

เอกสารไม่ควบคุม

Cert. No. : ACL24049
Job No. : VC67AC0034
Pages : 4 of 8

Result of calibration :

I. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.8
Flat	23.6

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	0.1	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.2	-0.1	-0.2	±5.0

เอกสารไม่ควบคุม

Cert. No. : ACL24049
Job No. : VC67AC0034
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	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	± 0.2

เอกสารไม่ควบคุม

Cert. No. : ACL24049
Job No. : VC67AC0034
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.8	-0.2	± 1.1
25.0	24.8	-0.2	± 1.1

เอกสารไม่ควบคุม

Cert. No. : ACL24049
Job No. : VC67AC0034
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.7	-0.7	±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

เอกสารไม่ควบคุม

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Cert. No. : ACL24049
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11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

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SITHIPORN ASSOCIATES CO., LTD.
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Cert. No. : ACL24050
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 : 21 DECEMBER 2023
Calibration Date : 18-19 JANUARY 2024
Date of Issue : 22 JANUARY 2024

Calibrated by : Nuthakorn Pisutpaisan

Approved by : *T. Petchum*
(Thanakul Petchumai)

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

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

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

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

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

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Cert. No. : ACL24050
Job No. : VC67AC0034
Pages : 3 of 8

Summary of Measurement Result :

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

เอกสารไม่ควบคุม

Cert. No. : ACL24050
Job No. : VC67AC0034
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	12.0
C - weight	18.9
Flat	24.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	1.8	1.9	1.8	±5.0

เอกสารไม่ควบคุม

Cert. No. : ACL24050
Job No. : VC67AC0034
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	0.0	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

เอกสารไม่ควบคุม

Cert. No. : ACL24050
Job No. : VC67AC0034
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	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

เอกสารไม่ควบคุม

Cert. No. : ACL24050
Job No. : VC67AC0034
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.1	-0.3	±3.0

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

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

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Cert. No. : ACL24098
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-S2 / Preamplifier NH-24
Serial No. : 00408981 / 186171 / 90426
ID No. : UAE.EFM.008/2564

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 : 18 JANUARY 2024
Calibration Date : 29-30 JANUARY 2024
Date of Issue : 02 FEBRUARY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :
(Thanakul Peichurai)

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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Cert. No. : ACL24098
Job No. : VC67AC0057
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAJ	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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Cert. No. : ACL24098
Job No. : VC67AC0057
Pages : 3 of 8

Summary of Measurement Result :

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

เอกสารไม่ควบคุม

Cert. No. : ACL24098
Job No. : VC67AC0057
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	16.8
Flat	23.0

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	0.0	0.0	0.0	± 1.0
8000	1.0	1.0	1.0	±5.0

เอกสารไม่ควบคุม

Cert. No. : ACL24098
Job No. : VC67AC0057
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	-0.2	-0.1	±2.0
125	-0.1	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	0.0	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	± 0.2

เอกสารไม่ควบคุม

Cert. No. : ACL24098
Job No. : VC67AC0057
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	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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Cert. No. : ACL24098
Job No. : VC67AC0057
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.9	-0.5	±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

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Cert. No. : ACL24098
Job No. : VC67AC0057
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	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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SITHIPORN ASSOCIATES CO., LTD.
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Cert. No. : ACL24051
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00408982 / 186172 / 00727
ID No.: UAE.EFM.009/2564

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pinitpaissam

Approved by :

T. Petchum
(Thanakul Petchumai)

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

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SITHIPORN ASSOCIATES CO., LTD.
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Cert. No. : ACL24051
Job No. : VC67AC0034
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 50/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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Cert. No. : ACL24051
Job No. : VC67AC0034
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
3000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	-	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Time 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. : ACL24051
Job No. : VC67AC0034
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	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	Measured value (dB)
A - weight	12.6
C - weight	19.2
Flat	24.7

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	2.3	2.4	2.4	±5.0

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Cert. No. : ACL24051
Job No. : VC67AC0034
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	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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Cert. No. : ACL24051
Job No. : VC67AC0034
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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Cert. No. : ACL24051
Job No. : VC67AC0034
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	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	128.1	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	133.0	133.0	0.0	±3.0
One	136.4	136.3	-0.1	±3.0

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

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Cert. No. : ACL24051
Job No. : VC67AC0034
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

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TEL: +66 210 5860-1 FAX: +66 210 57140



Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING
Name : CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok,
Prakong, Bangkok 10240
Certificate No : 24-TPM-248
Request No : Req-2023-2361
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-32
Serial Number : TPT000014
Resolution : 0.1 °C
ID Number : DAE-EFM-221-2562
Range Calibration : -20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 47.5
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 9 November 2023
Calibrated Date : 3 June 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: 00000057, 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 Roborn 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
3 June 2024

Issue Date :

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AMPHOE BANG PHU I SAMUT PRAKAN PROVINCE 10940 THAILAND
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Calibration Date :
LDC Adjustment : Not Adjust
Certificate No : 24-TPM-347
Request No : Req-2024-1620
Page : 2/2

Result of Calibration :

TEC Sensor	Standard Temperature (°C)	TEC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.031	19.9	-0.1	0.13
	25.034	24.9	-0.1	0.13
	30.034	29.9	-0.1	0.13
	35.037	34.9	-0.1	0.13
	40.038	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
DRY	20.032	19.9	-0.1	0.13
	25.034	24.9	-0.1	0.13
	30.036	29.9	-0.1	0.13
	35.037	34.9	-0.1	0.13
	40.040	39.9	-0.1	0.13
	45.040	44.9	-0.1	0.13
	50.042	49.9	-0.1	0.13
	60.046	59.9	-0.1	0.13
GLDHC	20.032	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.034	30.0	0.0	0.13
	35.036	35.0	0.0	0.13
	40.038	40.0	0.0	0.13
	45.040	45.0	0.0	0.13
	50.042	50.0	0.0	0.13
	60.046	60.0	0.0	0.13

End of Certificate

Calibrated By :

Mr. Sirichok Jongsakulchai

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Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING
Name : CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok,
Prakong, Bangkok 10240
Certificate No : 24-TPM-347
Request No : Req-2024-1620
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-32
Serial Number : TPC000013
Resolution : 0.1 °C
ID Number : DAE-EFM-117-2566
Range Calibration : -20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 47.5
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: 00000057, 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 Roborn 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
6 August 2024

Issue Date :

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Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 24-TPM-347

Request No : Req-2024-1426

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.076	20.1	-0.1	0.13
	25.033	25.1	-0.1	0.13
	30.034	30.1	-0.1	0.13
	35.077	35.1	-0.1	0.13
	40.039	40.0	+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	20.0	0.0	0.13
	25.034	25.0	0.0	0.13
	30.035	30.0	0.0	0.13
	35.036	35.0	0.0	0.13
	40.077	39.6	+0.2	0.13
	45.041	44.8	+0.2	0.13
	50.043	49.9	+0.1	0.13
	60.046	59.9	+0.1	0.13
GLOBE	20.031	20.1	-0.1	0.13
	25.033	25.1	-0.1	0.13
	30.038	30.1	-0.1	0.13
	35.077	35.1	-0.1	0.13
	40.036	39.8	+0.1	0.13
	45.040	44.9	+0.1	0.13
	50.042	49.9	+0.1	0.13
	60.043	59.9	+0.1	0.13

End of Certificate

Calibrated By :

Mr. Sirichok Jangpadeesakul

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

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Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 43, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260

Certificate No : 24-TPM-313

Request No : Req-2024-1485

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature

Instrument Name : Thermal Environment Monitor

Manufacturer : TSI QUEST

Model : QT-34

Serial Number : TEX040015

Resolution : 0.1 °C

ID Number : UAE.FPM.119/2566

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 : 9 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: 08000957, ID: 02-TPM
Which was calibrated on 1 March 2024, Calibration Certificate No.: QR24-0478

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

Note

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

Approved By :

Mr. Noppadon Luangrat

Technical Manager

Issue Date :

10 July 2024

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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-780-TPM-01 Rev.01 Issue date 13/07/20



Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 24-TPM-313

Request No : Req-2024-1485

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	25.0	0.0	0.13
	30.031	30.1	-0.1	0.13
	35.037	35.1	-0.1	0.13
	40.040	40.2	-0.2	0.13
	45.039	45.1	-0.1	0.13
	50.042	50.2	-0.2	0.13
	60.045	60.3	-0.3	0.13
DRY	20.033	20.0	0.0	0.13
	25.039	25.0	0.0	0.13
	30.032	30.1	-0.1	0.13
	35.034	35.1	-0.1	0.13
	40.039	40.2	-0.2	0.13
	45.038	45.1	-0.1	0.13
	50.042	50.2	-0.2	0.13
	60.046	60.3	-0.3	0.13
GLOBE	20.033	19.9	+0.1	0.13
	25.030	25.1	-0.1	0.13
	30.033	30.0	0.0	0.13
	35.039	35.0	0.0	0.13
	40.038	40.1	-0.1	0.13
	45.041	45.1	-0.1	0.13
	50.040	50.1	-0.1	0.13
	60.043	60.1	-0.1	0.13

End of Certificate

Calibrated By :

Mr. Sirichok Jangpadeesakul

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-780-TPM-01 Rev.01 Issue date 13/07/20

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Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 43, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260

Certificate No : 24-TPM-152

Request No : Req-2024-0542

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature

Instrument Name : Thermal Environment Monitor

Manufacturer : TSI QUEST

Model : QT-33

Serial Number : TPQ08025

Resolution : 0.1 °C

ID Number : UAE.FPM.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 : 5 March 2024

Calibrated Date : 21 March 2024

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

Reference Standard

Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/RTD100, SN: 12000077, ID: AR-TPM Which was calibrated on 27 October 2023, Calibration Certificate No.: QR23-2574

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

Note

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

Approved By :

Mr. Noppadon Luangrat

Technical Manager

Issue Date :

21 March 2024

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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.



Calibration Note

UUC Adjustment: ☒ Non Adjust

Certificate No : 24-TPM-157

Request No : Req-2024-0542

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.050	20.1	-0.1	0.13
	25.053	25.1	-0.1	0.13
	30.055	30.1	-0.1	0.13
	35.056	35.1	-0.1	0.13
	40.058	40.2	-0.2	0.13
	45.061	45.2	-0.2	0.13
	50.064	50.2	-0.2	0.13
DRY	20.051	20.0	0.0	0.13
	25.053	25.0	0.0	0.13
	30.054	30.0	0.0	0.13
	35.056	35.0	0.0	0.13
	40.058	40.1	-0.1	0.13
	45.059	45.1	-0.1	0.13
	50.060	50.1	-0.1	0.13
GL GLOBE	20.052	20.1	-0.1	0.13
	25.053	25.1	-0.1	0.13
	30.054	30.1	-0.1	0.13
	35.057	35.1	-0.1	0.13
	40.058	40.1	-0.1	0.13
	45.061	45.2	-0.2	0.13
	50.064	50.2	-0.2	0.13

End of Certificate

Calibrated By :

Mr. Sirichok Jongsakulchai

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

Certificate No : 24-TPM-148

Request No : Req-2024-0540

Customer

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

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature

Instrument Name : Thermal Environment Monitor

Manufacturer : TSI QUEST

Model : QT-32

Serial Number : TPKQ0604

Resolution : 0.1 °C

ID Number : UAE.EPM.0072259

Range Calibration : 20 °C to 40 °C

Type of Sensor : RTD

Sensor Diameter (mm) : 4.5

Calibration Position (mm) : 67.5

Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 15 %RH

Received Date : 5 March 2024

Calibrated Date : 21 March 2024

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

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO GINGO, Model: GT11/RTD100, SN: 12000977, ID: AB-TPM Which was calibrated on 27 October 2023, Calibration Certificate No.: QR23-2574

Traceability

This Certificate is traceable to SI Unit through Quality Robum Co., Ltd., NSC-NSC 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 Luangrat

Technical Manager

Issue Date :

21 March 2024

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

UUC Adjustment: ☒ Non Adjust

Certificate No : 24-TPM-149

Request No : Req-2024-0540

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.053	20.0	0.0	0.13
	25.055	25.0	0.0	0.13
	30.057	30.0	0.0	0.13
	35.056	35.0	0.0	0.13
	40.058	40.0	0.0	0.13
	45.061	45.0	0.0	0.13
	50.064	50.0	0.0	0.13
DRY	20.052	19.9	-0.1	0.13
	25.053	24.9	-0.1	0.13
	30.054	29.9	-0.1	0.13
	35.056	34.9	-0.1	0.13
	40.058	40.0	0.0	0.13
	45.059	45.0	0.0	0.13
	50.060	50.0	0.0	0.13
GL GLOBE	20.051	19.9	-0.1	0.13
	25.053	24.9	-0.1	0.13
	30.054	29.9	-0.1	0.13
	35.057	34.9	-0.1	0.13
	40.058	40.0	0.0	0.13
	45.061	45.0	0.0	0.13
	50.064	50.0	0.0	0.13

End of Certificate

Calibrated By :

Mr. Sirichok Jongsakulchai

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

Certificate No : 24-TPM-043

Request No : Req-2023-2688

Customer

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

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature

Instrument Name : Thermal Environment Monitor

Manufacturer : TSI QUEST

Model : QT-32

Serial Number : TPT060013

Resolution : 0.1 °C

ID Number : UAE.EPM.2202582

Range Calibration : 28 °C to 60 °C

Type of Sensor : RTD

Sensor Diameter (mm) : 4.5

Calibration Position (mm) : 67.5

Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 15 %RH

Received Date : 21 December 2023

Calibrated Date : 25 January 2024

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

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO GINGO, Model: GT11/RTD100, SN: 09000957, ID: 62-TPM Which was calibrated on 27 February 2023, Calibration Certificate No.: QR23-0494

Traceability

This Certificate is traceable to SI Unit through Quality Robum Co., Ltd., NSC-NSC 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 Luangrat

Technical Manager

Issue Date :

25 January 2024

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

UUC Adjustment: ☐ Not Adjust

Certificate No.: 24-TPM-049

Request No.: Req-2023-2891

Page: 2/2

Result of Calibration:

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Coverage (°C)	Uncertainty (°C)
WET	20.001	20.1	-0.1	0.13
	25.001	25.1	-0.1	0.13
	30.001	30.1	-0.1	0.13
	35.000	35.1	-0.1	0.13
	40.009	40.2	-0.2	0.13
	45.040	45.2	-0.2	0.13
	50.043	50.2	-0.2	0.13
	60.047	60.2	-0.2	0.13
DRY	20.001	20.2	-0.2	0.13
	25.002	25.2	-0.2	0.13
	30.005	30.2	-0.2	0.13
	35.008	35.2	-0.2	0.13
	40.014	40.3	-0.3	0.13
	45.044	45.3	-0.3	0.13
	50.042	50.3	-0.3	0.13
	60.052	60.3	-0.2	0.13
GL GLOBE	20.012	20.1	-0.1	0.13
	25.012	25.1	-0.1	0.13
	30.015	30.1	-0.1	0.13
	35.015	35.1	-0.1	0.13
	40.018	40.2	-0.2	0.13
	45.044	45.1	-0.1	0.13
	50.044	50.1	-0.1	0.13
	60.045	60.1	-0.1	0.13

End of Certificate

Calibrated By:

Mr. Sirinich Anpachaisri

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

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Certificate of Calibration

Customer

Name: UNITED ANALYST AND ENGINEERING

Certificate No.: 24-TPM-047

Request No.: Req-2023-2886

Address

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

Page: 1/2

Unit Under Calibration Details

Calibration Parameter: Temperature

Instrument Name: Thermal Environment Monitor

Range Calibration: 20 °C to 40 °C

Manufacturer: TSI QUEST

Type of Sensor: RTD

Model: QT-34

Sensor Diameter (mm): 4.5

Serial Number: TEG100075

Calibration Position (mm): 47.5

Resolution: 0.1 °C

Instrument Status: Used

ID Number: UAE/EMA2-006-2052

Calibration Environment and Details

Temperature: 23 °C ± 0.3 °C

Humidity: 55 %RH ± 15 %RH

Received Date: 21 December 2023

Calibrated Date: 25 January 2024

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

Reference Standard: Digital Thermometer with Sensor, Manufacturer: GINGO-GINGO, Model: GT11-RTD100, SN:

08000057, ID: 02-TPM Which was calibrated on 27 February 2023, Calibration Certificate No.: QR23-

0094

Traceability

This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NISC-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 Luangon

Technical Manager

Issue Date:

23 January 2024

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

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Calibration Note

UUC Adjustment: ☐ Not Adjust

Certificate No.: 24-TPM-047

Request No.: Req-2023-2896

Page: 2/2

Result of Calibration:

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Coverage (°C)	Uncertainty (°C)
WET	20.011	20.1	-0.1	0.13
	25.012	25.1	-0.1	0.13
	30.013	30.1	-0.1	0.13
	35.017	35.1	-0.1	0.13
	40.018	40.1	-0.1	0.13
	45.048	45.1	-0.1	0.13
	50.040	50.1	-0.1	0.13
	60.046	60.1	-0.1	0.13
DRY	20.011	20.2	-0.2	0.13
	25.013	25.2	-0.2	0.13
	30.015	30.2	-0.2	0.13
	35.019	35.2	-0.2	0.13
	40.018	40.2	-0.2	0.13
	45.042	45.2	-0.2	0.13
	50.042	50.2	-0.2	0.13
	60.046	60.2	-0.2	0.13
GL GLOBE	20.011	20.1	-0.1	0.13
	25.013	25.2	-0.2	0.13
	30.015	30.1	-0.1	0.13
	35.017	35.2	-0.2	0.13
	40.017	40.2	-0.2	0.13
	45.018	45.2	-0.2	0.13
	50.044	50.2	-0.2	0.13
	60.046	60.2	-0.2	0.13

End of Certificate

Calibrated By:

Mr. Sirinich Anpachaisri

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

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Certificate of Calibration

Customer

Name: UNITED ANALYST AND ENGINEERING

Certificate No.: 24-ACT-008

CONSULTANT CO., LTD.

Request No.: Req-2024-1366

Address

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

Unit Under Calibration Details

Measurement Item: Acoustic Calibrator

Class: 1

Manufacturer: SVANTEK

Range: 94, 114 dB / 1000 Hz

Model: SV 35

Instrument Status: Used

Serial Number: 44783

ID: UAE-EFM-019-2559

Calibration Environment and Details

Temperature: (23 ± 2 °C)

Humidity: (50 ± 20 %RH)

Barometric Pressure: (1013 ± 10.0 hPa)

Received Date: 20 June 2024

Calibration Date: 25 June 2024

Location of Calibration: LAB 1 Acoustic

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58979	EE3	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 Luangon

Service Calibration Engineer

Approved By:

Mr. Pich Mahavorn

Calibration Engineer Supervisor

Issue Date:

25 June 2024

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

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Rev: 000-AC/1-02 Rev 018 Issue Date: 3/10/24

Certificate No : 24-ACT-088

Request No : Req-2024-1366

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class I (± dB)	Result
	Measured	Deviated value	Measured	Deviated value			
94 dB / 1000 Hz	94.23	0.23	-	-	0.13	0.25	Pass
114 dB / 1000 Hz	114.22	0.22	-	-	0.13	0.25	Pass

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class I (± %)	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 I (± %)	Result
	Measured (%)		Measured (%)				
94 dB / 1000 Hz	0.05		-	-	0.40	2.5	Pass
114 dB / 1000 Hz	0.09		-	-	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 IEC 60942:2017 Class 1.

- The calibration results include the calibration pressure correction.

- The calibration results include the microphone volume correction.

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
IM-TB-ACT-02 Rev 03 Issue date 5/5/24

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Certificate No : 24-ACT-088

Request No : Req-2024-1366

Decision Rule for Statements of Conformity

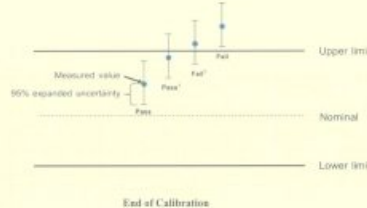
The standard decision rule applied for the statements of conformity to each calibration result will be applied using ILAC/ISO 90:2019. Guidelines on the Reporting of Compliance with Specification as following Fig. and statements.

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.



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.
IM-TB-ACT-02 Rev 03 Issue date 5/5/24

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Certificate of Calibration

Customer

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

Certificate No : 24-NDM-015

Address : 81 Set Udomrak 41, Sukhumburi Road, Bangchak, Prakanong, Bangkok 10260

Request No : Req-2023-2880

Unit Under Calibration Details

Measurement item : Noise Disturbance

Microphone Class : 2

Manufacturer : SVANTEK

Microphone Model : SV27

Model : SV 104

Microphone SN : 96690

Serial Number : 91924

Preamplifier Model : -

ID : -

Preamplifier SN : -

Resolution : 0.1 dB

Instrument Status : Good

Calibration Environment and Details

Temperature : 23 °C ± 2 °C

Humidity : 50 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 21 December 2023

Calibrated Date : 25 January 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	Date calibration	Traceability
Multi-frequency Calibrator	Quest	Questcal	EFAM0234	25 July 2024	YSI
Standard Microphone	GRAS	80AN	18873	21 August 2024	GRAS
Site Generator	Swank	Swan401	531	9 December 2024	WK Electric
Timer	EXTech	-	05-ACT	21 March 2024	TPA

Note

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

Calibrated By : [Signature]
Mr. Noppadol Luangrat
Service Calibration Engineer

Approved By : [Signature]
Mr. Patch Mahasorn
Calibration Engineer Supervisor
Issue Date : 25 January 2024

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

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Certificate No : 24-NDM-015

Request No : Req-2023-2880

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref (Pa·s)	UUC (Pa·s)	Error (%)		
FAST / A / 55-140	60	60	3.18	3.13	-1.6	3.1	-21, -28
Calibrator Setting	120	120					

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 (± dB)	Tolerances Limit (± dB)
	A	C		
FAST / 20-140				
STD Setting	(dB)	(dB)		
63 Hz	-0.1	0.0	0.40	2.0
125 Hz	0.0	0.0	0.40	1.5
250 Hz	-0.3	-0.3	0.40	1.5
500 Hz	-0.2	-0.2	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.7	0.7	0.40	2.0
4000 Hz	2.5	2.4	0.40	3.0
8000 Hz	-3.0	-2.9	0.40	5.0

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เอกสารไม่ควบคุม

Certificate No : 24-NDM-015
Request No : Req-2023-2680

3. Linearity of response to steady signals

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

UUC Setting		FAST / A / High									
1000 Hz	Ref	(dB)	55.0	60.0	65.0	70.0	75.0	80.0	85.0	90.0	95.0
	Level A	(dB)	55.4	60.2	65.1	70.0	75.0	80.0	85.0	90.0	95.0
	Error	(dB)	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
8000 Hz	Ref	(dB)	88.9	93.9	98.9	103.9	108.9	113.9	118.9	123.9	128.9
	Level A	(dB)	88.9	93.9	98.9	103.9	108.9	113.9	118.9	123.9	128.9
	Error	(dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
63 Hz	Ref	(dB)	87.8	92.8	97.8	102.8	107.8	112.8	117.8	122.8	127.8
	Level A	(dB)	87.8	92.8	97.8	102.8	107.8	112.8	117.8	122.8	127.8
	Error	(dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tolerances Limit		(dB)	± 0.5								
UNCERTAINTY		(dB)	± 0.3								

b. Sound exposure meter linearity of error

UUC Setting		Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
FAST / A / 55-140		Ref	UUC	Ref (Pa ² /s)	UUC (Pa ² /s)	Error (%)		
Calibrator Setting		(s)	(s)				5.6	-21 ~ +26
1000 Hz 110 dB		27	27	0.30	0.30	0.00		
1000 Hz 110 dB		45	45	0.50	0.51	+2.00		
1000 Hz 110 dB		90	90	1.00	1.01	+1.00		
1000 Hz 110 dB		180	180	2.00	2.02	+1.00		
1000 Hz 120 dB		36	36	4.00	4.03	+0.75	5.6	-21 ~ +26
1000 Hz 120 dB		72	72	8.00	8.05	+0.63		
1000 Hz 120 dB		90	90	10.00	10.13	+1.30		
1000 Hz 120 dB		180	180	20.00	20.22	+1.10		
1000 Hz 120 dB		360	360	40.00	40.34	+0.85		
1000 Hz 120 dB		720	720	80.00	80.49	+0.61		

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

เอกสารไม่ควบคุม

Certificate No : 24-NDM-015
Request No : Req-2023-2680

4. Response to short duration

a. Response for sinusoidal signals - reference level

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

b. Sound exposure meter response for series of toneburst impulses

UUC Setting		Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
FAST / A / 55-140		Ref	UUC	Ref (Pa ² /s)	UUC (Pa ² /s)	Error (%)		
Calibrator Setting		(s)	(s)				5.6	-21 ~ +26
Burst 1 ms, 95 dB		2846	2846	1.00	0.98	-2.00		
Burst 1 ms, 100 dB		900	900	1.00	0.98	-2.00		
Burst 1 ms, 105 dB		143	143	1.00	0.99	-1.00		

5. Response to unipolar pulse

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

* Indicates non accredited

End of Certificate

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

เอกสารไม่ควบคุม

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udonnakh 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Certificate No : 24-NDM-110
Request No : Req-2024-0835

Unit Under Calibration Details

Measurement item : Noise Disturbance
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 117008
ID : UAEFM1122565
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : S927
Microphone SN : 112933
Preamplifier Model : -
Preamplifier SN : -
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 0.2 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 19 April 2024
Calibrated Date : 26 April 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Multi-frequency Calibrator	Quest	Questrol	EFM06234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	186273	27 August 2024	GRAS
Size Generator	Standis	Standis	131	9 October 2024	WK Flacore
Timer	EXTech	-	05-ACT	14 March 2025	IPA

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. Nopadol Lungsang
Service Calibration Engineer

Approved By : 
Mr. Pait Mahasarak
Calibration Engineer Supervisor
Issue Date : 26 April 2024

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

เอกสารไม่ควบคุม

Certificate No : 24-NDM-110
Request No : Req-2024-0835

1. Absolute acoustical sensitivity

UUC Setting		Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
FAST / A / 55-140		Ref	UUC	Ref (Pa ² /s)	UUC (Pa ² /s)	Error (%)		
Calibrator Setting		(s)	(s)				3.1	-21 ~ +26
1000 Hz 114 dB		120	120	3.18	3.11	-1.6		

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

2. Frequency weightings

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

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

เอกสารไม่ควบคุม

Certificate No : 24-NDM-118
Request No : Req-2024-0835

3. Linearity of response to steady signals

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

UUC Setting	FAST / A : High											
	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0	
1000 Hz	Level A	(dB)	54.0	80.1	90.1	100.0	110.0	114.0	120.0	129.9	139.9	
	Error	(dB)	-0.4	0.1	0.1	0.0	0.0	0.0	0.0	-0.1	-0.1	
8000 Hz	Level A	(dB)										
	Error	(dB)										
63 Hz	Level A	(dB)										
	Error	(dB)										
Tolerances Limit : (±dB)												±0.5
UNCERTAINTY : (±dB)												±0.3

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
	Ref	UUC	Ref	UUC	Error		
FAST / A : 55-140							
Calibrator Setting	60	60	(Pa ² /s)	(Pa ² /s)	(%)	(%)	(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00		
1000 Hz 119 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	0.99	-1.00	5.6	
1000 Hz 110 dB	180	180	2.00	1.99	-1.00		
1000 Hz 120 dB	36	36	4.00	3.94	-1.50		
1000 Hz 120 dB	72	72	8.00	7.87	-1.63		
1000 Hz 120 dB	90	90	10.00	9.80	-1.00		
1000 Hz 120 dB	180	180	20.00	19.76	-1.20	5.6	
1000 Hz 120 dB	360	360	40.00	39.42	-1.45		
1000 Hz 120 dB	720	720	80.00	78.66	-1.68		

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

Certificate No : 24-NDM-118
Request No : Req-2024-0835

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
	Ref	UUC	Ref	UUC	Error		
FAST / A : 55-140							
Calibrator Setting	60	60	(Pa ² /s)	(Pa ² /s)	(%)	(%)	(%)
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.852	-0.20 ~ +0.40

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
	Ref	UUC	Ref	UUC	Error		
FAST / A : 55-140							
Calibrator Setting	60	60	(Pa ² /s)	(Pa ² /s)	(%)	(%)	(%)
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00		-21 ~ +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00	5.6	-29 ~ +41
Burst 1 ms, 108 dB	143	143	1.00	1.00	+1.00		-29 ~ +41

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
	Ref	UUC	Ref	UUC	Different		
FAST / A : 55-140							
Calibrator Setting	60	60	(Pa ² /s)	(Pa ² /s)	(%)	(%)	(%)
Continuous Rectangle +			10.37				
Continuous Rectangle -	28		10.37		0.00	3.7	-21 ~ +26

* Indicates non accredited

End of Certificate

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

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Certificate No : 24-NDM-013
Request No : Req-2023-2678

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 304
Serial Number : 91025
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV27
Microphone S/N : 96602
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 : 21 December 2023
Calibrated Date : 24 January 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
Multi-frequency Calibrator	Qson	Qson-cal	1FA900234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Site Generator	Swanick	Swan401	131	9 October 2024	WK Electric
Timer	EXTRECH	-	05-ACT	21 March 2024	TPA

Note

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

Calibrated By : 
Mr. Noppadol Luanagat
Service Calibration Engineer

Approved By : 
Mr. Pachi Mallavorn
Calibration Engineer Supervisor
Issue Date : 24 January 2024

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

Certificate No : 24-NDM-013
Request No : Req-2023-2678

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
	Ref	UUC	Ref	UUC	Error		
FAST / A : 55-140							
Calibrator Setting	60	60	(Pa ² /s)	(Pa ² /s)	(%)	(%)	(%)
1000 Hz 114 dB	120	120	3.18	3.13	-1.6	3.1	-21 ~ +26

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances
	A	C		
FAST / 55-140			(± dB)	(± dB)
STD Setting	(dB)	(dB)		
763 Hz	-0.2	0.1	0.40	2.0
125 Hz	-0.3	-0.1	0.40	1.5
250 Hz	-0.4	-0.2	0.40	1.5
500 Hz	-0.5	-0.1	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.7	0.9	0.40	2.0
4000 Hz	2.5	2.5	0.40	3.0
8000 Hz	-3.1	-2.9	0.40	3.0

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เอกสารไม่ควบคุม

Certificate No : 24-NDM-013

Request No : Req-2023-2678

3. Linearity of response to steady signals

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

UUC Setting		FAST / A / High									
1000 Hz	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
	Level A	(dB)	55.5	80.2	90.2	100.3	110.3	114.0	120.3	130.3	140.3
	Error	(dB)	0.5	0.2	0.2	0.3	0.3	0.0	0.3	0.3	0.3
8000 Hz	Ref	(dB)	68.0	88.0	108.0	112.0	118.0	128.0	138.0	148.0	
	Level A	(dB)		89.0	99.0	108.5	112.5	118.5	128.5	138.5	148.5
	Error	(dB)		0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
63 Hz	Ref	(dB)					87.8	93.8	103.8	113.8	
	Level A	(dB)					87.8	93.8	103.8	113.8	
	Error	(dB)					0.0	0.0	0.0	0.0	0.0
Tolerances Limit:		(±dB)	±3.0								
UNCERTAINTY		(±dB)	0.3								

b. Sound exposure meter linearity of error

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

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เอกสารไม่ควบคุม

Certificate No : 24-NDM-013

Request No : Req-2023-2678

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting		Time		Exposure Measurement			UNCERTAINTY (Pa ² /s)	Tolerances Limit (Pa ² /s)
FAST / A / 55-140		Ref	UUC	Ref	UUC	Error		
Calibrator Setting		(s)	(s)	(Pa ² /s)	(Pa ² /s)	(%)		
4000 Hz 95 dB		2848	2848	1.00	1.00	0.00	0.057	-0.29 - +0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting		Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
FAST / A / 55-140		Ref	UUC	Ref	UUC	Error		
Calibrator Setting		(s)	(s)	(Pa ² /s)	(Pa ² /s)	(%)		
Burst 1 ms, 95 dB		2848	2848	1.00	1.00	0.00	5.6	-21 - +26
Burst 1 ms, 100 dB		900	900	1.00	1.00	0.00		-28 - +41
Burst 1 ms, 104 dB		143	143	1.00	1.01	+1.00		-28 - +41

5. Response to unipolar pulse

UUC Setting		Time	Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140		UUC	UUC	Difference	Limit		
Calibrator Setting		(s)	(Pa.k)	(%)	(%)	(%)	
Continuous Rectangle +		29	10.37		0.00	3.7	-21 ~ +26
Continuous Rectangle -			10.37				

* Indicates non accredited

End of Certificate

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

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

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

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

Unit Under Calibration Details


Measurement Item : Noise Detection
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 343224
ID : UAE EFM 3422566
Resolution : 0.1 dB
Calibration Environment and Details
Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Revised Date : 1 July 2024
Calibrated Date : 15 July 2024
Calibration Procedure : Reference method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Multi-frequency Calibrator	Quest	Questcal	EF3000234	25 July 2024	TSR
Standard Microphone	GRAS	40AN	188773	21 August 2024	GRAS
Noise Generator	Svante	Svap901	131	9 October 2024	WK Electric
Timer	EXTRECH	-	49-ACT	14 March 2023	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. Noppakorn Laungam
Service Calibration Engineer

Approved By : 
Mr. Pachi Mahavorn
Calibration Engineers 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 the Innovative Instrument Co., Ltd.

เอกสารไม่ควบคุม

CP-NDM-01 Rev.04 Issue date 16/03/24

Certificate No : 24-NDM-172

Request No : Req-2024-1471

1. Absolute acoustical sensitivity

UUC Setting		Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)	Result
FAST / A / 55-140		Ref	UUC	Ref	UUC	Error			
Calibrator Setting		(s)	(s)	(Pa ² /s)	(Pa ² /s)	(%)			
1000 Hz 114 dB		120	120	3.37	3.13	-1.3	3.3	-21, +26	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN: 88079

2. Frequency weightings

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

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

เอกสารไม่ควบคุม

CP-NDM-01 Rev.04 Issue date 16/03/24

List of Instruments Certification for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Equipment for Air Quality Analysis									
1	Analytical Balance (Readability 0.1 mg)	TSP	Mettler-Toledo	MS204TS/00 C252436235	National Food Institute, Ministry of Industry, Thailand	2402420-003-01	19 Apr 24	18 Apr 25	-
2	Analytical Balance (Readability 0.001 mg)	Respirable Dust	Mettler-Toledo	XP6 / B322373893	National Food Institute, Ministry of Industry, Thailand	2402420-002-01	19 Apr 24	18 Apr 25	-
3	UV-VIS Spectrophotometer	Oxide of Nitrogen	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP24-018	9 May 24	8 May 25	-
4	Ion Chromatography Anion (IC)	Phosphoric acid Hydrochloric acid	Dionex	DionexAqionRfIC / 220380031	Archemica Lab Co.Ltd.	Qualification Report Anion (ID#1047)	23 Apr 24	22 Apr 25	-
5	Gas Chromatography (GC)	Toluene, Acetone Xylene	Agilent Technologies	System ID:CN11021007 7890 / CN11021007	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	21 Feb 24	19 Feb 25	-
6	Atomic Absorption Spectrometer (AAS)	Chromium, Chromium Fume Zinc Oxide Fume	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research(TISTR)	MTC-ACL No. 358/67	11 Mar 24	10 Mar 25	-
7	Inductively Coupled Plasma (ICP)		Agilent Technologies	System ID:G8015A G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	4 Nov 24	3 Nov 25	-
Equipment for Water Quality Analysis									
8	pH Meter	Phosphoric acid Temp	Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2401718-001-01	11 Mar 24	10 Mar 25	-
9	pH Meter		Mettler-Toledo	Seven Easy S20 / 1230525212	DKSH (Thailand) Ltd.	C07240167	9 Apr 24	8 Apr 25	-
10	Conductivity Meter	Conductivity	SI Analytics	Lab955 / 16300356	DKSH (Thailand) Ltd.	C24240057	11 Mar 24	10 Mar 25	-

บริษัท โพสโค ใต้แคด แอนนาลิตด์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์มาตรฐาน ISO/IEC 17025

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List of Instruments Certification for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
11	BOD Incubator	BOD	Arco	UC4-1320 / (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	24TM303	10 Feb 24	9 Feb 25	-
12	DO Meter		YSI	5100 / 11B101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25	-
13	COD Reactor (Heating Block)	COD	Hanna	H839800 / 1147807	Hanna Instruments (Thailand) Ltd.	HT-2417-0568	25 Apr 24	24 Apr 25	-
14	UV-VIS Spectrophotometer		Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP24-018	7 May 24	6 May 25	-
15	Analytical Balance (Readability 0.1 mg)	Oil & Grease	Mettler-Toledo	XSR204 / C117635043	Technology Promotion Association (Thailand-Japan)	24MM293	11 May 24	10 May 25	-
16	Analytical Balance (Readability 0.01 mg)	TDS	Mettler-Toledo	XSR205DU / C210685394	National Food Institute, Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25	-
17	Hot Air Oven	TSS	Memmert	UF55 / B216.1666	National Food Institute, Ministry of Industry, Thailand	2500116-001-01	8 Oct 24	7 Oct 25	-
18	Atomic Absorption Spectrophotometer (AAS)	Zinc, Hexavalent Chromium, Trivalent Chromium Pb, Hg, Ni, Cu, As, Cr	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research(TISTR)	MTC-ACL No 358/67	11 Mar 24	10 Mar 25	-
19	Inductively Coupled Plasma (ICP)		Agilent Technologies	System ID:G8015A G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	4 Nov 24	3 Nov 25	-

บริษัท โพสโค ใต้แคด แอนนาลิตด์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์มาตรฐาน ISO/IEC 17025

Page 2/1

List of Instruments Certification for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
20	Incubator	Coliform Bacteria	Binder	KB400 / 20200000015535	Technology Promotion Association (Thailand-Japan)	24TM647	1 Apr 24	31 Mar 25	-
21	Incubator		Memmert	IPP 260 / V616.0066	Technology Promotion Association (Thailand-Japan)	24TM650	2 Apr 24	1 Apr 25	-
22	Water Bath		Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	24TM29	10 Feb 24	8 Feb 25	-
23	Water Bath		Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	24TM30	10 Feb 24	8 Feb 25	-
24	Auto Clave		ALP	CL-40L / 807298	National Food Institute, Ministry of Industry, Thailand	2403982-001-01	7 Aug 24	6 Aug 25	-
25	Auto Clave		ALP	CL-40L / 808763	National Food Institute, Ministry of Industry, Thailand	2402281-001-01	2 Apr 24	1 Apr 25	-
26	Analytical Balance		OHAUS	PX623 / C236754745	DKSH (Thailand) Ltd.	2402419-001-01	19 Apr 24	18 Apr 25	-

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

Calibration Certificate

Certificate No.: 2402420-003-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: MS204TS/00
Serial No.: C252436235
ID No.: UAE.AIR.023/2566
Order No.: 2402420
Operation No.: 2402420-003
Date of Receipt: 19 April 2024
Date of Calibration: 19 April 2024

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

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognised 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-C5-009 Revision: 01 Date: 20-04-65

2000 Sukhumvit Road, 35 (Kusumpradit Road) Sukhumvit Road, Bangkok 10700
2000 Suk 35, Asoke Road, Bang 11 Khun Sukdarn, Bang 11 District, Bangkok 10700, Thailand
Tel: +662 2422 8500, Fax: +662 2422 8505



24 Apr 2024
MPE: $0.20g \pm 0.0003g$
 $50-100g \pm 0.0016g$
 $150-200g \pm 0.0020g$

Cert. No.: 2402420-003-01
Electronic Balance
METTLER TOLEDO
Model: MS204TS/00
S/N: C252436235
ID No: UAE-AIR-023/2566

Nominal Value		Standard Value	Average Reading	Error	Correction	Uncertainty (U)	U + Error	Judgment	Total Error (Judgment)
(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.000004	0.0000	Pass	0.0000
0.1	0.1000	0.1000	0.1000	0.0000	0.0000	0.000004	0.0000	Pass	0.0000
1	0.9998	1.0000	0.9998	-0.0002	0.0002	0.000007	0.0000	Pass	0.0002
5	4.9997	5.0000	4.9997	-0.0003	0.0003	0.000006	0.0000	Pass	0.0003
10	9.9992	10.0000	9.9992	-0.0008	0.0008	0.000012	0.0000	Pass	0.0008
20	19.9993	20.0000	19.9993	-0.0007	0.0007	0.000014	0.0000	Pass	0.0007
50	49.9998	50.0000	49.9998	-0.0002	0.0002	0.000013	0.0000	Pass	0.0002
100	99.9997	100.0000	99.9997	-0.0003	0.0003	0.000017	0.0000	Pass	0.0003
150	149.9994	150.0000	149.9994	-0.0006	0.0006	0.000022	0.0000	Pass	0.0006
200	199.9991	200.0000	199.9991	-0.0009	0.0009	0.000028	0.0000	Pass	0.0009

U+U₁ Limit Under Calibration
Remarks:

Calibration Report

Certificate No.: 2402420-003-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: MS204TS/00
Resolution: 0.0001 g
Serial No.: C252436235
ID No.: UAE.AIR.023/2566
Capacity: 220 g

Date of Calibration: 19 April 2024 **Page 2 of 3**

Environment Condition: Ambient Temperature: 23.7 ± 1.5 °C Relative Humidity: 65 ± 5.7 %
Place of Calibration: Room 206 Service 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-901-001 In-House Method based on OAS Lab 04 : 2019

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	P02111815	28 November 2024
Standard Weight Class E2	1-500g	15882	TCS	P02111825	28 November 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	628-H1	NFI.07H.018/23	Quality Reason:	QC24-0402	4 March 2025

3. This certification is traceable to SI UNIT
4. This certificate was certified only for the instrument we calibrated.
5. The 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	0.000074
200	0.000074

2. Off-Center Error:

A mass of 100 g was placed and moved to various position on pan.
The balance reading observed is given in the table.

1	2	3	4	5	6	(Average Diff) (g)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
199.9995	200.0006	200.0003	200.0005	199.9993	200.0005	0.0002

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

2000 Sukhumvit Road, 35 (Kusumpradit Road) Sukhumvit Road, Bangkok 10700
2000 Suk 35, Asoke Road, Bang 11 Khun Sukdarn, Bang 11 District, Bangkok 10700, Thailand
Tel: +662 2422 8500, Fax: +662 2422 8505



Calibration Report

Certificate No.: 2402420-003-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: MS204TS/00
Resolution: 0.0001 g
Serial No.: C252436235
ID No.: UAE.AIR.023/2566
Capacity: 220 g

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

Calibration Results: (Continued)

Calibration Range: 0-200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value	Standard Value	Average Reading	Correction	Uncertainty	Coverage Factor
(g)	(g)	(g)	(g)	(g)	
Unloaded	0.00000	0.00000	0.00000	0.000004	2.00
0.1	0.10000	0.10000	0.00000	0.000004	2.00
1	0.99998	1.00000	0.00002	0.000007	2.00
5	4.99997	5.00000	0.00003	0.000006	2.00
10	9.99992	10.00000	0.00008	0.000012	2.00
20	19.99993	20.00000	-0.00007	0.000014	2.00
50	49.99998	50.00000	-0.00002	0.000013	2.00
100	99.99997	100.00000	-0.00003	0.000017	2.00
150	149.99994	150.00000	-0.00006	0.000022	2.00
200	199.99991	200.00000	-0.00009	0.000028	2.00

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 %.

----- End -----

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

2000 Sukhumvit Road, 35 (Kusumpradit Road) Sukhumvit Road, Bangkok 10700
2000 Suk 35, Asoke Road, Bang 11 Khun Sukdarn, Bang 11 District, Bangkok 10700, Thailand
Tel: +662 2422 8500, Fax: +662 2422 8505



Calibration Certificate

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

Page 1 of 2

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XP6
Serial No.: 8322373893
ID No.: UAE-AIR.019/2556
Order No.: 2402420
Operation No.: 2402420-002
Date of Receipt: 19 April 2024
Date of Calibration: 19 April 2024

Calibrated by Mr. Phraphat Tuenjit
Scientist

Approved by *P. Janghant*
(Miss Preyasorn Jaengkarnit)
Vice President, Department of Laboratory Services
Responsible for the Technical Management Team

Date of Issue: 23 April 2024

The uncertainties are for a confidence probability of approximately 95%

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

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

2006 Soi 36, Anu Anant Road, Bang Yai Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +662 2542 0608, Fax: +662 2542 0545



21 Apr 2024 May 3, 2024

Cert No: 2402420-002-01
Electronic Balance
METTLER TOLEDO
Model: XP6
S/N: B392373893
ID No: UAE-AIR.019/2556

Equipment: Electronic Balance									
Model: XP6									
Serial No: 8322373893									
Nominal Value	Standard Value	Average Reading	Error	Correction	Uncertainty (2σ)	U+1 Error	U-1 Error	Judgment	Total Error < Judgment
(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(Pass/Fail)	(Pass/Fail)
0	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000001	Pass	Pass
0.01	0.000010	0.000009	-0.000001	0.000001	0.000001	0.000001	0.000001	Pass	Pass
0.05	0.000050	0.000049	-0.000001	0.000001	0.000001	0.000001	0.000001	Pass	Pass
0.10	0.000100	0.000099	-0.000001	0.000001	0.000001	0.000001	0.000001	Pass	Pass
0.15	0.000150	0.000149	-0.000001	0.000001	0.000001	0.000001	0.000001	Pass	Pass
0.17	0.000170	0.000169	-0.000001	0.000001	0.000001	0.000001	0.000001	Pass	Pass
0.20	0.000200	0.000199	-0.000001	0.000001	0.000001	0.000001	0.000001	Pass	Pass
1.50	1.000150	1.000149	-0.000001	0.000001	0.000001	0.000001	0.000001	Pass	Pass
5.50	5.000550	5.000549	-0.000001	0.000001	0.000001	0.000001	0.000001	Pass	Pass
6.50	6.000650	6.000649	-0.000001	0.000001	0.000001	0.000001	0.000001	Pass	Pass
6.00	5.999900	5.999899	-0.000001	0.000001	0.000001	0.000001	0.000001	Pass	Pass

UCL: Limit Under Calibration

Remarks:

Calibration Report

Certificate No.: 2402420-002-01
Equipment: Electronic Balance
Model: XP6
Serial No.: 8322373893
Capacity: 6.1 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g
ID No.: UAE-AIR.019/2556

Page 2 of 3

Date of Calibration: 19 April 2024
Environment Conditions: Ambient Temperature: 22.6 ± 1.8 °C Relative Humidity: 46 ± 6.0 %
Place of Calibration: Room 259 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-99-001 2. In-House Method based on OIML Lab 34 : 2009

2. Reference Standard:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	PC21118025	28 November 2024
Standard Weight Class E2	1-500g	15882	TCS	PC21118025	28 November 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	508-HS	NFI.8TH-015123	Quality Return	QK24-6492	4 March 2025

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

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
3	0.00000257
6	0.0000019

2. Off-Center Error:

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

The balance reading obtained is given in the table.

1	2	3
4	5	6
(g)	(g)	(g)
1.999981	1.999983	1.999980
1.999984	1.999985	1.999982
1.999986	1.999987	1.999984
1.999988	1.999989	1.999986
1.999990	1.999991	1.999988
1.999992	1.999993	1.999990
1.999994	1.999995	1.999992
1.999996	1.999997	1.999994
1.999998	1.999999	1.999996
1.999999	1.999999	1.999998
1.999999	1.999999	1.999999

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

2006 Soi 36, Anu Anant Road, Bang Yai Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +662 2542 0608, Fax: +662 2542 0545



Calibration Report

Certificate No.: 2402420-002-01
Equipment: Electronic Balance
Model: XP6
Serial No.: 8322373893
Capacity: 6.1 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g
ID No.: UAE-AIR.019/2556

Page 3 of 3

Date of Calibration: 19 April 2024
Calibration Results: (Continued)
Calibration Range: 0-6 g
Calibration Adjustment: Internal Calibration
3. Departure from Nominal Value:

Nominal Value	Standard Value	Average Reading	Correction	Uncertainty	Coverage Factor
(g)	(g)	(g)	(g)	(g)	#
Unloaded	0.000000	0.000000	0.000000	0.0000032	2.00
0.01	0.000010	0.000009	-0.000001	0.0000047	2.00
0.05	0.000050	0.000049	-0.000001	0.0000046	2.00
0.10	0.000100	0.000099	-0.000001	0.0000044	2.00
0.15	0.000150	0.000149	-0.000001	0.0000043	2.00
0.17	0.000170	0.000169	-0.000001	0.0000042	2.00
0.20	0.000200	0.000199	-0.000001	0.0000043	2.00
1.50	1.000150	1.000149	-0.000001	0.0000037	2.00
3.00	3.000300	3.000299	-0.000001	0.0000036	2.00
4.50	4.000450	4.000449	-0.000001	0.0000032	2.00
6.00	5.999900	5.999899	-0.000001	0.0000032	2.00

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 %.

----- End -----

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

2006 Soi 36, Anu Anant Road, Bang Yai Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +662 2542 0608, Fax: +662 2542 0545



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 DQF Services Co., Ltd.

เอกสารไม่ควบคุม

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	242.0	-0.28	0.18	2.00
279.45	279.5	-0.05	0.18	2.00
287.81	287.9	-0.09	0.18	2.00
334.06	333.9	0.16	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.1	0.49	0.18	2.00
445.94	445.6	0.34	0.18	2.00
453.66	453.3	0.36	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.0	0.59	0.18	2.00
637.98	638.7	-0.72	0.18	2.00
431.38	430.8	0.58	0.18	2.00
472.50	472.4	0.10	0.18	2.00
513.47	513.7	-0.23	0.18	2.00
528.88	529.1	-0.22	0.18	2.00
573.17	573.5	-0.33	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	685.1	-0.70	0.18	2.00
740.72	741.4	-0.68	0.20	2.00
748.55	749.1	-0.55	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.3	-0.02	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- * Indicates not TSI accredited

- End of Certificate -

เอกสารไม่ควบคุม
PM-768-02 9/04 01/1/2023

Certificate of Calibration

AquionRFIC : Anion (ID#1047)

This certificate is to verify that instrument below are calibrated

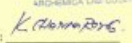
by Archemica Lab Co.,Ltd.

AquionRFIC S/N : 220380031

AS-DV S/N : 220360045



United Analyst and Engineering Consultant Co.,Ltd.

Operator Signature :  Date : Apr 23, 2024

(Mr.Channarong Khiao-Un)

Test Engineer

เอกสารไม่ควบคุม

Qualification Report

PM Check list,CM_OQ and PQ

AquionRFIC : Anion (ID#1047)

Aquion : Cation (ID#1048)

For

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

เอกสารไม่ควบคุม

PM Anion ID#1047

Preventive Maintenance
Check List

เอกสารไม่ควบคุม

Dionex Ion Chromatography
Preventive Maintenance Report

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

Instrument Detail

Instrument Model	Application
AquionRFIC	Anion
Instrument components	Serial Number
AquionRFIC	220380031
AS-DV	220380045

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
AS18	AG18	ADRS-600	-	EOC III KOH
				CR-ATC
Remark: มาตรฐาน Ion Column, Guard Column และ Suppressor ต้อง peak shift ๑๐๐ tail				

Perform By Archemica



Archemica

Date

23/Apr/2024

Customer

Date

เอกสารไม่ควบคุม



General ICS Maintenance Checklist

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

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AS-DV Autosampler Preventive Maintenance Checklist

Model	Serial number	Firmware Version
<input checked="" type="checkbox"/> AS-DV	220380045	1.6.0

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

Others / comments

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PM Cation ID#1048

Preventive Maintenance
Check List

เอกสารไม่ควบคุม

Dionex Ion Chromatography
Preventive Maintenance Report

Customer Organization	Name/ Department
United Analyst and Engineering Consultant Co., Ltd.	Khun.Suwan Kongthong / Lab
Engineer	Date
Mr.Channarong Khiao-Un	23.24/Apr/2024

Instrument Detail

Instrument Model	Application
Aquion	Cation
Instrument components	Serial Number
Aquion	220340349

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
CS12A	CG12A	CDER-600	-	-

Remark: ตรวจสอบและเปลี่ยนไส้กรอง, System ใช้งานได้ปกติ

Perform By Archemica

Archemica
23/Apr/2024
Date

Customer
23/Apr/2024
Date

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General ICS Maintenance Checklist

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

เอกสารไม่ควบคุม

CM OQ

Chromeleon
Operation QualificationThermoFisher
SCIENTIFIC

Chromeleon Operational Qualification

General Information

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

Overall Test Result: Passed

Comparison Format:

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

Operator's Signature / Date

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

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Chromeleon Operational Qualification, Part 1
Verification of Selected Results

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

Report Variable	Peak Name	Status
Offset (c0)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Slope (c1)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Correlation 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

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Chromeleon Operational Qualification, Part 1
Verification of Selected Results

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

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Chromeleon Operational Qualification, Part 1
Verification of Selected Results

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

Test Result: Passed

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

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

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

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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

Test Result: Passed

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Chromeleon Operational Qualification, Part 3

System Suitability Test: Comparison with Expected Results

Variable Category	Report Variable	Status
System Suitability Test Case	Number	ok
	Name	ok
	Ini.Condition	ok
	Eval. Formula	ok
	Operator	ok
	Statistics	ok
	Rounding	ok
	MinimumNumberOfInjections	ok
	MaximumNumberOfInjections	ok
	Channel	ok
	Peak	ok
	Ref. Value Formula 1	ok
	Ref. Value Formula 2	ok
	N.A.	ok
System Suitability Test Case Result	Ini. 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

เอกสารไม่ควบคุม

SOFTWARE OQ



Chromeleon

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

OVERALL TEST RESULT: PASS



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

เอกสารไม่ควบคุม

PQ Anion ID#1047

Performance Qualification

เอกสารไม่ควบคุม

TEST EQUIPMENT AND STANDARDS

ThermoFisher
SCIENTIFIC

Test Equipment

Equipment	Manufacturer	Model	Serial Number	Cal/Ver Date	Good Until
Multimeter	Fluke	289	27970244	N/A	N/A
Thermocouple	Fluke	K-Type	27970244	N/A	N/A
Balance	Mettler Toledo	A8204-S	1129361010	N/A	N/A
IC Qualification	Thermo Scientific	Test Box	21379153	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A

Standards/Chemicals

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

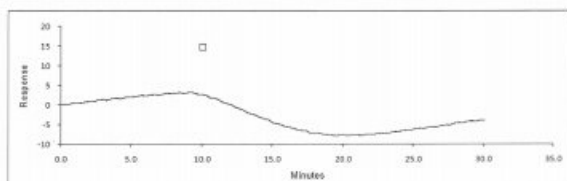


Field Service Representative Signature:	Customer Signature:
<i>R. Gammakorn</i>	<i>Surin</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

เอกสารไม่ควบคุม

NOISE AND DRIFT (CD)

ThermoFisher
SCIENTIFIC



Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	chrom:\desktop-c4fs3\7\ChromleonLocal\Archemica\Service Contract\Validate 2024\1PM1PQ 23-04-24\AnionIC OQ.seq\278.emp\ECD_1.channel

Noise and Drift

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

OVERALL TEST RESULT: PASS



Field Service Representative Signature:	Customer Signature:
<i>R. Gammakorn</i>	<i>Surin</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

เอกสารไม่ควบคุม

REPEATABILITY (CD)

ThermoFisher
SCIENTIFIC

Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	ChromleonLocal\Archemica\Service Contract\Validate 2024\1PM1PQ 23-04-24\AnionIC OQ

Peak Results

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

Repeatability

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

OVERALL TEST RESULT: PASS



Field Service Representative Signature:	Customer Signature:
<i>R. Gammakorn</i>	<i>Surin</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

เอกสารไม่ควบคุม

CARRYOVER (CD)

ThermoFisher
SCIENTIFIC

Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	Chromeleon\Local\Archemica\Service Contract\Validate 2024\1PM1PQ 23-04-24\Anion\IC OQ

Peak Results

Sample Name	Injection Volume (µL)	Retention Time (min)	Area
Reference Blank	25	0.265	0.053
High Standard	25	0.265	49.734
Carryover	25	0.265	0.051

Results

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

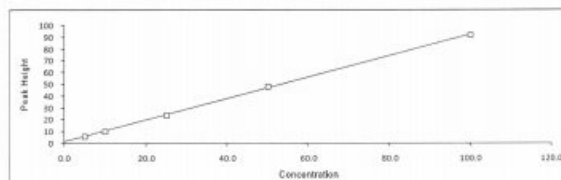
OVERALL TEST RESULT: PASS

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

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Carryover (CD) Report Page 1 of 1

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DETECTOR LINEARITY (CD)

ThermoFisher
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Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	Chromeleon\Local\Archemica\Service Contract\Validate 2024\1PM1PQ 23-04-24\Anion\IC OQ

Peak Results

Sample Name	Concentration	Peak Height	Calculated
Detector Linearity 01	5	5.872	4.82
Detector Linearity 02	10	10.299	9.68
Detector Linearity 03	25	23.794	24.52
Detector Linearity 04	50	48.473	51.65
Detector Linearity 05	100	91.855	99.34

Linearity

Test	Observed	OQ Limit	Result
r ²	0.999	≥ 0.999	PASS

OVERALL TEST RESULT: PASS

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

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Detector Linearity (CD) Report Page 1 of 1

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ELUENT GENERATOR TEST

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EG Current Test

Set Point (mM)	Expected (mA)	Reading (mA)	Deviation (mA)	OQ Limit (mA)	Result
1.00	1.6082	1.604	0.00	± 0.01	PASS
5.00	8.041	8.019	0.02	± 0.05	PASS
10.00	16.082	16.037	0.05	± 0.10	PASS
50.00	80.41	80.17	0.24	± 0.50	PASS
100.00	160.82	160.32	0.50	± 1.00	PASS

OVERALL TEST RESULT: PASS

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

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Eluent Generator Test Report Page 1 of 1

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IC PUMP FLOW RATE ACCURACY

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IC Pump Flow Rate

Set Point (mL/min)	Reading (mL/min)	Deviation (%)	OQ Limit (%)	Result
0.5	0.4995	0.100	± 2.0	PASS
1.0	0.999	0.10	± 2.0	PASS

OVERALL TEST RESULT: PASS

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

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IC Pump Flow Rate Accuracy Report Page 1 of 1

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TEMPERATURE ACCURACY

ThermoFisher
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Column Compartment

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

OVERALL TEST RESULT: PASS



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

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Temperature Accuracy Report Page 1 of 1

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OQ EXCEPTIONS AND COMMENTS

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N/A

Remainder of Page Intentionally Blank



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

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OQ Exceptions and Comments Report Page 1 of 1

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OQ REVIEW AND COMPLETION

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These Operational Qualification Results should be reviewed by the Customer. If the qualification is accepted, both the Customer and the Service Representative should sign the Operational Qualification Results, below.

OPERATIONAL QUALIFICATION RESULTS

Based upon the actual results obtained, this Operational Qualification **PASSED** the acceptance criteria described in the Operational Qualification in the Installation Checklist procedure.

Service Representative

A Field Service Representative signature below confirms the completion of all aspects of the Operational Qualification and have concluded that the system has been successfully verified to be operating as required.

Customer

A Customer signature below confirms the completion of all aspects of the Operational Qualification have been completed and that the system has been successfully verified to be operating as required.



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

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เอกสารไม่ควบคุม

Agilent
CrossLab
From Insights to OutcomesAgilent 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.



เอกสารไม่ควบคุม

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	CN11021007
Instrument System Site and Location	Instrument Room

List System Component Product Numbers	List the Serial Numbers of each Component
1. G3440A	CN11021007
2.	
3.	
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 Browser Interface or 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 PMA, 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.

เอกสารไม่ควบคุม

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	NA.	NA.
Back detector output	NA.	22.0
AUX detector output	NA.	NA.
Pressure decay test	Expected test result	Actual test result
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	NA.

เอกสารไม่ควบคุม

7890 Parts List Table

The following kits are recommended for capillary and surge 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 MML PTV & VI)	5188-6495	7890A/B	
MML 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	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/adjustable FID base	19244-80560	7890A/B	
High Temperature .018-inch FID Jet for capillary column with packed/adjustable 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 sp	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.

Service Completion

Service request number 6005748380 Date service completed 21Feb2024

Agilent signature Phuwansai Yokragul Customer signature

Total number of pages in this document 9

เอกสารไม่ควบคุม



Request No. 25-67 / 0275

MTC. ACL. No. 358 / 67

CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"

Model AA240FS, Serial No. MY13160001

2. Working standard solution "Inorganic Ventures"

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

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

3 Sol Udomsuk 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260

CALIBRATION PROCEDURE : 1. Performance Verification of Atomic Absorption Spectrophotometer

(W-500-02-30)

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

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

CALIBRATION DATE : 2 February 2024

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

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

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

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

Calibrated by Atipat

(Mr. Atipat Ratana)

Approved by

(Miss Subadda Deawong)

Director of Analytical Chemistry Laboratory

Ref. 2015267020100454001

Issued Date : 11 March 2024

The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FMIL.MTC.002 Rev.4

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Request No. 25-67 / 0275

1 / 5

MTC. ACL. No. 358 / 67

CALIBRATION DATA

1. Noise Level

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

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MTC. ACL. No. 358 / 67

2. Precision

Element	Conc. (mg/L)	Absorbance										Ave. Abs.	SD	WRS2
Cd	0.02	0.0078	0.0076	0.0069	0.0075	0.0071	0.0070	0.0076	0.0074	0.0077	0.0067	0.007	0.0004	5.15
	0.30	0.1008	0.1007	0.0999	0.0997	0.1000	0.0996	0.1008	0.1002	0.1005	0.0999	0.100	0.0005	0.96
	0.70	0.2301	0.2306	0.2277	0.2305	0.2310	0.2295	0.2290	0.2293	0.2305	0.2296	0.230	0.0010	0.42
	0.10	0.0094	0.0093	0.0093	0.0098	0.0094	0.0095	0.0090	0.0090	0.0094	0.0090	0.009	0.0003	2.75
Cr	0.30	0.0041	0.0036	0.0021	0.0038	0.0021	0.0026	0.0021	0.0023	0.0020	0.0021	0.002	0.0006	2.75
	0.70	0.0500	0.0500	0.0500	0.0524	0.0499	0.0511	0.0509	0.0512	0.0515	0.0504	0.051	0.0008	1.63
	0.05	0.0061	0.0062	0.0064	0.0061	0.0069	0.0069	0.0061	0.0062	0.0064	0.0061	0.006	0.0003	5.00
	0.30	0.0419	0.0411	0.0402	0.0407	0.0405	0.0406	0.0399	0.0400	0.0399	0.0400	0.040	0.0006	1.58
Cu	0.70	0.0960	0.0960	0.0960	0.0959	0.0967	0.0955	0.0952	0.0952	0.0951	0.0955	0.096	0.0005	0.48
	0.10	0.0096	0.0101	0.0103	0.0100	0.0099	0.0096	0.0106	0.0099	0.0105	0.0102	0.010	0.0003	3.38
	0.50	0.0424	0.0415	0.0428	0.0427	0.0421	0.0426	0.0413	0.0430	0.0421	0.0419	0.042	0.0006	1.33
	1.00	0.0830	0.0839	0.0847	0.0834	0.0832	0.0820	0.0839	0.0838	0.0837	0.0845	0.084	0.0008	0.92
Fe	0.30	0.0078	0.0074	0.0078	0.0078	0.0076	0.0078	0.0077	0.0078	0.0078	0.0077	0.008	0.0001	1.71
	0.70	0.0278	0.0273	0.0271	0.0267	0.0270	0.0264	0.0274	0.0273	0.0269	0.0269	0.027	0.0004	1.45
	1.50	0.0551	0.0548	0.0552	0.0555	0.0567	0.0546	0.0544	0.0549	0.0549	0.0547	0.055	0.0004	0.64
	0.05	0.0114	0.0107	0.0110	0.0103	0.0108	0.0108	0.0112	0.0107	0.0109	0.0108	0.011	0.0003	3.15
Mn	0.30	0.0650	0.0649	0.0649	0.0651	0.0646	0.0646	0.0649	0.0646	0.0640	0.0648	0.065	0.0003	0.48
	0.70	0.1463	0.1465	0.1459	0.1471	0.1475	0.1474	0.1487	0.1473	0.1462	0.1468	0.147	0.0008	0.56
	0.10	0.0095	0.0100	0.0096	0.0103	0.0102	0.0096	0.0100	0.0095	0.0097	0.0096	0.010	0.0003	3.04
	0.50	0.0413	0.0433	0.0438	0.0444	0.0430	0.0437	0.0444	0.0437	0.0438	0.0434	0.044	0.0005	1.09
Ni	1.00	0.0812	0.0820	0.0834	0.0829	0.0818	0.0829	0.0831	0.0835	0.0816	0.0819	0.082	0.0008	0.99
	0.05	0.0374	0.0377	0.0373	0.0377	0.0374	0.0377	0.0373	0.0371	0.0371	0.0374	0.037	0.0002	0.61
	0.30	0.1985	0.1993	0.1975	0.1992	0.1979	0.1988	0.1995	0.1985	0.1974	0.2004	0.199	0.0009	0.47
	0.70	0.4027	0.4031	0.4019	0.4021	0.4023	0.3981	0.4042	0.4025	0.3993	0.3997	0.402	0.0019	0.45

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MTC. ACL. No. 358 / 67

3. Trueness

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

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

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

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

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

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

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Fe	0.100	0.106	0.005	4.60	± 0.014
	0.500	0.482	-0.018	3.55	± 0.016
	1.006	0.968	-0.038	3.75	± 0.029

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

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

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Mn	0.0905	0.090	0.000	0.85	± 0.005
	0.3031	0.306	0.003	1.12	± 0.007
	0.7023	0.698	-0.004	0.62	± 0.014

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Ni	0.101	0.098	-0.003	2.90	± 0.013
	0.508	0.502	-0.006	1.16	± 0.018
	1.012	0.962	-0.051	5.02	± 0.052

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Zn	0.050	0.005	-0.005	9.39	± 0.013
	0.303	0.324	0.021	7.04	± 0.015
	0.707	0.675	-0.032	4.52	± 0.019

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

which gives a level of confidence of approximately 95%

Calibrated by Atipat

(Mr. Atipat Ratana)

Approved by Sula

(Miss Suladda Deawong)

Director of Analytical Chemistry Laboratory

Issued Date : 11 March 2024

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE
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Agilent 5110 and 5100 ICP-OES
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.

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

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- For customers using HP applications, the instrument should be returned to its standard sample introduction system.
- 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 additional or special procedures and/or parts for the instrument service, then these must be ordered separately and charged as a repair, which may incur additional

Service Engineer's Responsibilities

- Only complete/printout pages that relate to the system being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "✓" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM service in the order of the tasks listed.
- Complete the Service Review section together with the customer.

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System Information

Instrument system name and ID	ICP 5110 VDV
Instrument system site and location	UAE / 3rd Floor Laboratory
List system component product numbers	List the serial numbers of each component
1. G 8015 A	1. MY 18030001
2. G 8016 A	2. 1801-01988
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

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

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General Preparation

- ☒ Discuss any specific questions or issues with the customer prior to starting.
- ☒ Review the instrument logbook.
- ☒ Perform general external inspection of system for cleanliness.
- ☒ Check for proper installation of safety-related parts, assemblies, sensors etc.
- ☒ Check for required firmware/software updates and verify with customers if they would like it installed.
- ☒ For HP application systems, if standard sample introduction system was not installed, ask the customer to install it. *N/A*
- ☒ Run Instrument Performance test and record results in Instrument Performance Test Results Table - Pre PM.

Inspect and clean the 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.

G8481A Cooling water system

- ☐ Section NOT Applicable
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir
- ☒ Remove, clean and reinstall water inlet metal mesh filter.
- ☒ Re fill with Polyclear cooling fluid.
- ☒ Clean the cooling system Air filter and the condenser by compressed air or vacuum cleaner.

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Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

SPS 3 Auto Sampler

- ☒ Section 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

- ☒ Section 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 PFC 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

AVS 4, 6, 7

- ☒ Section 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

Instrument Adjustment

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.
- ☒ Run Instrument Performance Test and 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 and record the result in the Instrument Test Results Table
 - ☐ Subsystem Communications Test
 - ☐ Air Flow

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- ☒ Water Flow
- ☒ Gas Flows
- ☒ RF Generator
- ☒ Camera Test
- ☒ Optics Test
- ☒ Nebulizer Test

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	4100.6	8364.8	4375.0	8400.8
Mn 257.610 nm SRBR	11064.7	31849.1	12801.7	30846.2
Al 396.152 nm SBR	7.5	14.9	9.9	16.8
K 766.491 nm SBR	5.1	36.8	6.4	29.7

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

Instrument Test Results Table

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

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

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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	224.540 VAC	224.710 VAC
Mains Current	0.204 A	0.184 A
Instrument Temperature	22.6 °C	23.7 °C
RF Air Flow (sensor speed)	15.0 Hz	15.0 Hz
Plasma Exhaust Temperature	No measurement	26.7 °C
Water Flow Oscillator	No measurement	1.64 L/min
Water Flow Detector	1.06 L/min	1.06 L/min
Water Inlet Temperature	18.0 °C	18.0 °C
Polychromator Temperature	35.0 °C	35.0 °C
CCD Temperature	-39.8 °C	-39.8 °C
Thermal Stabilizer	35.0 °C	35.0 °C
Argon Supply Pressure	671.94 kPa	627.33 kPa
Purge Gas Supply Pressure*1	674.30 kPa	645.40 kPa
Option Gas Supply Pressure*1	N/A kPa	N/A kPa
Nebulizer Flow	No measurement	0.78 L/min
Nebulizer Back Pressure	No measurement	164.63 kPa
Plasma Gas Flow	No measurement	11.92 L/min
Auxiliary Gas Flow	No measurement	1.00 L/min
RF Power	No measurement	1200 W
RF Supply Current	No measurement	8.663 A
RF Supply Voltage	No measurement	184.660 V

*1 If option installed

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Preventive Maintenance Checklist

ICP-OES Parts List Table

Part description	Part Number	Product /Model # where used	Quantity Consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Polyclear Cooling Fluid	G8292-80010	G8481A	
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/T	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 engineers 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	

Restore system

For HF applications, ask the customer to reinstall their sample introduction system.

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

- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☐ Complete the Service Engineer Comments section below if there are additional comments.

Issued: 3 February 2017, Revision: 1.1 Copyright © 2017
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Agilent Technologies

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

- ☒ Review the service and any test results with the customer.
- ☒ If the Instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

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.

Other Important Customer Web Links

How to get information on your product:

- ☒ Literature Library - <http://www.agilent.com/en-us/products/icp-oes/icp-oes-systems/5110-icp-oes#literature>
- ☒ Need to know more? - <http://www.agilent.com/crosslab/university/>
- ☒ Need technical support, FAQs? - <http://www.agilent.com/en-us/support/landing/icp-oes>
- ☒ Need supplies? - www.agilent.com/chem/supplies

Service Completion

Service request number 6005625287 Date service completed 30 Nov 2017

Agilent signature 40mg4 T Customer signature 2/11/17

Document part number: G8014-90075

Issued: 3 February 2017, Revision: 1.1 Copyright © 2017
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Agilent Technologies

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 Test Before PM
Test Completed On 11/30/2022 9:35:32 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

เอกสารไม่ควบคุม

Resolution Test

Pass

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.62
As (188.980 nm)	≤ 8.20	6.20
C (193.027 nm)	≤ 11.50	8.35
Mo (202.032 nm)	≤ 8.20	6.41
Cr (206.158 nm)	≤ 13.40	9.04
Zn (213.857 nm)	≤ 8.70	6.62
Pb (220.353 nm)	≤ 9.50	7.13
Co (228.615 nm)	≤ 17.20	11.71
Ba (230.424 nm)	≤ 9.40	7.21
Mn (257.610 nm)	≤ 13.30	9.50
Mn (260.568 nm)	≤ 20.30	14.33
Cr (267.716 nm)	≤ 11.00	8.14
Cu (324.754 nm)	≤ 25.00	18.88
Cu (327.395 nm)	≤ 14.20	11.24
Sr (338.071 nm)	≤ 33.50	24.47
Ba (455.403 nm)	≤ 44.00	33.88
Sr (460.733 nm)	≤ 36.00	17.22
Ba (493.408 nm)	≤ 36.00	25.48
Ba (614.171 nm)	≤ 42.00	25.47
Ar (675.283 nm)	≤ 74.00	59.82
K (766.491 nm)	≤ 80.00	64.94

เอกสารไม่ควบคุม

Sensitivity Test					
Pass					
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	147.7	1156.5	55.5
Se (196.026 nm)	≥ 41.0	SRBR	111.1	1195.3	97.7
Zn (213.857 nm)	≥ 1421.0	SRBR	4100.6	51959.5	159.6
Pb (220.353 nm)	≥ 46.0	SRBR	192.5	2808.6	185.7
Mn (257.610 nm)	≥ 3518.0	SRBR	11064.7	264165.0	567.6
Al (396.152 nm)	≥ 3.4	SBR	7.5	49047.9	5770.5
Ba (493.408 nm)	≥ 34.0	SBR	107.4	1887710.3	17407.5
K (766.491 nm)	≥ 1.8	SBR	5.1	100905.9	16626.4
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	234.9	3056.4	152.9
Se (196.026 nm)	≥ 159.0	SRBR	218.1	3865.1	271.6
Zn (206.200 nm)	≥ 234.0	SRBR	1306.5	15850.4	144.5
Zn (213.857 nm)	≥ 1743.0	SRBR	8364.0	183037.8	476.4
Cd (214.439 nm)	≥ 4227.0	SRBR	7718.5	143240.2	342.8
Pb (220.353 nm)	≥ 320.0	SRBR	575.3	14465.2	580.4
Mn (257.610 nm)	≥ 10525.0	SRBR	31842.1	1411257.3	1958.9
Cr (267.716 nm)	≥ 1048.0	SRBR	4492.1	183110.6	1632.2
Cu (324.754 nm)	≥ 19.0	SBR	46.2	371487.5	7862.9
Al (396.152 nm)	≥ 6.0	SBR	14.9	278447.4	17562.6
Ba (493.408 nm)	≥ 60.0	SBR	190.6	10061527.3	52519.8
K (766.491 nm)	≥ 24.0	SBR	36.8	1922163.4	50858.1

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เอกสารไม่ควบคุม

Precision Test		
Pass		
Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.82
Se (196.026 nm)	≤ 2.60	0.71
Zn (213.857 nm)	≤ 1.50	0.43
Pb (220.353 nm)	≤ 2.60	0.78
Mn (257.610 nm)	≤ 1.50	0.60
Al (396.152 nm)	≤ 1.50	0.48
Ba (493.408 nm)	≤ 1.50	0.89
K (766.491 nm)	≤ 1.50	0.42
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.57
Se (196.026 nm)	≤ 1.50	0.78
Zn (206.200 nm)	≤ 1.50	0.61
Zn (213.857 nm)	≤ 1.50	0.51
Cd (214.439 nm)	≤ 1.50	0.56
Pb (220.353 nm)	≤ 1.50	0.52
Mn (257.610 nm)	≤ 1.50	0.54
Cr (267.716 nm)	≤ 1.50	0.54
Cu (324.754 nm)	≤ 1.50	0.69
Al (396.152 nm)	≤ 1.50	0.91
Ba (493.408 nm)	≤ 1.50	0.85
K (766.491 nm)	≤ 1.50	1.22

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เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100S/110 VDM ICP-OES	
Instrument ID	G8011A/GB015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	PM Functional test	
Test Completed On	11/30/2022 11:43:36 AM	
Result Summary		
Subsystem Communications Test	Pass	
Air Flow Test	Pass	
Water Flow Test	Pass	
Gas Flows Test	Pass	
RF Generator Test	Pass	
Camera Test	Pass	
Optics Test	Skipped	
Advanced Valve System Test	Skipped	
Resolution Test	Skipped	
Sensitivity Test	Skipped	
Precision Test	Skipped	
Subsystem Communications Test	Pass	
Air Flow Test	Pass	
30% Air Flow (relative speed)	75% Air Flow (relative speed)	
14.00	19.00	
Water Flow Test	Pass	
RF Water Flow (L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.44	1.06	18.51

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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	163.37	2.00	1.99	108.49
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	112.85	18.00	17.91	23.46
RF Generator Test			Pass		
RF Power Supply Test		Passed			
RF Power Supply (V)		147.437			
RF Oscillator Test		Passed			
RF Oscillator Frequency (MHz)		0.000			
Work Coil Current (A)		45.069			
RF Power Supply Current (A)		1.997			
Camera Test			Pass		
	Integration Time (ms)	Standard Deviation	Status		
Electronic Offset Test	1000	5.305	Passed		
Dark Current Test	6000	0.578	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 PM Performance test
Test Completed On 11/30/2022 12:10:42 PM

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 Pass
Advanced Valve System Test Skipped
Resolution Test Pass
Sensitivity Test Pass
Precision Test Pass

Optics Test

Radial
Intensity 5674608
Wavelength 737.212

Axial
5023476
737.212

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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	6.09
C (193.027 nm)	≤ 11.50	8.29
Mo (202.032 nm)	≤ 8.20	6.30
Cr (206.198 nm)	≤ 13.40	9.05
Zn (213.857 nm)	≤ 8.70	6.77
Pb (220.353 nm)	≤ 9.50	7.02
Co (228.615 nm)	≤ 17.20	11.67
Ba (230.424 nm)	≤ 9.40	7.39
Mn (257.610 nm)	≤ 13.30	9.48
Mn (260.568 nm)	≤ 20.30	14.25
Cr (267.716 nm)	≤ 11.00	7.94
Cu (324.754 nm)	≤ 25.00	18.99
Cu (327.395 nm)	≤ 14.20	11.33
Sr (338.071 nm)	≤ 33.50	24.44
Ba (455.403 nm)	≤ 44.00	33.86
Sr (460.733 nm)	≤ 36.00	17.51
Ba (493.408 nm)	≤ 36.00	25.56
Ba (614.171 nm)	≤ 42.00	24.96
Ar (675.283 nm)	≤ 74.00	59.38
K (766.491 nm)	≤ 80.00	65.63

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เอกสารไม่ควบคุม

Sensitivity Test**Pass****Radial**

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	147.8	1149.3	54.8
Se (196.026 nm)	≥ 41.0	SRBR	111.6	1222.8	101.0
Zn (213.857 nm)	≥ 1421.0	SRBR	4375.0	52592.3	143.7
Pb (220.353 nm)	≥ 46.0	SRBR	199.8	2744.4	166.5
Mn (257.610 nm)	≥ 3518.0	SRBR	12801.7	265561.3	496.0
Al (396.152 nm)	≥ 3.4	SBR	9.9	52888.6	4873.6
Ba (493.408 nm)	≥ 34.0	SBR	154.6	2287291.6	14698.1
K (766.491 nm)	≥ 1.8	SBR	6.4	106701.6	14350.9

Axial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	242.4	3170.1	154.8
Se (196.026 nm)	≥ 159.0	SRBR	226.1	4134.5	289.3
Zn (206.200 nm)	≥ 234.0	SRBR	1126.6	13782.0	146.5
Zn (213.857 nm)	≥ 1743.0	SRBR	8400.8	177166.3	442.5
Cd (214.439 nm)	≥ 4227.0	SRBR	7001.9	125884.2	321.6
Pb (220.353 nm)	≥ 320.0	SRBR	536.3	12909.3	532.6
Mn (257.610 nm)	≥ 10625.0	SRBR	30846.2	1287989.0	1738.8
Cr (267.716 nm)	≥ 1048.0	SRBR	4396.0	167335.6	1424.4
Cu (324.754 nm)	≥ 19.0	SBR	52.1	373890.7	7033.1
Al (396.152 nm)	≥ 6.0	SBR	16.8	268357.7	15112.4
Ba (493.408 nm)	≥ 60.0	SBR	225.2	10173441.5	44971.7
K (766.491 nm)	≥ 24.0	SBR	38.7	1874136.2	46065.7

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เอกสารไม่ควบคุม

Precision Test**Pass****Radial**

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.60
Se (196.026 nm)	≤ 2.80	0.84
Zn (213.857 nm)	≤ 1.50	0.29
Pb (220.353 nm)	≤ 2.60	0.59
Mn (257.610 nm)	≤ 1.50	0.28
Al (396.152 nm)	≤ 1.50	0.26
Ba (493.408 nm)	≤ 1.50	0.59
K (766.491 nm)	≤ 1.50	0.23

Axial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.71
Se (196.026 nm)	≤ 1.50	0.43
Zn (206.200 nm)	≤ 1.50	0.46
Zn (213.857 nm)	≤ 1.50	0.37
Cd (214.439 nm)	≤ 1.50	0.48
Pb (220.353 nm)	≤ 1.50	0.48
Mn (257.610 nm)	≤ 1.50	0.74
Cr (267.716 nm)	≤ 1.50	0.26
Cu (324.754 nm)	≤ 1.50	0.51
Al (396.152 nm)	≤ 1.50	0.45
Ba (493.408 nm)	≤ 1.50	0.81
K (766.491 nm)	≤ 1.50	0.84

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เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2401718-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsak 41, Sukhumvit Road,
Bangchack, Prakhong, Bangkok 10280

Page 1 of 5

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.0102553
Order No.: 2401718
Operation No.: 2401718-001
Date of Receipt: 27 February 2024
Date of Calibration: 11 March 2024

Calibrated by: Mr. Manas Somsak
Approved by: 
(Mr. Phraphat Tuxat)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 12 March 2024

The uncertainty 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 inability to recognize 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: 28-04-65

Calibration Report

Certificate No.: 2401718-001-01
Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.0102553
Resolution: 0.01 pH ; 1 mV
Type: Bench top

Date of Calibration: 11 March 2024 Page 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (23.4 ± 1.5) °C Relative Humidity: (51 ± 3) %
Condition of Equipment: Good Condition

Condition of this Results of Calibration

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

2. Reference Standards : Certified Reference Material

Instrument	Serial / ID No.	Manufacturer	Certificate No.	Due Date	
2.1 DC Voltage Calibrator	2190007	Fuke	2190007	14 June 2024	
2.2 Digital Thermometer	2190007	Fuke	CC 605570-01	30 October 2024	
2.3 Thermo-Hgno Meter	NF18TH 01402	testo	CC 605553-01	3 April 2024	
Certified Reference Material		Lot No.	Manufacturer	Ref. N	Expiry Date
2.4 pH buffer 4.006 (Primary pH buffer Solution)	688043	CPAchem	P-016-L3		13 April 2025
2.5 pH buffer 6.865 (Primary pH buffer Solution)	688043	CPAchem	P-017-L3		13 April 2025
2.6 pH buffer 10.01 (Primary pH buffer Solution)	688044	CPAchem	P-020-L3		13 April 2024
2.7 pH buffer 7.00 (Standard pH buffer Solution)	030109	HACH LANGE GmbH	S1190004		16 October 2025

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

3.1 Instruments Nq 2.1	through	NIST-1815-1725 Laboratory Accreditation of Calibration No.0068
3.2 Instruments Nq 2.2 and 2.3	through	NIST-1815-1725 Laboratory Accreditation of Calibration No.0061
3.3 Certified Reference Material Nq 2.4 to 2.6	traceable to	Primary measurement method: Manual cell using calibrated thermometer, barometer, and microbalance. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17024 and ISO/IEC 17025
3.4 Certified Reference Material Nq 2.7	traceable to	PTB Certificate No. PTB-PH04-8535058423 and Certificate No. PTB-PH06-55530029-02 (PTB: Physikalisch-Technische Bundesanstalt, Braunschweig, Germany)

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

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

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

Calibration Report

Certificate No.: 2401718-001-01
Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.0102553
Resolution: 0.01 pH ; 1 mV
Type: Bench top

Date of Calibration: 11 March 2024 Page 3 of 5

Calibration Results:

1. Calibration of pH Meter (Manual Temperature Compensation at 20 °C)

(offset value before adjust: -0.4 mV)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (± mV)	Coverage Factor (K)
		mV	pH		
0	-414.121	414	0.00	0.58	2.00
2	-296.814	296	0.00	0.58	2.00
4	-177.464	178	0.00	0.58	2.00
6	-59.190	59	0.00	0.58	2.00
7	0.001	0	7.00	0.58	2.00
8	-59.159	-59	8.00	0.58	2.00
10	-177.461	-177	10.00	0.58	2.00
12	-296.811	-296	12.00	0.58	2.00
14	-414.118	-414	14.00	0.58	2.00

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

Equipment: pH Electrode
Type: Combined Electrode
Manufacturer: METTLER TOLEDO
Model: InLab Solids
Serial No.: 3066501
ID No.: N/A

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

Certified Value (pH 10 (pH))	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (K)
	pH	mV			
4.006	4.01	186	-	0.0071	2.85
7.001	7.00	13	88.8	0.0066	2.85
10.010	10.01	-160	97.2	0.0066	2.85
6.865	6.87	21	-	0.0074	2.85

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

Calibration Report

Certificate No.: 2401718-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.0102553
Manufacturer: METTLER TOLEDO

Date of Calibration: 11 March 2024 Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute

Environment Condition: Ambient Temperature: 23 °C ± 1 °C
Relative Humidity: 51 % ± 2 %

Condition of this results of Calibration:

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

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 087768	06-Jun-24	T6TR
Potentiometer Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 3410502

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

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

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

6. Condition of Calibrated Item :

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

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

Calibration Report

Certificate No.: 2401718-001-01

Equipment: Digital Thermometer with RTD (pH Meter)

Resolution: 0.1 °C Model: SevenEasy pH
Serial No.: 1231155210 ID No.: UAE-WAT-0102553
Manufacturer: METTLER TOLEDO

Date of Calibration: 11 March 2024

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Calibration point: 15.0, 25.0 and 35.0 °C

Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.
- Description of probe, model: N/A, S/N: N/A
- Dimension of probe: Diameter 4 mm, Length 120 mm.
- Sheath material: Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	14.998	0.1	0.099
25.1	24.998	0.1	0.099
35.1	34.997	0.1	0.099

Note

* UUC*: Unit Under Calibration

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

End

FCS-012 Revision: 01 Date: 23-04-85

2533 Sukhumvit Road, Bangchak, Bangkok 10260 Thailand
2533 Sukhumvit Road, Bangchak, Bangkok 10260 Thailand
Phone: +66 2039 7000 Email: info@dksh.com Website: www.dksh.com/thailand

Certificate of Calibration

Equipment: pH METER Certificate No.: C07240167
Model: SevenEasy Issued Date: 9 April 2024
Serial No. (or ID.): 1230525212 (UAE.WAS.003/2553) Job No.: WO-00024208
Manufacturer: METTLER TOLEDO Page: 1 of 3
Electrode Serial No.: 1156863 Model: InLab Solids Brand: METTLER TOLEDO
Condition: In Condition

Customer: United Address and Engineering Consultant Company Limited
3 Soi Udomsuk 41 Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260 Thailand

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

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

Calibration By: Miss. Oranwan Khlaiphichai

Calibration Date: 9 April 2024

The Method used: In house method, CAL-WI-58, base on ASTM E 70-07

Traceability: This certificate is traceable to SI Units, Sample Test is assured through primary measurement method Harned cell, through CPAchem Ltd. (ISO/IEC 17034) Certificate No. 938377, 931985, 931984 And pH Scale traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Industrial Foundation Electrical and Electronics Institute Certificate No. CA28230350EA

Oranwan Khlaiphichai
(Miss Oranwan Khlaiphichai)
Person in charge

Nitinun Srirawan
(Mr. Nitinun Srirawan)
Authorized signatory

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

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CAL-FM-C07-14, 9 Apr 2024

Certificate No.: C07240167 Page 2 of 3

Calibration Results:

pH Scale

Input (mV)	pH Meter Reading			Uncertainty of Measurement (mV)	Coverage Factor (k)
	(mV)	Error (mV)	(pH)		
414.12	414	-0.12	0.00	0.58	2.00
354.96	355	0.04	1.00	0.58	2.00
295.8	296	0.20	2.00	0.58	2.00
236.64	237	0.36	3.00	0.58	2.00
177.48	178	0.52	4.00	0.58	2.00
118.32	118	-0.32	5.00	0.58	2.00
59.16	59	-0.16	6.00	0.58	2.00
0	0	0.00	7.00	0.58	2.00
-59.16	-59	0.16	8.00	0.58	2.00
-118.32	-118	0.32	9.00	0.58	2.00
-177.48	-177	0.48	10.00	0.58	2.00
-236.64	-236	0.64	11.00	0.58	2.00
-295.8	-296	-0.20	12.00	0.58	2.00
-354.96	-355	-0.04	13.00	0.58	2.00
-414.12	-414	0.12	14.00	0.58	2.00

Unit Address and Engineering Consultant Company Limited
DKSH Technology Limited
2533 Sukhumvit Road, Bangchak, Bangkok 10260 Thailand
Phone: +66 2039 7000 Email: info@dksh.com Website: www.dksh.com/thailand

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CAL-FM-C07-14, 9 Apr 2024

Certificate No.: C07240167 Page 3 of 3

Practical slope and zero point*

The three-point calibration using three standard buffer solutions; pH 4.008, pH 6.985 and pH 9.997

*During calibration, display of pH meter reading; pH 4.00, pH 7.00 and pH 10.01

The practical slope of the pH electrode; 57.01 (mV/pH), 96.37%

The zero point of the pH electrode; 6.88 (pH)

Sample Test Results

Standard Buffer Solution (pH)	Unit Under Calibration (pH)	Difference (pH)	Uncertainty of Measurement (pH)	Coverage Factor (k)
4.008	3.99	-0.018	0.0070	2.00
6.985	7.00	0.015	0.0091	2.00
9.997	10.02	0.023	0.0074	2.00

* Calibration Marked * Not TISI Accredited * in this Certificate have been included for completeness.

The End of Certificate

Unit Address and Engineering Consultant Company Limited
DKSH Technology Limited
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เอกสารไม่ควบคุม
CAL-FM-C07-14, 9 Apr 2024

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00024208

ชนิดเครื่องมือ: pH METER

รุ่น: SevenEasy

หมายเลขเครื่อง: 1230525212

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
09 Apr 2024			09 Apr 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ซองใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ เปิด - ปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Spectrophotometer					
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่ (Battery Backup) ≥ 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ควบคุมเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	9. แสงอุลตราไวโอเลต (UV $< 3,000$ hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. แสงที่มองเห็น (Visible $< 5,000$ hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. ซองวัดหลายสีรวม (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>	
pH Meter and Conductivity Meter					
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันฝุ่น Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาตั้งอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
Turbidimeter					
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นไม่มีค่า (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (≥ 2.5 ไม่น้อย 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
Automatic titrator					
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาวะ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เซ็นเซอร์แนบมา :

Miss.Orawan Khlaiphloi
Service Engineer

DKSH Technology Limited
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เอกสารไม่ควบคุม
CAL-FM-R31-03; 20 Jul 2022



Certificate of Calibration

Equipment: Digital Thermometer with Probe
Model: SevenEasy pH
Serial No.: 1230525212
Manufacturer: METTLER TOLEDO
ID No.: UAE.WAS.003/2553

Certificate No.: C15240373
Issued Date: 09 April 2024
Job No.: WO-00024208
Page: 1 of 2
Condition: In Condition

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

Environment Condition: Temperature: 22 °C \pm 3 °C
Humidity: 50 %RH \pm 20 %RH
Voltage: 220 VAC \pm 10 %

Calibration Place: Thermo-Hygro Laboratory, DKSH Technology Limited.
2533 Sukhumvit Road, Bangkok,
Prakanong, Bangkok 10260 Thailand

Calibration By: Mr. Nateskam Miljit
Calibration Date: 09 April 2024
The Method used: In house method, CAL-WI-19, by comparison with standard thermometer
Traceability: This certificate is traceable to the International System of Unit maintained by Quality Reborn Co.,Ltd. (QR) Certificate No. QR23-1073

(Mr. Nateskam Miljit)
Person in charge

(Mr. Pramote Ramrong)
Authorized signatory

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

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เอกสารไม่ควบคุม
CAL-FM-C15-14; 06 Dec 2022

Certificate No.: C15240373

Page: 2 of 2

Reference standard equipment:

Equipment	Certificate no	Cal. date	Next Cal. date
Digital Thermometer with Probe	QR23-1073	2 May 23	2 May 24

Calibration Results:

Without Adjustment

Sensor Type: RTD

Diameter (mm) 4

Length (mm): 135

Channel: -

Immersion (mm): 110

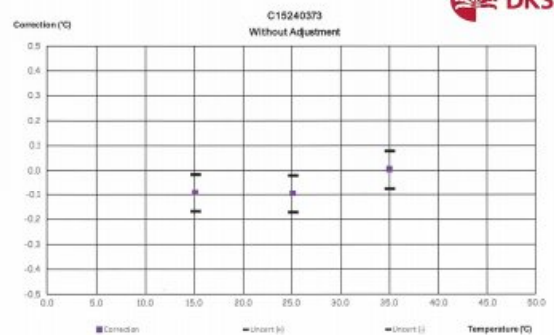
Calibrate Point (°C)	STD. Reading (°C)	UUC Reading (°C)	Correction of UUC (°C)	Uncertainty (\pm °C)
15.0	15.010	15.1	-0.090	0.076
25.0	25.006	25.1	-0.094	0.076
35.0	35.004	35.0	0.004	0.076

The End of Certificate

DKSH Technology Limited
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เอกสารไม่ควบคุม
CAL-FM-C15-14; 06 Dec 2022



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เอกสารไม่ควบคุม

ใบตรวจสอบสภาพเครื่องมือวัดอุณหภูมิ

Equipment: Digital Thermometer with Probe
Serial No.: 1230525212

Certificate No C15240373
Model: SevenEasy pH

ตรวจสอบ (รับ)	รายการตรวจเช็ค	ตรวจสอบ (ส่ง)	หมายเหตุ
9-Apr-2024		9-Apr-2024	
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ
General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. Adapter / Power supply 220 / 110 VAC	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Main Switch	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การทำงาน Selector Key	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การแสดงผล Display	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. Battery	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพ Sensor (In / Ex)	<input checked="" type="checkbox"/>

ชื่อเจ้าหน้าที่ :

Mr. Nateekam Mitjit
Service Engineer

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 สุขุมวิท ถนนสุขุมวิท กรุงเทพมหานคร 10260
Phone: +66 2533 7300 Email: info.calibration@dksh.com Website: www.dksh.com/certification-thailand
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เอกสารไม่ควบคุม



Certificate of Calibration

Equipment: CONDUCTIVITY METER
Model: Lab 955
Serial No. (or ID.): 16300396
Manufacturer: SI Analytic
Electrode Serial No.: 16070067
Condition: In Condition

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

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

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

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

Calibration By: Mr. Pongpiet Suebchantha
Calibration Date: 11 March 2024
The Method used: In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14
Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 960753, 890591, 890593

(Mr. Pongpiet Suebchantha)
Person in charge

(Mr. Nitinun Srihawan)
Authorized signatory

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

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Phone: +66 2533 7300 Email: info.calibration@dksh.com Website: www.dksh.com/certification-thailand
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เอกสารไม่ควบคุม

CAL-FM-C24-03: 12 Sep 2022

Certificate No.: C24240057 Page: 2 of 2

Calibration Results:

Before Adjustment

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

After Adjustment ; at 1413 µS/cm

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty (±)
Conductivity Solution	Reading		(k)	
25.000 µS/cm	25.9 µS/cm	-0.900 µS/cm	2.00	0.21 µS/cm
1413.0 µS/cm	1413 µS/cm	0.0 µS/cm	2.00	9.0 µS/cm
111.3 mS/cm	107.5 mS/cm	3.8 mS/cm	2.00	0.67 mS/cm

The End of Certificate

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 สุขุมวิท ถนนสุขุมวิท กรุงเทพมหานคร 10260
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เอกสารไม่ควบคุม

CAL-FM-C24-03: 12 Sep 2022



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-39 FAX: 0-2719-9484



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

Certificate of Calibration

Equipment: BOD Incubator
Manufacturer: Arco
Model: UC4-1320
Serial No.: 13URC49013201
ID No.: UAE.WAO.015/2561

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangkok, Phrakhanong,
Bangkok 10260
Lab Floor 2

Location: Lab Floor 2

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

Calibrated by: Tawatchai Pama

Approved by:
Approved Signatory

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

Issue Date: 19 February 2024

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

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เอกสารไม่ควบคุม



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

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

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.1	19.9	0.37	0.72	1.4	2

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

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

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม




TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUJANLUANG, SUJANLUANG BANGKOK 10250
TEL. 0-2717-3866 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) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method

Tested by : Walalek Sirthean

Approved by : 
Approved Signatory

() Ponthiphe Tameyakul
() Unnopphol Harachal
(✓) Sathip Meangmai

Issue Date : 22 February 2024

เอกสารไม่ควบคุม



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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เอกสารไม่ควบคุม



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

Cert. No.: 24TM303
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	MY59003411	23LM208	TPA	27 Dec 2024

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

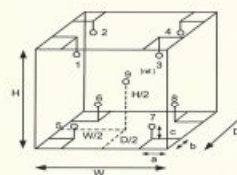
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

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



Probe Installation Details :

a = 10 cm
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	20RTD-2/1
2	20RTD-2/2
3	20RTD-2/3
4	20RTD-2/4
5	20RTD-2/5
6	20RTD-2/6
7	20RTD-2/7
8	20RTD-2/8
9 (ref.)	20RTD-2/9

เอกสารไม่ควบคุม

Certificate No. : HIT-2417-0568

Page : 1 of 2

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater

Meter Model : HB39800-Q2 Serial No. : 1147807

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 : RE240681

Ambient Temperature : (25 ± 2)°C Relative Humidity : (50 ± 15)%RH

Customer name : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomesuk 41, Sukhumvit Rd., Bangchak,
Phra Khanong, Bangkok 10260

Received date : 22 April 2024

Calibrate date : 23 April 2024

Issue date : 25 April 2024

Calibrated Location : Hanna Instruments (Thailand) Ltd.

Calibration Procedure : This calibration was conducted by using in-house calibration procedure
CP-04 by using certified reference standard instruments.

Calibrated by :  Mr. Pichit Pethong
□ Mr. Channarong Soinak

Approved by : 
Mr. Asan 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).

เอกสารไม่ควบคุม

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	0.49

Unit : °C

(1A)	(2A)	(3A)	(4A)	(5A)
148.901	149.249	149.950	150.042	149.186
(1B)	(2B)	(3B)	(4B)	(5B)
149.724	149.578	149.852	150.100	150.117
(1C)	(2C)	(3C)	(4C)	(5C)
149.863	149.799	150.233	149.847	149.977
(1D)	(2D)	(3D)	(4D)	(5D)
149.550	149.666	149.958	149.744	149.819
(1E)	(2E)	(3E)	(4E)	(5E)
150.044	149.869	149.361	149.973	149.654

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 **

เอกสารไม่ควบคุม



CERTIFICATE OF CALIBRATION

Certificate No. : SP24-018 Page 1 of 5

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

Address : 3 Soi Udomesuk 41, Sukhumvit Road, Bangchak, Phra Khanong, Bangkok 10260

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009


ID No. : UAE.WAT.020/2558

Received Date : 7 May 2024

Calibration Date : 7 May 2024

Issue Date : 9 May 2024

Condition Instrument : Good

Calibrated by : 
(Mr. Tanawat Ritidach)
Technical Manager

Approved by : 
(Ms. Chordicha Sangsarn)
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 scale of measurement realized at the corresponding national
standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

เอกสารไม่ควบคุม

PHE-700-62 Rev. 1/15/2021



REPORT OF CALIBRATION

Certificate No. : SP24-018 Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

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

Certified Reference Materials :

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

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 60 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

PHE-700-62 Rev. 1/15/2021

DQE Services Co.,Ltd.

DQE Services

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

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

ISO 9001:2015

Calibration JAK-001

ISO 17025:2017

Calibration JAK-002

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.0000	0.0000	0.0028	2.00
	0.5780	0.5747	0.0033	0.0031	2.00
	1.0484	1.0438	0.0046	0.0029	2.00
	2.1876	2.1832	0.0044	0.0080	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5595	0.5581	0.0014	0.0034	2.00
	1.0239	1.0231	0.0008	0.0035	2.00
	2.1230	2.1219	0.0011	0.0080	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5230	0.5184	0.0046	0.0030	2.00
	0.9633	0.9614	0.0019	0.0029	2.00
	1.9753	1.9731	0.0022	0.0070	2.00
546.1	0.0000	0.0000	0.0000	0.0028	2.00
	0.5181	0.5150	0.0031	0.0031	2.00
	1.0002	0.9964	0.0038	0.0033	2.00
	1.9973	1.9914	0.0059	0.0088	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5517	0.5485	0.0032	0.0030	2.00
	1.0803	1.0772	0.0031	0.0030	2.00
	2.0373	2.0293	0.0080	0.0080	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5591	0.5565	0.0026	0.0031	2.00
	1.0518	1.0482	0.0036	0.0030	2.00
	1.9274	1.9202	0.0072	0.0079	2.00

เอกสารไม่ควบคุม

PM-708-02 B01 1/1/2021

DQE Services Co.,Ltd.

DQE Services

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

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

ISO 9001:2015

Calibration JAK-001

ISO 17025:2017

Calibration JAK-002

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 4 of 5

Photometric Accuracy :

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

เอกสารไม่ควบคุม

PM-708-02 B01 1/1/2021

DQE Services Co.,Ltd.

DQE Services

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

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

ISO 9001:2015

Calibration JAK-001

ISO 17025:2017

Calibration JAK-002

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	242.0	-0.28	0.18	2.00
279.45	279.5	-0.05	0.18	2.00
287.81	287.9	-0.09	0.18	2.00
334.06	333.9	0.16	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.1	0.49	0.18	2.00
445.94	445.6	0.34	0.18	2.00
453.66	453.3	0.36	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.0	0.59	0.18	2.00
637.98	638.7	-0.72	0.18	2.00
431.38	430.8	0.58	0.18	2.00
472.50	472.4	0.10	0.18	2.00
513.47	513.7	-0.23	0.18	2.00
528.88	529.1	-0.22	0.18	2.00
573.17	573.5	-0.33	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	685.1	-0.70	0.18	2.00
740.72	741.4	-0.68	0.20	2.00
748.55	749.1	-0.55	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.3	-0.02	0.18	2.00

เอกสารไม่ควบคุม

PM-708-02 B01 1/1/2021

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- * Indicates not TISI accredited

- End of Certificate -

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES

53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

TEL.0-2717-3000-29 FAX.0-2718-9484

ILAC-MRA

ISO 17025:2017

Calibration JAK-002

Certificate of Calibration

Cert.No.: 24NM293

Page.: 1 of 3

Equipment : Electronic Balance

Manufacturer : Mettler Toledo

Model : XSR204

Serial No. : C117635043

ID No. : UAE.WAS.012/2564

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phraekhanong,
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 Rutanaprapachai

Approved by : Kunchit

Approved Signatory

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 : 2405-01660C-2
Procedure used :-

Cert.No.: 24MM293
Page: 2 of 3

Calibration were conducted using in-house calibration procedure CP-0801 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 request 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	0.27	2.03
200	200.0001	-0.0001	0.31	2

After Adjustment :

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

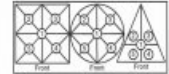
Applied Weight	Standard Deviation of Reading (g)
(g)	
100	0.00007
200	0.00007

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2405-01660C-2

Cert.No.: 24MM293
Page: 3 of 3



Maximum difference between off-center and central loading

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)	(g)
+0.0002	-0.0001	0.0000	+0.0002	0.0000	0.0003

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.0000	0.0000	0.15	2.13
5	5.0000	0.0000	0.15	2.13
10	10.0000	0.0000	0.15	2.11
20	20.0000	0.0000	0.19	2.03
50	50.0001	-0.0001	0.19	2.06
80	80.0001	-0.0001	0.19	2.04
100	100.0002	-0.0002	0.27	2.03
120	120.0001	-0.0001	0.29	2
200	200.0001	-0.0001	0.31	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 %.

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เอกสารไม่ควบคุม



มูลนิธิศูนย์วิจัยและพัฒนาอาหาร
ศูนย์บริการห้องปฏิบัติการอาหารอุตสาหกรรม
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Certificate

Certificate No.: 2402283-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 SOI UDOMSUK 41, SUKHUMVIT ROAD,
Bangchack, Prakanong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR2050U

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.Jerawat Prapawattipong
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-C5-009 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม



มูลนิธิศูนย์วิจัยและพัฒนาอาหาร
ศูนย์บริการห้องปฏิบัติการอาหารอุตสาหกรรม
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR2050U
Serial No.: C210685394
Capacity: 200 g
Resolution: 0.0001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Page 2 of 4

Date of Calibration: 2 April 2024
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-M-081 (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	PD3640335	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	609 HI	NFI 87H 016/23	Quality Reborn	Q024-0343	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	0.000032
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	100.0000	100.0000	0.0001

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

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2402283-002-01

Equipment: Electronic Balance
Model: XSR250U
Serial No.: C210665394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 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/-g)	Coverage Factor k
Unloaded	0.00000	0.00000	0.00000	0.0000006	2.00
0.001	0.001003	0.001011	-0.00001	0.0000009	2.00
0.005	0.005003	0.005006	-0.00001	0.0000009	2.00
0.01	0.010002	0.010004	-0.00001	0.0000009	2.00
0.05	0.050006	0.050009	-0.00001	0.0000006	2.00
0.1	0.100011	0.100006	0.00001	0.0000011	2.00
0.5	0.500016	0.500001	0.00001	0.0000015	2.00
1	1.000003	1.000002	-0.00001	0.0000016	2.00
2	2.000022	2.000001	0.00001	0.0000017	2.00
5	5.000017	5.000002	0.00001	0.0000020	2.00
10	10.000009	10.000000	0.00001	0.0000026	2.00
20	20.000031	20.000000	0.00001	0.0000037	2.00
30	30.000040	30.000001	0.00001	0.0000050	2.00
50	50.000028	50.000002	0.00001	0.0000068	2.00
80	80.000048	80.000002	0.00001	0.000011	2.00

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

2500116-001-01
2500116-001-01, Unit Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2402283-002-01

Equipment: Electronic Balance
Model: XSR250U
Serial No.: C210665394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 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: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (+g/-g)	Coverage Factor k
90	90.00010	90.00001	0.00009	0.000015	2.00
100	100.00006	100.00001	0.00005	0.000015	2.00
110	110.00007	110.00001	0.00006	0.000016	2.00
120	120.00009	120.00000	0.00009	0.000017	2.00
130	130.00009	130.00000	0.00009	0.000019	2.00
140	140.00014	140.00000	0.00014	0.000020	2.00
150	150.00009	150.00001	0.00008	0.000020	2.00
160	160.00009	160.00001	0.00008	0.000022	2.00
170	170.00012	170.00001	0.00011	0.000023	2.00
200	200.00006	200.00002	0.00004	0.000028	2.00

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

***** End *****

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

2500116-001-01
2500116-001-01, Unit Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

เอกสารไม่ควบคุม



Calibration Certificate

Certificate No.: 2500116-001-01

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

Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: CHAMBER (Hot Air Oven)

Manufacturer: MEMMERT

Model: 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.Yuthin 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-C5-009 Revision: 01 Date: 20-04-65

2500116-001-01
2500116-001-01, Unit Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

เอกสารไม่ควบคุม



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 TIAS 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	MYS7003188	TE 670486-01	8 June 2025	NATIONAL FOOD INSTITUTE
RTD	CH4301-208/ RTD4301-209				

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibration 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 -
Fan 49%
Not Available
2. Result of Calibration : ☒ Without adjustment ☐ After adjustment

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

2500116-001-01
2500116-001-01, Unit Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

เอกสารไม่ควบคุม



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 λ/λ

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.

Revision: 10.00, Issued: November 2021

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เอกสารไม่ควบคุม

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 barbs
- ☒ 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

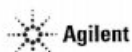
- ☐ Check that external optical surfaces are clean – Clean or replace as required.
- ☐ Use SVD and perform **Mono Wavelength Correction**.
- ☐ Use SVD and perform **Slit Calibration**.
- ☐ Use SVD and perform **Grating Squareness Diagnostic**.
- ☐ Use SVD and perform **Zero Order Offset/Mono Correction**.
- ☐ 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

- ☐ Check and clean the end windows on the workhead.
- ☐ Check safety interlock operation.

Analytical performance for Furnace systems

- ☐ 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.

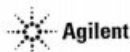
NOTE: The autosampler requires no extra lubrication throughout its lifetime.
For further details refer to the SPS 4 service manual G8410-90090.

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 0 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

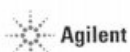
- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the 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		
Flame optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	44 %
Flame performance test with 5 ppm copper sample		
Air /acetylene, mixing paddle removed	Abs value > 0.5	0.7401
Air /acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	0.5 % 0.50
Deuterium furnace optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	44 %
Deuterium furnace performance test with 25 ppb copper sample (327.4 nm)		
Precision %RSD	< 4.0 %	1.1 %
Abs value	> 0.15	0.17
Zeeman furnace analytical performance: 25 ppb copper sample (327.4 nm)		
Precision %RSD	< 4.0 %	1.1 %
Abs value	> 0.10	0.17
MSR%	> 70 %	71 %

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AA consumable and parts list table

Part Description	Product/Model # where used	PM supplied or Consumable	Instrument Type
Test Solution - Cu ppm solution	6610030100	50 55 140 240 280	PM supplied Common
Test Solution - Blank solution	5190-7021	50 55 140 240 280	PM supplied Common
Copper, 1000 ug/mL, 100mL	5190-8279	50 55 140 240 280	* Common
KOL kit 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 Nets	9910024800	50 55 140 240 280	consumable Flame
Capillary Tube Hvac Net (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 pt) (D2)	6310003400	GTA120	PM supplied Furnace
Shroud (D2)	6310003500	GTA120	PM supplied Furnace
Zeeman electrode kit (1 pt)	6310003500	GTA120	PM supplied Furnace
Zeeman shroud	6310003600	GTA120	PM supplied Furnace
O-ring PSD rinse bottle	6910023500	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 details you wish to note as part of performing the installation of other items of interest for the customer, please write in this box.

Service Completion

Service request number: 6006371115 Date service completed: 24 January 2024
Agilent signature: Worawit T. Customer signature: [Signature]
Total number of pages in this document: 13

SVD Results Report



Report ID: Diagnostic Start Time: 7/24/2024 9:24:55 Diagnostic End Time: 7/24/2024 10:06:00
Customer: Service Engineer: Worawit T.
Address: Contact Details:

Instrument Configuration

Configuration:

Serial Number: MY13160001 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: 62609.832 D2 Run Hours: 49136.000
Zero Wavelength Offset: 30.148 D2 Serial Number: not set 1
Mono Correction: 0.765 D2 Install Date: 1/1/1970
Flame Hours: 29802.416 D2 Original Intensity: 1.000
D2 Last Intensity: 475.000

Frequency:

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

Result: **Passed**

Power Supply:

Averaging Period: 30.0
Datapoint Count: 20

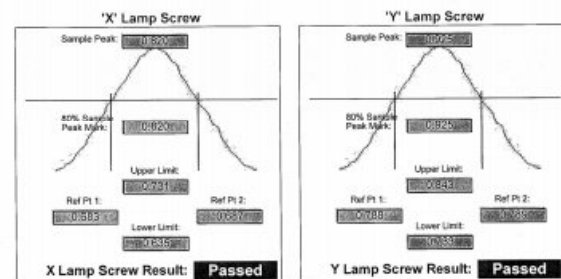
	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	12.19	13.20	Passed
-12.00 V Rail	-13.20	-11.90	-10.80	Passed
5.00 V Rail	4.50	5.05	5.50	Passed
310.00 V Rail	279.00	320.00	341.00	Passed

Optics

Beam Balance:

Lamp Type: Copper
Lamp Socket Used: 3

Peak Selected: 324.80
Lamp Alignment: **Performed**



Grating Squareness:

Lamp Element(s): Copper
Lamp Turret Position: 3
Lamp Current(mA): 4.00
Slit Width(nm): 0.5
1st Order Wavelength(nm): 324.80
Lamp Alignment: **Performed**

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	Passed
First Order	324.45	324.75	325.15	Passed
Second Order	649.23	649.52	649.97	Passed

Wavelength Repeatability:

Lamp Used: Copper
Peak Used(nm): 324.750
Connected to Socket: 3
Lamp Current(mA): 4
Slit Width(nm): 0.2
Slit Height: Normal
Lamp Alignment: **Performed**
Lower Limit(nm): 324.768
Upper Limit(nm): 324.888
(Approach from Zero Order) (Approach from end)
Sample 1: 324.828 Sample 2: 324.828
Sample 3: 324.828 Sample 4: 324.823
Sample 5: 324.823 Sample 6: 324.823
Sample 7: 324.823 Sample 8: 324.823
Sample 9: 324.823 Sample 10: 324.823
Mean: 324.825 Standard Deviation: 0.002
Result: **Passed**

Report Generated At: 1/24/2024 10:11:18 AM

4

SVD Results Report
เอกสารไม่ควบคุม

Mechanical

Wavelength Drive:

Passed

Slit Drive:

Passed

Turret Drive:

Passed

Auto Burner Adjuster Drive:

Untested

Miscellaneous

Signal Processing Linearity:

Calculate Mode: New Calc Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	114	261	297	Passed
S1	156	165	191	Passed
S2	271	296	332	Passed
S3	474	507	579	Passed
S4	825	918	1008	Passed
S5	1435	1528	1754	Passed
S6	2498	2769	3053	Passed
S7	4347	4752	5313	Passed

Interlocks:

Burner Fitted: **Working** Flame Detect: **Working**
N2O Burner Fitted: **Untested** GCU Active: **Working**
Flame Shield Closed: **Working** Oxidant Pressure: **Working**
Gas Control Fitted: **Untested** Oxidant Changeover: **Untested**
Pressure Release Bung Fitted: **Working** Ignition: **Working**
Liquid Trap Fitted: **Working**

Report Generated At: 1/24/2024 10:11:18 AM

5

SVD Results Report
เอกสารไม่ควบคุม

Auto Lamp Recognition:

Lamp 1: Uncoded Lamp/Not Connected
Lamp 2: 87 - Silver/Cadmium/Lead/Zinc(UltraAA) (Ag/C Lamp 6: Not Supported
Lamp 3: 14 - Copper (Cu)
Lamp 4: Uncoded Lamp/Not Connected
Lamp 5: Not Supported
Lamp 6: Not Supported
Lamp 7: Not Supported
Lamp 8: Not Supported

Result: **Passed**

GTA Temperature Monitoring:

Not Performed

Notes:

PM 24 Jan 2024

Signatures:

David 24/1/24 Worawit T. 24/1/24
Date Date Date Date

Report Generated At: 1/24/2024 10:11:18 AM

6

SVD Results Report
เอกสารไม่ควบคุม

Sequential by time report

1/24/2024 11:46 AM
Page 1 of 1

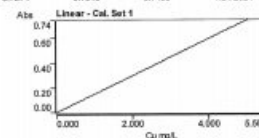
SpectraAA

Analyst
Date Started 1/24/2024 11:33 AM GMT: 1/24/2024 4:39 AM
Worksheet
Comment Cu 5 PPM Sense check
Method: Cu
Computer name DESKTOP-RJUFFS
Serial Number: MY13160301

Method: Cu (Ppm)

Sample ID	Conc. mg/L	%RSD	Mean Abs
CAL ZERO	0.000	55.0	0.0003
	Readings		
	0.0002	0.0002	0.0004

STANDARD 1	5.000	1.7	0.7419
	Readings		
	0.7214	0.7515	0.7488



Curve Fit = Linear
Characteristics Conc = 0.028 mg/L
r = 1.0000
Calculated Conc = 0.000 5.000
Residuals = 0.000 0.000

Abs = 0.14833 x C + 0.00028

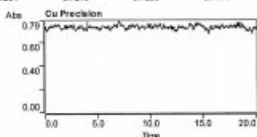
Sample 001	4.980	0.7	0.7401
	Readings		
	0.7454	0.7399	0.7349

เอกสารไม่ควบคุม

Analyst
Date Started: 1/24/2024 11:47 AM GMT: 1/24/2024 4:47 AM
Worksheet: Cu 5 PPM Precision
Comment:
Method: Cu
Computer name: DESKTOP-R8UJF8S
Serial Number: MY13180001

Method: Cu (Flame)

Sample ID	Rep Abs	%RSD	Mean Abs
Cu Precision	0.723	0.5	0.7232
Readings			
0.7221	0.7186	0.7226	0.7283
0.7201	0.7213	0.7266	0.7174
			1/24/2024



เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG (BANGKOK 10250)
TEL. 0-2717-3000-29 FAX. 0-2719-9434



Certificate of Calibration

Cert. No.: 24TM647
Page: 1 of 3

Equipment : Incubator
Manufacturer : Binder
Model : KB 400 E6
Serial No. : 20200000015535
ID No. : UAE.MC.018/2564
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Sol Udomsak 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory (302)
Received Order : 01 April 2024
Calibration Date : 01 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanapongpatboon
Approved by :
() Ponpan Palpim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 7 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



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2404-0003OC-6
Cert. No.: 24TM647
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)

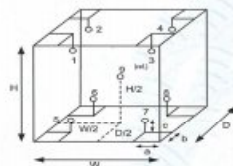
Result of Calibration :- (") Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	24	24
REL.Humid. (%)	54	57
AC Supply (Volt)	221	223

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



Probe Installation Details :

Dimension of Chamber :

a =	10	cm	D =	0.48	m
b =	10	cm	W =	0.65	m
c =	10	cm	H =	1.2	m
			Capacity =	0.37	m ³

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2404-0003OC-6
Cert. No.: 24TM647
Page: 3 of 3

Result of Calibration :-
Function of UUC* : Temperature Source
Fresh air setting : Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor
35.0	35.0	35.0	0.035	0.19	0.22	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.000	35.022	34.841	34.851	35.027	35.011	35.023	35.028	35.007	0.30

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

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

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

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

UUC* : Unit Under Calibration

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

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

-o00-

เอกสารไม่ควบคุม



Certificate of Calibration

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

Equipment : Incubator
Manufacturer : Memmert
Model : IPP 260
Serial No. : V616.0066
ID No. : UAE.MIC.032/2559
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory (302)
Received Order : 01 April 2024
Calibration Date : 02 - 03 April 2024
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
Calibrated by : Man Pattanapongpalboon
Approved by :
() Ponpan Palpim
(✓) Suwit Imjai
() Kunchit Promprat
Issue Date : 7 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



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

Cert. No.: 24TM650
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	MY49023632	23LM122	TPA	26 Jul 2024

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

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

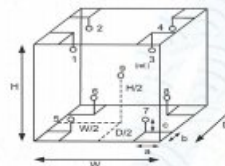
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

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



Probe Installation Details :

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

Dimension of Chamber :

D = 0.50 m
W = 0.84 m
H = 0.80 m
Capacity = 0.26 m³

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

เอกสารไม่ควบคุม



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

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

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
25.0	25.0	25.0	0.053	0.78	1.3	2
36.0	36.0	36.0	0.14	0.57	0.93	2

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

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

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



Certificate of Calibration

Cert. No.: 24TM29
Page : 1 of 3

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L416.0606
ID No. : UAE.MIC.002/2560
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 10 February 2024
Calibration Date : 10 February 2024
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
Calibrated by : Kritsda Malee

Approved by :
() Pornthippa Tameyakul
(✓) Unnopphol Harachai
() Suwit Imjai

Issue Date : 19 February 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2402-0232OC-2
Cert. No.: 24TM29
Page : 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

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

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

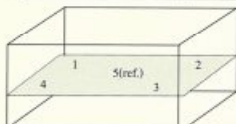
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	25	51	220
Finished of Calibration	25	50	221



Front

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

เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2402-0232OC-2
Cert. No.: 24TM29
Page : 3 of 3

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			1	2	3	4	5 (ref.)	
44.5	44.4	44.4	44.508	44.469	44.502	44.521	44.527	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
44.5	0.15	0.074	2

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
55/44 PATTAKARN ROAD 505 18, SUANLUANG, SUANLUANG BANGKOK 10256
TEL: 0-2715-3000-29 FAX: 0-2719-9484



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

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : Arco
Model : UC4-1320
Serial No. : 13URC45013201
ID No. : UAE,WAQ.015/2581
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phraekhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 10 February 2024
Calibration Date : 10 February 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Tawatchai Pama

Approved by :
() Pongthippa Tameyakul
(✓) Unnopphol Hirachai
() Suwit Imjai

Issue Date : 19 February 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2402-0234OC-1
Cert. No.: 24TM303
Page : 3 of 3

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.1	19.9	0.37	0.72	1.4	2

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

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

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



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

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

Procedure Used >

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

Condition of this result of calibration

1. Reference standard instrument:-

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

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

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

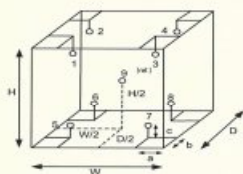
Result of Calibration :- (°) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

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

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



Probe Installation Details :

Dimension of Chamber :

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

D = 0.62 m
W = 1.2 m
H = 1.2 m
Capacity = 0.89 m³

เอกสารไม่ควบคุม



Calibration Certificate

Certificate No.: 2403982-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomeuk 41, Sukhumvit Road, Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Autoclave
Manufacturer: ALP
Model: CL-40L
Serial No.: 807298
ID No.: UAE.MIC.019/2560
Order No.: 2403982
Operation No.: 2403982-001
Date of Receipt: 7 August 2024
Date of Calibration: 7 August 2024

Calibrated by Mr. Manas Somsak Specialist
Approved by P. Jaenghachit (Miss Preeyaporn Jaengkamnit)
Vice President, Department of Laboratory Services
Responsible for the Technical Management Team

Date of Issue: 14 August 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-C5-009 Revision: 01 Date: 20-04-65

2000 ถนนสุขุมวิท 35 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2000 Soi 35, Asoi Avenue Road, Bang Khun Si Subdistrict, Bangkok District, Bangkok 10110, Thailand
Tel: +662 042 0500 Fax: +662 042 0500

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2403982-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 807298
Resolution: 1 °C ID No.: UAE.MIC.019/2560
Manufacturer: ALP

Date of Calibration: 7 August 2024

Page 3 of 3

Calibration point: 121 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	28.0	55	234
Max	30.0	65	236

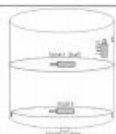


Table 1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.2 is REF)			Uncertainty ± (°C)
	Std. # 1	Std. # 2 (Ref)	Std. # 3	
121	122.43	122.44	122.44	0.65

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	Min (°C)	Max (°C)	Average (°C)	MPa	Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
122	122	122	122	0.11	0.065	0.031	0.14

Note

The quoted uncertainty include " Stability " and " Loading effect (25% of Uniformity)".

UUC* = UME Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.

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

----- End -----

P. Jaenghachit
14 Aug 2024

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

2000 ถนนสุขุมวิท 35 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2000 Soi 35, Asoi Avenue Road, Bang Khun Si Subdistrict, Bangkok District, Bangkok 10110, Thailand
Tel: +662 042 0500 Fax: +662 042 0500

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2403982-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 807298
Resolution: 1 °C ID No.: UAE.MIC.019/2560
Manufacturer: ALP

Date of Calibration: 7 August 2024

Page 2 of 3

Location: MICROBIOLOGY LABORATORY (301), UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Environment Condition: Ambient Temperature (29 ± 1) °C
Relative Humidity (60 ± 5) %
Line Voltage (225 ± 1) Volt

Condition of this results of Calibration:

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

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with RTD (Data Logger)	OH-CP-RHTDMP-140	Q88335	TE 670230-01	25-Feb-25	NATYONAL FOOD INSTITUTE
	OH-CP-RHTDMP-140	R59951	TE 670231-01	25-Feb-25	NATYONAL FOOD INSTITUTE
	OH-CP-RHTDMP-140	R59916	TE 670232-01	25-Feb-25	NATYONAL FOOD INSTITUTE

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. This standard does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical.

7. Condition of Calibrated Item : Good

UUC Description : Setting program function sterilization : STERILIZE/NORMAL
Time of sterilization 15 Minute At 121 °C

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

P. Jaenghachit
14 Aug 2024

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

2000 ถนนสุขุมวิท 35 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2000 Soi 35, Asoi Avenue Road, Bang Khun Si Subdistrict, Bangkok District, Bangkok 10110, Thailand
Tel: +662 042 0500 Fax: +662 042 0500

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2402281-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

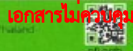
Page 1 of 3

Equipment: Autoclave
Manufacturer: ALP
Model: CL-40L
Serial No.: 808763
ID No.: UAE.MIC.026/2563
Order No.: 2402281
Operation No.: 2402281-001
Date of Receipt: 2 April 2024
Date of Calibration: 2 April 2024

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

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

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



Calibration Report

Certificate No.: 2402281-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 808763
Resolution: 0.1 °C ID No.: UAE.MIC.026/2563
Manufacturer: ALP
Date of Calibration: 2 April 2024

Page 2 of 3

Location: LABORATORY, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Environment Condition: Ambient Temperature (25 ± 1) °C
Relative Humidity (55 ± 7) %
Line Voltage (225 ± 5) Volt

Condition of this results of Calibration:

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

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with RTD (Data Logger)	HiTemp140-2	854918	TE 630383-01	8 April 2024	NATIONAL FOODS INDUSTRIES
	HiTemp140-2	525601	TE 630333-01	9 November 2024	MADETECH INC.
	HiTemp140-2	525602	TE 630324-01	9 November 2024	MADETECH INC.

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- This standard does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical.
- Condition of Calibrated item : Good

UUC Description : Setting program function sterilization : STERILIZE/NORMAL

Time of sterilization 15 Minute At 115.0 and 121.0 °C

8. Result of Calibration :
- | | |
|---|--------------------|
| X | Without adjustment |
| | After adjustment |

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



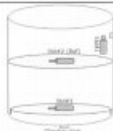
Calibration Report

Certificate No.: 2402281-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 808763
Resolution: 0.1 °C ID No.: UAE.MIC.026/2563
Manufacturer: ALP
Date of Calibration: 2 April 2024

Page 3 of 3

Calibration point: 115.0 and 121.0 °C

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	24.4	48.6	220
Max	25.5	52.1	230



Standard at location:
Sentry is observed in the food temperature probe.
Sentry is in the upper left of the chamber.
Sentry is in any chamber drain, within 100 mm.

Table 1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.2 is REF)			Uncertainty ± (°C)
	Std.# 1	Std.# 2 (Ref)	Std.# 3	
115.0	115.28	115.35	115.38	0.64
121.0	121.28	121.36	121.37	0.64

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	Min (°C)	Max (°C)	Average (°C)			
115.0	115.0	115.1	115.0	0.08	0.13	0.48
121.0	121.0	121.1	121.0	0.12	0.10	0.38

Note:

The quoted uncertainty include " Stability " and " Loading effect (20% of Uniformity)"

UUC* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.

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

----- End -----

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



Calibration Certificate

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

Page 1 of 3

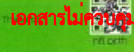
Equipment: Electronic Balance
Manufacturer: OHAUS
Model: PX623
Serial No.: C236754745
ID No.: UAE.MIC.055/2565

Order No.: 2402419
Operation No.: 2402419-001
Date of Receipt: 19 April 2024
Date of Calibration: 19 April 2024

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

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

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



Calibration Report

Certificate No.: 2402419-001-01
Equipment: Electronic Balance
Model: P9623
Serial No.: C236794745
Capacity: 600 g
Manufacturer: OHAUS
Resolution: 0.001 g
ID No.: UAE-MIC-855/2565

Date of Calibration: 19 April 2024 Page 2 of 3

Environment Condition: Ambient Temperature: 26.0 ± 0.3 °C Relative Humidity: 57 ± 0.4 %

Place of Calibration: Room 301, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard Model Serial No. Calibrated By Certificate No. Due Date
Standard Weight Class E2 1-500g 15882 TCS M2311025 28 November 2024

Instrument Model Serial No. Calibrated By Certificate No. Due Date
Thermo Hygro Meter 608-H1 NFI-BTH 019/23 Quality Reborn Q824-0492 4 March 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
300	0.0007
600	0.0019

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)
206.008	206.002	206.001	206.999	206.000	206.008	0.007

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

Calibration Report

Certificate No.: 2402419-001-01
Equipment: Electronic Balance
Model: P9623
Serial No.: C236794745
Capacity: 600 g
Manufacturer: OHAUS
Resolution: 0.001 g
ID No.: UAE-MIC-855/2565

Date of Calibration: 19 April 2024 Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-600 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
Unloaded	0.0000	0.000	0.000	0.00002	2.00
1	1.0000	1.000	0.000	0.00002	2.00
5	5.0000	5.000	0.000	0.00002	2.00
10	10.0000	10.000	0.000	0.00002	2.00
20	20.0000	20.000	0.000	0.00002	2.00
50	50.0000	50.001	-0.001	0.00002	2.00
100	100.0000	100.001	-0.001	0.00004	2.00
200	200.0000	200.001	-0.001	0.00011	2.00
300	300.0000	300.001	-0.001	0.00011	2.00
400	400.0000	400.001	-0.001	0.00012	2.00
500	500.0000	500.001	-0.001	0.00013	2.00
600	600.0000	600.002	-0.002	0.00014	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 %.

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

เอกสารไม่ควบคุม

Calibration Electronic Balance									
Model: P9623									
ID No.: UAE-MIC-855/2565									
Nominal Value	Standard Value	Average Reading	Error	Correction	Uncertainty U95	U = 1 Error	Judgement	Total Error < Judgement	
(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(Pass / Fail)	(Pass / Fail)
0	0.0000	0.000	0.000	0.000	0.00009	0.001	0.000	Pass	Pass
1	1.0000	1.000	0.000	0.000	0.00009	0.001	0.000	Pass	Pass
5	5.0000	5.000	0.000	0.000	0.00009	0.001	0.000	Pass	Pass
10	10.0000	10.000	0.000	0.000	0.00009	0.001	0.000	Pass	Pass
20	20.0000	20.000	0.000	0.000	0.00009	0.001	0.000	Pass	Pass
30	30.0000	30.001	0.001	-0.001	0.00009	0.002	0.000	Pass	Pass
50	50.0000	50.001	0.001	-0.001	0.00009	0.002	0.000	Pass	Pass
100	100.0000	100.001	0.001	-0.001	0.00009	0.002	0.000	Pass	Pass
200	200.0000	200.001	0.001	-0.001	0.00010	0.002	0.000	Pass	Pass
300	300.0000	300.001	0.001	-0.001	0.00011	0.004	0.010	Pass	Pass
400	400.0000	400.001	0.001	-0.001	0.00012	0.004	0.011	Pass	Pass
500	500.0000	500.001	0.001	-0.001	0.00013	0.004	0.010	Pass	Pass
600	600.0000	600.002	0.002	-0.002	0.00014	0.003	0.010	Pass	Pass

ภาคผนวก ฉ

หนังสือรับรองห้องปฏิบัติการวิเคราะห์

ที่ อก ๐๓๓๐(๓)/ ๔๓ ๓๕



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๐ ๓ พฤษภาคม ๒๕๖๗

เรื่อง เปลี่ยนแปลงบุคลากร สारมลพิษที่วิเคราะห์และเอกสารอ้างอิงวิธีวิเคราะห์สารมลพิษ

เรียน กรรมการผู้จัดการ บริษัท ยูนิเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง ๑. คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๔ มีนาคม ๒๕๖๗

๒. คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๑๒ มีนาคม ๒๕๖๗

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากร สารมลพิษที่วิเคราะห์และเอกสารอ้างอิง
วิธีวิเคราะห์สารมลพิษ บริษัท ยูนิเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด
จำนวน ๑๙ แผ่น

ตามคำขอที่อ้างถึง ๑ และ ๒ บริษัท ยูนิเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๔๕๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก
เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากร สารมลพิษที่วิเคราะห์และเอกสารอ้างอิงวิธีวิเคราะห์
สารมลพิษ ความละเอียดดังนี้

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นให้เปลี่ยนแปลงดังนี้

๑. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย

- | | |
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| ๑) นางสาววิจิตา ฝ่ายสิงห์ | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๔๓ |
| ๒) นายนันทพล สุขศรี | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๕๕ |

๒. ให้เพิ่มผู้ควบคุมห้องปฏิบัติการวิเคราะห์เอกชน จำนวน ๑ ราย

- | | |
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| นางสาวสริน ไชยเชษฐ์พิพัฒกุล | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๐๔๓ |
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๓. ให้เพิ่มเจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน จำนวน ๒๗ ราย

- | | |
|-------------------------------|-----------------------------|
| ๑) นางสาวนนท์ทิศา กลิ่นหนู | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๕๘ |
| ๒) นายนันทวัฒน์ หันประโยชน์ | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๕๙ |
| ๓) นางสาวปิทยา ชูเชิดเชื้อ | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๖๐ |
| ๔) นางสาวลัดดาวัลย์ ไพธัพันธ์ | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๖๑ |
| ๕) นายอาทิตย์ ตาภา | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๖๒ |
| ๖) นางสาวบุญยาพร บุญอมศรี | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๖๓ |
| ๗) นางสาวพัชรพรรณ จันทรบุตร | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๖๔ |
| ๘) นางสาวนฤกร ไก่บ้านแก้ว | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๖๕ |
| ๙) นางสาวนรินทร์ รินทรราช | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๖๖ |
| ๑๐) นางสาวพัชรินทร์ แพรกทอง | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๖๗ |
| ๑๑) นายธิติศักดิ์ ภูผิวขาว | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๖๘ |

๑๒) นางสาวปวีณา...

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| ๑๒) นางสาวปวีณา แดนชนบท | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๖๙ |
| ๑๓) นางสาวนันธิศา พรหมกวด | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๗๐ |
| ๑๔) นางสาวกรรณิกา ทองด้วง | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๗๑ |
| ๑๕) นางสาวกมลชนก ปูนคำ | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๗๒ |
| ๑๖) นายณัฐชัย จุแสง | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๗๓ |
| ๑๗) นางสาวปาริฉัตร ทองใบ | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๗๔ |
| ๑๘) นางสาวสุกัลสร สันโคข | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๗๕ |
| ๑๙) นายชัยวัฒน์ จันละคร | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๗๖ |
| ๒๐) นางสาวสุพิศรา วรดี | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๗๗ |
| ๒๑) นางสาวกัญญา สิงห์แก้ว | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๗๘ |
| ๒๒) นางสาวชญาณี เมินกระโทก | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๗๙ |
| ๒๓) นางสาวญาณินดา แซ่มเล็ก | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๘๐ |
| ๒๔) นายธนกร เชื้อมาก | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๘๑ |
| ๒๕) นางสาวรชยา ปรีดี | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๘๒ |
| ๒๖) นางสาวอนกร และกระโทก | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๘๓ |
| ๒๗) นางสาวอารีนา มะดีเยาะ | ทะเบียนเลขที่ ๖-๑๔๕๕-๖-๐๑๘๔ |

๔. ให้ยกเลิกขอบข่ายรายการสารมลพิษในน้ำเสีย น้ำใต้ดิน และสิ่งปฏิกูลหรือวัสดุที่ไม่ได้ดิน
ตามรายการเอกสารแนบท้ายหนังสือต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ที่ อก ๐๓๓๐(๓)/
๑๘๗๙ ลงวันที่ ๙ กุมภาพันธ์ ๒๕๖๕

๕. ให้วิเคราะห์สารมลพิษตามขอบข่ายที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำ น้ำเสีย น้ำใต้ดิน
และสิ่งปฏิกูลหรือวัสดุที่ไม่ได้ดิน ตามเอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากร สารมลพิษที่วิเคราะห์และ
เอกสารอ้างอิงวิธีวิเคราะห์สารมลพิษ ดังสิ่งที่ส่งมาด้วย

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายพรยศ กลิ่นกรอง)
รองอธิบดี ปฏิบัติราชการแทน
อธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและพัฒนาย้อมมลพิษโรงงาน
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ
โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕
โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๕๙
ไปรษณีย์อิเล็กทรอนิกส์ sarabangk@diw.mail.go.th



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



DIAE
UNITED ANALYST AND ENGINEERING
CONSULTANT COMPANY LIMITED

สำเนาถูกต้อง

เอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากร สารมลพิษที่วิเคราะห์และเอกสารอ้างอิงวิธีวิเคราะห์สารมลพิษ
บริษัท ยูนิเทค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๔๕
ที่ อก ๐๓๑๐(๑)/ ๔๓ ๓ ๕ | ลงวันที่ ๐๓ พฤษภาคม ๒๕๖๗
ขอข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๒๐๗ รายการ

น้ำ/น้ำเสีย จำนวน 46 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]
2	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[3] 2) Digestion, Inductively Coupled Plasma Method ^[3]
3	Barium	Digestion, Inductively Coupled Plasma Method ^[3]
4	α-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]
5	β-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]
6	δ-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]
7	γ-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]
8	Biochemical Oxygen Demand	1) 5-Day BOD Test, Azide Modification Method ^[3] 2) 5-Day BOD Test, Membrane Electrode Method ^[3]
9	Cadmium	1) Digestion, Direct Air-Acetylene Flame Method ^[3] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[3] 3) Digestion, Inductively Coupled Plasma Method ^[3]
10	Chemical Oxygen Demand	1) Closed Reflux, Titrimetric Method ^[3] 2) Closed Reflux, Colorimetric Method ^[3] 3) Open Reflux, Titrimetric Method ^[3]
11	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]
12	Chromium	1) Digestion, Direct Air-Acetylene Flame Method ^[3] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[3] 3) Digestion, Inductively Coupled Plasma Method ^[3]
13	Color	ADMI Weighted-Ordinate Spectrophotometric Method ^[3]
14	Copper	1) Digestion, Direct Air-Acetylene Flame Method ^[3] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[3] 3) Digestion, Inductively Coupled Plasma Method ^[3]
15	Cyanide	1) Distillation, Colorimetric Method ^[3] 2) Flow Injection Analysis Method ^[3]
16	o,p'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]

17 4,4'-DDD...

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ลำดับ	สารมลพิษ	วิธีวิเคราะห์
17	4,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]
18	4,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]
19	4,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]
20	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]
21	Endosulfan I	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]
22	Endosulfan II	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]
23	Endosulfan sulfate	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]
24	Endrin	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]
25	Endrin aldehyde	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]
26	Formaldehyde	Distillation, Colorimetric Method ^[2]
27	Free Chlorine	1) Iodometric Method ^[3] 2) DPD Ferrous Titrimetric Method ^[3]
28	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]
29	Heptachlor Epoxide	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]
30	Hexavalent Chromium	1) Colorimetric Method ^[3] 2) Extraction, Direct Air-Acetylene Flame Method ^[3]
31	Lead	1) Digestion, Direct Air-Acetylene Flame Method ^[3] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[3] 3) Digestion, Inductively Coupled Plasma Method ^[3]
32	Manganese	1) Digestion, Direct Air-Acetylene Flame Method ^[3] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[3] 3) Digestion, Inductively Coupled Plasma Method ^[3]
33	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^[3]
34	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]
35	Nickel	1) Digestion, Direct Air-Acetylene Flame Method ^[3] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[3] 3) Digestion, Inductively Coupled Plasma Method ^[3]
36	Oil & Grease	1) Liquid-Liquid Partition Gravimetric Method ^[3] 2) Soxhlet Extraction Method ^[3]
37	pH	Electrometric Method ^[3]

38 Phenols...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
38	Phenols	1) Distillation, Chloroform Extraction Method ^[3] 2) Distillation, Direct Photometric Method ^[3]
39	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[3] 2) Digestion, Inductively Coupled Plasma Method ^[3]
40	Sulfide	1) Iodometric Method ^[3] 2) Methylene Blue Method ^[3]
41	Temperature	Laboratory and Field Methods ^[3]
42	Total Dissolved Solids	Dried at 180 °C ^[3]
43	Total Kjeldahl Nitrogen	Semi-Micro-Kjeldahl Method ^[3]
44	Total Suspended Solids	Dried from 103 to 105 °C ^[3]
45	Trivalent Chromium	1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation ^[3] 2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ^[3]
46	Zinc	1) Digestion, Direct Air-Acetylene Flame Method ^[3] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[3] 3) Digestion, Inductively Coupled Plasma Method ^[3]

น้ำใต้ดิน จำนวน 126 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[3] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[3]
2	Acetone	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[3]
3	Aldrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[3] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[3]
4	Anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[3] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[3]

5 Antimony...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
5	Antimony	Digestion, Inductively Coupled Plasma Method ^[3]
6	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[3] 2) Digestion, Inductively Coupled Plasma Method ^[3]
7	Atrazine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[3]
8	Barium	1) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[3] 2) Digestion, Inductively Coupled Plasma Method ^[3]
9	Benz(a)anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[3] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[3]
10	Benzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[3]
11	Benzo(b)fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[3] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[3]
12	Benzo(k)fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[3] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[3]
13	Benzoic acid	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[3]
14	Benzo(a)pyrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[3] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[3]
15	Benzo(g,h,i)perylene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[3] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[3]
16	Beryllium	Digestion, Inductively Coupled Plasma Method ^[3]
17	Bis(2-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[3]
18	Bis(2-ethylhexyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[3]

19 Bromodichloromethane...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
19	Bromodichloromethane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
20	Bromoform	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
21	Butanol	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
22	Butyl benzyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
23	Cadmium	1) Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽³⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽³⁾
24	Carbazole	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
25	Carbon disulfide	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
26	Carbon tetrachloride	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
27	Chlordane	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽³⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
29	Chlorobenzene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
30	Chlorodibromomethane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
31	Chloroform	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
33	Chromium	1) Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽³⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽³⁾

34 Chromium (III)...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
34	Chromium (III)	1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation ⁽³⁾ 2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽³⁾
35	Chromium (VI)	1) Colorimetric Method ⁽³⁾ 2) Extraction, Air-Acetylene Flame Method ⁽³⁾
36	Chrysene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽³⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
37	Cyanide	Distillation, Colorimetric Method ⁽³⁾
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽³⁾
39	DDD	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽³⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
40	DDE	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽³⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
41	DDT	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽³⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
42	Dibenz(a,h)anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽³⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
43	Di-n-butyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
44	1,2-Dichlorobenzene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
45	1,3-Dichlorobenzene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
46	1,4-Dichlorobenzene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
47	3,3'-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾

48 1,1-Dichloroethane...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
48	1,1-Dichloroethane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
49	1,2-Dichloroethane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
50	1,1-Dichloroethylene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
51	cis-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
52	trans-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
54	1,2-Dichloropopane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
55	1,3-Dichloropropane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
56	1,3-Dichloropropene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
57	Dieldrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽³⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
58	Diethyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
63	Di n Octyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
64	Endosulfan	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽³⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾

65 Endrin...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
65	Endrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽³⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
66	Ethylbenzene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
67	Fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽³⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
68	Fluorene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽³⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
69	Heptachlor	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽³⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
70	Heptachlor epoxide	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽³⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
71	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
72	Hexachloro-1,3-butadiene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
73	n-Hexane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
74	α-HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽³⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾
75	β-HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽³⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽³⁾

76 γ-HCH...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
76	γ-HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[3] 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[3]
77	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[3]
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[3]
79	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[3]
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[3]
81	Lead	1) Digestion, Direct Air-Acetylene Flame Method ^[3] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[3] 3) Digestion, Inductively Coupled Plasma Method ^[3]
82	Manganese	1) Digestion, Direct Air-Acetylene Flame Method ^[3] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[3] 3) Digestion, Inductively Coupled Plasma Method ^[3]
83	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^[3]
84	Methanol	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^[3]
85	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method ^[3]
86	Methyl bromide	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^[3]
87	Methylene chloride	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^[3]
88	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[3]
89	2-Methylnaphthalene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[3] 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[3]
90	Methyl tert-butyl ether	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^[3]

91 Naphthalene...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
91	Naphthalene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[3] 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[3]
92	Nickel	1) Digestion, Direct Air-Acetylene Flame Method ^[3] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[3] 3) Digestion, Inductively Coupled Plasma Method ^[3]
93	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[3]
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[3]
95	N-Nitrosodi-n-propylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[3]
96	Polychlorinated Biphenyls - PCB 1016 - PCB 1221 - PCB 1232 - PCB-1242 - PCB-1248 - PCB-1254 - PCB-1260	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[3] 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[3]
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[3]
98	pH	Electrometric Method ^[3]
99	Phenanthrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[3] 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[3]
100	Phenol	1) Distillation, Chloroform Extraction Method ^[3] 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[3]
101	Pyrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[3] 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[3]

102 Selenium...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
102	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[3] 2) Digestion, Inductively Coupled Plasma Method ^[3]
103	Silver	Digestion, Inductively Coupled Plasma Method ^[3]
104	Styrene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^[3]
105	1,1,2,2-Tetrachloroethane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^[3]
106	Tetrachloroethylene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^[3]
107	Toluene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^[3]
108	Toxaphene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ^[3] 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[3]
109	TPH (C ₅ - C ₈)	1) Purge and Trap, Gas Chromatographic Method ^[10,20] 2) Purge and Trap, Gas Chromatographic/ Mass spectrometric Method ^[10,23]
110	TPH (C ₉ - C ₁₆)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^[7,20]
111	TPH (C ₁₆ - C ₃₅)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^[7,20]
112	1,2,4-Trichlorobenzene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^[3]
113	1,1,1-Trichloroethane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^[3]
114	1,1,2-Trichloroethane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^[3]
115	Trichloroethylene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^[3]
116	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[3]
117	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[3]
118	1,3,5-Trimethylbenzene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^[3]

119 Vanadium...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
119	Vanadium	Digestion, Inductively Coupled Plasma Method ^[3]
120	Vinyl acetate	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^[3]
121	Vinyl chloride	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^[3]
122	m-Xylene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^[3]
123	o-Xylene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^[3]
124	p-Xylene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^[3]
125	Xylene (Total)	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^[3]
126	Zinc	1) Digestion, Direct Air-Acetylene Flame Method ^[3] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[3] 3) Digestion, Inductively Coupled Plasma Method ^[3]

สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 35 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^[1,7,21] 2) Ultrasonic Extraction, Gas Chromatographic Method ^[8,21]
2	Antimony	Digestion, Inductively Coupled Plasma Method ^[5,12]
3	Arsenic	1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[1,4,14] 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[1,4,12] 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[5,14] 4) Digestion, Inductively Coupled Plasma Method ^[5,12]
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[5,12] 2) Digestion, Inductively Coupled Plasma Method ^[5,12]

5 Beryllium...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,12)
6	Cadmium	2) Digestion, Inductively Coupled Plasma Method ^(5,12) 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1,4,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,12) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(5,13) 4) Digestion, Inductively Coupled Plasma Method ^(5,12)
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,7,21) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(8,21)
8	Chromium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1,4,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,4,12) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(5,13) 4) Digestion, Inductively Coupled Plasma Method ^(5,12)
9	Chromium (III)	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation ^(1,4,13,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation ^(1,4,12,15) 3) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^(5,6,13,15) 4) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation ^(5,6,12,15)
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method ^(1,15) 2) Alkaline Digestion, Colorimetric Method ^(6,15)
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,12) 2) Digestion, Inductively Coupled Plasma Method ^(5,12)

12 Copper...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
12	Copper	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1,4,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,12) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(5,13) 4) Digestion, Inductively Coupled Plasma Method ^(5,12)
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,7,21) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(8,21)
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,7,21) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(8,21)
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,7,21) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(8,21)
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,7,21) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(8,21)
17	Dieldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,7,21) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(8,21)
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,7,21) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(8,21)
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,7,21) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(8,21)

20 Lead...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
20	Lead	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1,4,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,12) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(5,13) 4) Digestion, Inductively Coupled Plasma Method ^(5,12)
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(3,7,21) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(8,21)
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(1,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,12) 3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁷⁾ 4) Digestion, Inductively Coupled Plasma Method ^(5,12) 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ⁽¹⁸⁾
23	Methoxychlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,7,21) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(8,21)
24	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,12) 2) Digestion, Inductively Coupled Plasma Method ^(5,12)
25	Nickel	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1,4,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,12) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(5,13) 4) Digestion, Inductively Coupled Plasma Method ^(5,12)

26 Polychlorinated Biphenyls...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
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 - 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	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,7,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(8,22)

27 Pentachlorophenol...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
27	Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,7,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(8,24)
28	pH	Electrometric Method ^(25,26)
29	Selenium	1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(3,4,19) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,12) 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(5,19) 4) Digestion, Inductively Coupled Plasma Method ^(5,12)
30	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,12) 2) Digestion, Inductively Coupled Plasma Method ^(5,12)
31	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,12) 2) Digestion, Inductively Coupled Plasma Method ^(5,12)
32	Toxaphene	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,7,21) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(8,21)
33	Trichloroethylene	1) Waste Extraction, Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(1,10,23) 2) Waste Extraction, Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(1,9,23) 3) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(1,1,23) 4) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(9,23)
34	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,12) 2) Digestion, Inductively Coupled Plasma Method ^(5,12)

35 Zinc...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
35	Zinc	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1,4,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,12) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(5,13) 4) Digestion, Inductively Coupled Plasma Method ^(5,12)

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สำนักงาน

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สำนักงานลูกค้า

ที่ อก ๐๓๓๐(๑)/ ๑ ๖ ๙ ๑ ๘



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๑๓ ธันวาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอคืนสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๗ พฤศจิกายน ๒๕๖๖

ตามหนังสือที่อ้างถึง บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๔๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท
แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์
ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์
จำนวน ๖ ราย ได้แก่

- | | |
|-----------------------------|----------------------------|
| ๑) นางสาวพรพิมล ประชาพันธุ์ | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๕๖ |
| ๒) นายวีรภัทร บุญญาธิ | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๕๓ |
| ๓) นางสาวณัฐชา แก้วภาพ | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๕๔ |
| ๔) นายนิพนธ์ พลสุขี | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๕๕ |
| ๕) นายสิทธิพล พร้อมพອฮ์นบุญ | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๕๖ |
| ๖) นางสาวมนัสพร การงานดี | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๕๗ |

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์
เอกชน คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์
กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายประสม คำทรงษ์)

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติการตามแผนปฏิบัติการโรงงานอุตสาหกรรม



สำเนาถูกต้อง

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๔๔

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



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ที่ อก ๐๓๓๐(๑)/ ๘ ๗ ๒ ๕



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๕ พฤษภาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอคืนสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๑๖ พฤษภาคม ๒๕๖๖

ตามหนังสือที่อ้างถึง บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๔๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก
เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ ราย

- | | |
|---------------------------------|----------------------------|
| ๑) นางสาวพุดตา เจริญชัยสมบัติ | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๓๐ |
| ๒) นายสงกรานต์ มาลัยทอง | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๘๗ |
| ๓) นางสาวอรอนงค์ คุณานุพันธ์ชัย | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๙๒ |
| ๔) นางสาวอรณีย์ ลาพรม | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๐๐ |
| ๕) นางสาวสุดารัตน์ จันทร์ประทีป | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๐๕ |

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๔ ราย

- | | |
|---------------------------|----------------------------|
| ๑) นางสาววิภาดา ฝ่ายสิงห์ | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๔๓ |
| ๒) นางสาวณัฏฐา สัจจิต | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๔๔ |
| ๓) นางสาวเพ็ญพิชชา รอดทอง | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๔๕ |
| ๔) นางสาวณัชชา แสงสว่าง | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๔๖ |

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์
เอกชน คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์
กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายประสม คำทรงษ์)

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติการตามแผนปฏิบัติการโรงงานอุตสาหกรรม

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สำเนาถูกต้อง

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๔๔

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"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



ที่ อก ๐๓๑๐(๑)/ ๖ ๐ ๒ ๘



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๒๒ มีนาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๓๐ มกราคม ๒๕๖๖

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์

บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด จำนวน ๒ แผ่น

ตามหนังสือที่อ้างถึง บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๔๕๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท
แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์
ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย

๑) นายวิชญ์ สุวรรณราช ทะเบียนเลขที่ ๖-๑๔๕๕-จ-๐๐๑๖

๒) นายพิพัฒน์ คันธกุล ทะเบียนเลขที่ ๖-๑๔๕๕-จ-๐๐๕๗

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๑ ราย

๑) นางสาวอรุณา ประสานศรี ทะเบียนเลขที่ ๖-๑๔๕๕-จ-๐๑๓๒

๒) นายพอล เนียมเนียม ทะเบียนเลขที่ ๖-๑๔๕๕-จ-๐๑๓๓

๓) นายศุภกร สวนศรี ทะเบียนเลขที่ ๖-๑๔๕๕-จ-๐๑๓๔

๔) นายคณพล ศิลาพันธ์ ทะเบียนเลขที่ ๖-๑๔๕๕-จ-๐๑๓๕

๕) นายโชคชัย พุ่มไส ทะเบียนเลขที่ ๖-๑๔๕๕-จ-๐๑๓๖

๖) นายณวัชย์ กลับบ้านเกาะ ทะเบียนเลขที่ ๖-๑๔๕๕-จ-๐๑๓๗

๗) นายธีรวัฒน์ ธรรมสุวรรณ ทะเบียนเลขที่ ๖-๑๔๕๕-จ-๐๑๓๘

๘) นายนิพนธ์พงศ์ ชะขุนทด ทะเบียนเลขที่ ๖-๑๔๕๕-จ-๐๑๓๙

๙) นางสาวณัฐกฤตา พลนิกรกิจ ทะเบียนเลขที่ ๖-๑๔๕๕-จ-๐๑๔๐

๑๐) นางสาวชไมพร ทองบุรินทร์ ทะเบียนเลขที่ ๖-๑๔๕๕-จ-๐๑๔๑

๑๑) นางสาวพรชิตา ขจรเนติยุทธ ทะเบียนเลขที่ ๖-๑๔๕๕-จ-๐๑๔๒

๓. ให้เพิ่มขอบข่ายสารมลพิษที่วิเคราะห์ใบดิน ตามสิ่งที่ส่งมาด้วย



ดำเนินถูกต้อง

อนึ่ง...

- ๒ -

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ที่ อก ๐๓๑๐(๑)/๑๘๗๔ ลงวันที่ ๙ กุมภาพันธ์ ๒๕๖๕ คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอ
ผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

สุรศักดิ์

(นายประสม ดำรงพงษ์)
ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๔๓๐-๕ โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ คือ ๒๔๓๔

ไปรษณีย์อิเล็กทรอนิกส์ sarabang@diw.mail.go.th



ดำเนินถูกต้อง



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



เอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์

บริษัท ยูนิเทค แอนาไลสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๔๕

ที่ อก ๐๓๑๐(๑)/ ๖ ๐ ๒ ๘ ลงวันที่ ๒๒ มีนาคม ๒๕๖๖

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๖ รายการ

คืน จำนวน 16 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Benzene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ^(1,2)
2	Carbon tetrachloride	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ^(1,2)
3	1,2-Dichloroethane	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ^(1,2)
4	1,1-Dichloroethylene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ^(1,2)
5	cis-1,2-Dichloroethylene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ^(1,2)
6	trans-1,2-Dichloroethylene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ^(1,2)
7	Ethylbenzene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ^(1,2)
8	Methylene chloride	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ^(1,2)
9	Styrene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ^(1,2)
10	Tetrachloroethylene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ^(1,2)
11	Toluene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ^(1,2)
12	Trichloroethylene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ^(1,2)
13	m-Xylene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ^(1,2)
14	o-Xylene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ^(1,2)
15	p-Xylene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ^(1,2)
16	Xylene (Total)	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ^(1,2)

เอกสารอ้างอิง...

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เอกสารอ้างอิง

1. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Volatile Organic Compounds in Various Sample Matrices Using Equilibrium Headspace Analysis. SW-846 Method 5021A, 2014.

2. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry. SW-846 Method 8260D, 2018.

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ดำเนินการโดย

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบและทะเบียนห้องปฏิบัติการ ก่อวิจัยและดำเนินงานทดสอบปริมาณ กรมโรงงานอุตสาหกรรม โทร. ๐ ๒๕๓๐ ๖๓๒๒ ต่อ ๒๑๐๓๕

ที่ อก ๐๓๓๐(๑)/ ๑๕๕๕๓



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๕ ตุลาคม ๒๕๖๕

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอคืนสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๑๘ ตุลาคม ๒๕๖๕

ตามหนังสือที่อ้างถึง บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๕๕๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก
เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๔ ราย

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| ๑) นางสุธรรมา แก้วช้อนอก | ทะเบียนเลขที่ ๖-๑๕๕๕-จ-๐๐๐๒ |
| ๒) นายกานต์พงศ์ บุญพวง | ทะเบียนเลขที่ ๖-๑๕๕๕-จ-๐๐๒๙ |
| ๓) นายกฤตพล พงศ์สถาพร | ทะเบียนเลขที่ ๖-๑๕๕๕-จ-๐๐๕๕ |
| ๔) นางสาวอัญญลักษณ์ ธนโชติกาญจนกร | ทะเบียนเลขที่ ๖-๑๕๕๕-จ-๐๑๐๗ |

๒. ให้เพิ่มผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย

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| ๑) นายกานต์พงศ์ บุญพวง | ทะเบียนเลขที่ ๖-๑๕๕๕-ค-๐๐๔๑ |
| ๒) นางสุธรรมา แก้วช้อนอก | ทะเบียนเลขที่ ๖-๑๕๕๕-ค-๐๐๕๒ |

๓. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๒ ราย

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| ๑) นายชินวัฒน์ หอยสังข์ | ทะเบียนเลขที่ ๖-๑๕๕๕-จ-๐๑๒๐ |
| ๒) นายประพันธ์ แก้วภาคคำ | ทะเบียนเลขที่ ๖-๑๕๕๕-จ-๐๑๒๑ |
| ๓) นายกิตติศักดิ์ มุสิกเกตุ | ทะเบียนเลขที่ ๖-๑๕๕๕-จ-๐๑๒๒ |
| ๔) นายคุณานนท์ ฤทธาพัฒนานนท์ | ทะเบียนเลขที่ ๖-๑๕๕๕-จ-๐๑๒๓ |
| ๕) นายชาญณรงค์ อ้าลอย | ทะเบียนเลขที่ ๖-๑๕๕๕-จ-๐๑๒๔ |
| ๖) นางสาวจิตรมาส ศรีวรรณ | ทะเบียนเลขที่ ๖-๑๕๕๕-จ-๐๑๒๕ |
| ๗) นายสุจิต ไปขึ้นเงิน | ทะเบียนเลขที่ ๖-๑๕๕๕-จ-๐๑๒๖ |
| ๘) นายเจษฎา ช่วยศรี | ทะเบียนเลขที่ ๖-๑๕๕๕-จ-๐๑๒๗ |
| ๙) นายรชต เหมะจุลิน | ทะเบียนเลขที่ ๖-๑๕๕๕-จ-๐๑๒๘ |
| ๑๐) นายสุรศักดิ์ ชุมเอียด | ทะเบียนเลขที่ ๖-๑๕๕๕-จ-๐๑๒๙ |
| ๑๑) นายสุรโชค หล้าไธ | ทะเบียนเลขที่ ๖-๑๕๕๕-จ-๐๑๓๐ |
| ๑๒) นายชัย บัวสด | ทะเบียนเลขที่ ๖-๑๕๕๕-จ-๐๑๓๑ |

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ดำเนินการถูกต้อง

อนึ่ง หนังสือฉบับนี้...

- ๒ -

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ที่ อก ๐๓๓๐(๑)/๑๕๕๕๓ ลงวันที่ ๙ กุมภาพันธ์ ๒๕๖๕ คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอ
ผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ที่แนบหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายประสม ดำรงพงษ์)

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๔๙

ไปรษณีย์อิเล็กทรอนิกส์ saraban@dlw.mail.go.th

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ดำเนินการถูกต้อง



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



ที่ อก ๐๓๑๐(๑)/ ๑๒ ๑๙ ๓



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๐๑ กันยายน ๒๕๖๕

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูโนเด็ค แอนาไลส์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และนิติสารณณ์ของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๒๖ สิงหาคม ๒๕๖๕

ตามหนังสือที่อ้างถึง บริษัท ยูโนเด็ค แอนาไลส์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๔๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก
เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้อยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๘ ราย

- | | |
|----------------------------------|----------------------------|
| ๑) นายปริดา ไชยภูมิสกุล | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๓๓ |
| ๒) นายปิยะณัฐ ศรีภูโรจน์ | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๓๕ |
| ๓) นายธีรเมธ สุขศรี | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๔๑ |
| ๔) นางสาวศิริวรรณ ขอนพา | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๕๐ |
| ๕) นายศักดิ์สิทธิ์ เกิดซิง | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๖๓ |
| ๖) นางสาวลัดดาวัลย์ โพธิ์พันธ์ | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๘๐ |
| ๗) นางสาวกมลวรรณ เจิมจันทร์ | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๘๑ |
| ๘) นางสาวจันทร์จิรา ประกอบทรัพย์ | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๐๘ |

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๑ ราย

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| ๑) นางสาวนาสาชา แหวนในเมือง | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๐๘ |
| ๒) นางสาวพิณวรรณ สิมมา | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๑๐ |
| ๓) นายนันทวัฒน์ วงศ์คำ | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๑๑ |
| ๔) นายประพันธ์ฤทธิ์ เผือกนาง | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๑๒ |
| ๕) นางสาวศมิษฐา ลำจิต | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๑๓ |
| ๖) นางสาวภาพร ชื่นนุกัม | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๑๔ |
| ๗) นางสาวเบญญา มอญคุณ | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๑๕ |
| ๘) นายอมรพล อมรลักษณ์ | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๑๖ |
| ๙) นางสาวศรีเพชร ทองขาว | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๑๗ |
| ๑๐) นางสาวนิชากร สุภชาติไกรสร | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๑๘ |
| ๑๑) นางสาววิมลวรรณ คำตัน | ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๑๙ |

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อนึ่ง หนังสือฉบับนี้...

- ๒ -

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ที่ อก ๐๓๑๐(๑)/๑๘๗๙ ลงวันที่ ๙ กุมภาพันธ์ ๒๕๖๕ คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอ
ผ่านระบบอิเล็กทรอนิกส์ได้ทั้งหน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ห้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



(นางจันทนา นนทะจรินทร์)

ผู้อำนวยการกองวิจัยและพัฒนายุทธศาสตร์โรงงาน
ปฏิบัติการกรมส่งเสริมการงานอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและพัฒนายุทธศาสตร์โรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบผลิตภัณฑ์และทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๔๔

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th

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ดำเนินถูกต้อง



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



ที่ อก ๐๓๓๐(๑)/ ๔๗๘ ๗



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๒๑ เมษายน ๒๕๖๕

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๓๐ มีนาคม ๒๕๖๕

ตามหนังสือที่อ้างถึง บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๔๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ถนนสุขุมวิท แขวงบางจาก
เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย

๑) นางมานิดา แย้มโย ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๐๕

๒) นางสาวนภสรวรรณ คงท่า ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๓๒

๒. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย

๑) นางสาวศิริพร อัมปารัตน์ ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๖๔

๒) นางสาวพรนัชชา กลิ่นจุ่น ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๘๔

๓. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย

๑) นางสาวธัญลักษณ์ อนุชิตกาญจนการ ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๐๗

๒) นางสาวจันทร์จิรา ประกอบทรัพย์ ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๐๘

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ที่ อก ๐๓๓๐(๑)/๑๔๗๘ ลงวันที่ ๔ กุมภาพันธ์ ๒๕๖๕ คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอ
ผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นางจินดา เดชะศรีรินทร์)

ผู้อำนวยการกองวิจัยและเปลี่ยนแปลงสารพิษ
ปฏิบัติการการควบคุมมลพิษกรมโรงงานอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๓๐๓-๕ โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๓๐๓-๕

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



สำเนาถูกต้อง



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"





ที่ อก ๐๓๓๐(๑)/ ๑๘๗ ๕

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๐ ๕ กุมภาพันธ์ ๒๕๖๕

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๒๗ ธันวาคม ๒๕๖๔

สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย
๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย
๓. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม

ตามหนังสือที่อ้างถึง บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด ขอต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๔๕ สถานที่ตั้งเลขที่ ๓
ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง
คอนซัลแตนท์ จำกัด ขอต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย ตามสิ่งที่ส่งมาด้วย ๑
ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย ตามสิ่งที่ส่งมาด้วย ๒
ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย น้ำใต้ดิน อากาศเสีย สิ่งปฏิกูล
หรือวัสดุที่ไม่ใช้แล้ว และดิน ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ หากประสงค์จะต่ออายุหนังสือ
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อ
กรมโรงงานอุตสาหกรรมภายใน ๓๐ วัน ก่อนวันสิ้นสุดอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ที่าย
หนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นางจินดา เดชะศรีนทร์)
ผู้อำนวยการกองวิเคราะห์และเฝ้าระวังมลพิษโรงงาน
ปฏิบัติการตามเทศบัญญัติกรุงเทพมหานคร



ยื่นคำขอต่ออายุห้องปฏิบัติการวิเคราะห์เอกชน

UNITE ANALYST AND ENGINEERING
CONSULTANT COMPANY LIMITED

สำนักงานถูกต้อง

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๔๔

ไปรษณีย์อิเล็กทรอนิกส์ saraban@dlw.go.th

สิ่งที่ส่งมาด้วย ๑

เอกสารแนบท้ายหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๔๕
ที่ อก ๐๓๓๐(๑)/ ๑๘๗ ๕ ลงวันที่ ๐ ๕ กุมภาพันธ์ ๒๕๖๕

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย

- ๑) นางสาวกฤษวรรณ ภัทรธีรกุล
- ๒) นายณรงค์ นิมาพัลล
- ๓) นางสาวนันท์ตา บุญไสย
- ๔) นางปิยะพัชร สุทมนัสวงษ์
- ๕) นางมานิดา แยมโย
- ๖) นางสาวกฤษวรรณ วิริยชัย
- ๗) นายพรรัตน์ วงศ์นุรักษ์ชัย
- ๘) นางสาวฉวีวรรณ บุญลา
- ๙) นายสุวิทย์ จอดนอก
- ๑๐) นางสาวโชติกา สมบูรณ์
- ๑๑) นางสาวบุษกร เลิศกาญจนา
- ๑๒) นางสาววิไลลักษณ์ ศรีสุข
- ๑๓) นางสาวปวีณา จรัสโชติพิณ
- ๑๔) นายศิลา บรรจงใจรักษ์
- ๑๕) นายปฏิกรณ์ คณณะ
- ๑๖) นายธีรวัฒน์ ชมมิ่ง
- ๑๗) นางสาวศิริพร ศรีประติษฐ์
- ๑๘) นางสาวสวดีศรี วิวัจ
- ๑๙) นางสาวนพวรรณ อูรารักษ์
- ๒๐) นายภูษงค์ พานิชย์เลิศอำไพ
- ๒๑) นายณัฐวัฒน์ แสงสวัสดิ์
- ๒๒) นายเอกรัตน์ ปถะคามินทร์
- ๒๓) นางสาวนิศากรรัตน์ ศรีสุทนต์วิโชค
- ๒๔) นางสาวเจตจิรินทร์ ทักษะอา
- ๒๕) นางสาวสุวรรณ คงทอง
- ๒๖) นางสาววรรกร พัดสองชั้น
- ๒๗) นายวิรุทธ โมกแก้ว
- ๒๘) นายธีรพงษ์ เทพดนตรี
- ๒๙) นายอนุศาสน์ สวัสดิ์
- ๓๐) นายกรวิทย์ เขียวศิริกุล
- ๓๑) นางสาวอริกา รงค์สวัสดิ์
- ๓๒) นางสาวนภสรวรรณ คงจำ
- ๓๓) นายสุทธิระ อรุณจันทร์
- ๓๔) นางสาวทัศนีย์ อ่อนคำ
- ๓๕) นางสาวพร้อมพรรณ สมบูรณ์ธรรม

- ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๐๑
ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๐๒
ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๐๓
ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๐๔
ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๐๕
ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๐๖
ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๐๗
ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๐๘
ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๐๙
ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๑๐
ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๑๑
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ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๑๓
ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๑๔
ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๑๕
ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๑๖
ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๑๗
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ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๒๐
ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๒๑
ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๒๒
ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๒๓
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ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๒๕
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ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๓๑
ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๓๒
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ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๓๔
ทะเบียนเลขที่ ๖-๑๔๕-๕-๐๐๓๕



UNITE ANALYST AND ENGINEERING
CONSULTANT COMPANY LIMITED

สำนักงานถูกต้อง

(นางจินดา เดชะศรีนทร์)


ผู้อำนวยการกองวิเคราะห์และเฝ้าระวังมลพิษโรงงาน

ปฏิบัติการตามเทศบัญญัติกรุงเทพมหานคร

๓๖) นายศุภณัฐ...

๓๖) นายสุภณัฐ คุณอนาญจน์
๓๗) นางสาวศิริภาพร เหมือนแร่
๓๘) นางศิวานัส ขำนิล
๓๙) นางสาวพรรณิภา ชีระจินดาชล
๔๐) นายนาคินทร์ พันธุ์ชาติกุล

ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๓๖
ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๓๗
ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๓๘
ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๓๙
ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๔๐


(นางจินดา เชชะศรีรินทร์)
ผู้อำนวยการกองวิจัยและเฝ้าระวังมลพิษทางอากาศ
ปฏิบัติการตามแผนงานจัดการมลพิษทางอากาศ

UAE
URBAN ANALYST AND ENGINEERING
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สำเนาถูกต้อง

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท ยูเออี แอนาไลซิส แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๔๕
ที่ อก ๐๓๑๐(๑)/ ๑๘๗ ๙ ลงวันที่ ๑๙ กุมภาพันธ์ ๒๕๖๕

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย

๑) นายสุสันต์ พันสิงห์	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๐๑
๒) นางสาวสุธรรมา แก้วชื่อนอก	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๐๒
๓) นายพริษฐ์ เจริญผล	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๐๓
๔) นางสาววิไลลักษณ์ เกโธสง	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๐๔
๕) นายสมชาติ อุทุมรัตน์	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๐๕
๖) นางสาวปรมาภรณ์ ทองแก้ว	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๐๖
๗) นางสาวกัลยา สมพงษ์	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๐๗
๘) นายอรรณพ เทพทอง	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๐๘
๙) นางสาวอมรรัตน์ พุทธาสี	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๐๙
๑๐) นางสาววรรณิ สายบุญเรือน	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๑๐
๑๑) นายภูษณพงษ์ นามทิพย์	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๑๑
๑๒) นางสาวอาภรณ์ อ่อนคง	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๑๒
๑๓) นายกิตติศักดิ์ ทรงจำรัส	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๑๓
๑๔) นางสาวอักษรินทร์ บุญคง	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๑๔
๑๕) นางสาวพรพิมล แวันทอง	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๑๕
๑๖) นายวิชญ์ สุวรรณราช	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๑๖
๑๗) นายอภิวิชญ์ ท่วงที	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๑๗
๑๘) นายมานิตย์ ปานโชติ	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๑๘
๑๙) นายทศพร ณะพิรุฬห์	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๑๙
๒๐) นางสาวกัลยาณี โยธา	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๒๐
๒๑) นางสาวเกวลี สุขศรี	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๒๑
๒๒) นางสาวชนอนันต์ อภิพัทธ์ปภา	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๒๒
๒๓) นายศิริพัชร จงผดุงเกียรติ	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๒๓
๒๔) นางสาวสุภาวดี อินยาศรี	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๒๔
๒๕) นายพงศ์เทพ เหล่าจระ	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๒๕
๒๖) นายขวัญชัย พันทุกข์	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๒๖
๒๗) นางสาวพัชจิรา ศดิพิศาล	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๒๗
๒๘) นางสาวเมธิกา เสือคำจันทร์	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๒๘
๒๙) นายภาณุพงศ์ บุญพวง	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๒๙
๓๐) นางสาวสุธิดา เจริญชัยสมบัติ	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๓๐
๓๑) นายนพรัตน์ จงไธ	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๓๑
๓๒) นายพีระพัฒน์ บุญฤทธิศิลป์	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๓๒
๓๓) นายปริดา ไชยภูมิสกุล	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๓๓
๓๔) นายรัชชาลัย เลื่อนล่อง	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๓๔
๓๕) นายปิยะนัฐ ศรีภูโรจน์	ทะเบียนเลขที่ ๖-๑๔๕-๓-๐๐๓๕

UAE
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(นางจินดา เชชะศรีรินทร์)
ผู้อำนวยการกองวิจัยและเฝ้าระวังมลพิษทางอากาศ
ปฏิบัติการตามแผนงานจัดการมลพิษทางอากาศ

๓๖) นายณสินธุ์...

๓๖) นายภณสินธุ์ ธนูธรรมรัตน์
๓๗) นายกันนิกร ไร่โส
๓๘) นายจักรพันธ์ ภูมิรินทร์
๓๙) นายปริญญ์ กลมเกลียว
๔๐) นายธีรวิจน์ มาตรโพธิ์ศรี
๔๑) นายธีรเมธ สุขศรี
๔๒) นายบุญฤทธิ์ ก้อนสิน
๔๓) นายพรพจน์ โฉมสกุล
๔๔) นายอชิตะ แสงจันทร์
๔๕) นายณัฐพงศ์ เมืองชัย
๔๖) นายอภิท เลิศประเสริฐ
๔๗) นางสาวนิภาพร จันทเขตต์
๔๘) นายยุทธพงษ์ อีสระสุข
๔๙) นายธนาภ ภูตระกูลพัฒนา
๕๐) นางสาวศิริวรรณ ขอนพา
๕๑) นายสมพงษ์ สกุลไทย
๕๒) นายสุริยัน นิธิเจ็ดขวงค์
๕๓) นายอัสฎาฐ ยนต์ศิริ
๕๔) นายเอกวุฒิ เสนอใจ
๕๕) นายสุสันต์ บุญเลี้ยง
๕๖) นายธนเดช หวานเสนาะ
๕๗) นายพิพัฒน์ ต้นธนกุล
๕๘) นายอภิสิทธิ์ ศรีคงแก้ว
๕๙) นายภูวดล มงคลสูง
๖๐) นายอุทัย แก้วรากนุช
๖๑) นางสาววนรินทร์ สานนท์
๖๒) นายศุภกร ธีรวงศ์
๖๓) นายศักดิ์สิทธิ์ เกิดขัง
๖๔) นางสาวศิริพร อภิการัตน์
๖๕) นางสาวจินตสุภา เปี่ยมศรี
๖๖) นางสาวนันทนา กมลบุรณ์
๖๗) นางสาวอารียา ทวามย์
๖๘) นายจิรวัฒน์ สุขเกษม
๖๙) นายกิตติพงษ์ สอนชัยภูมิ
๗๐) นายจุมพล สวนเพชร
๗๑) นางสาวพัชราภรณ์ แสงทิพย์
๗๒) นายรัตนชัย เหล่าธำ

ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๖
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ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๗๒

IAE สหนาฏคต
INDEPENDENT ANALYST AND ENGINEERING
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(นางจินดา เลขาศรีนทร์)

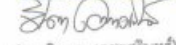
ผู้อำนวยการกองวิจัยและประเมินภัยพิบัติ
ปฎิบัติการตามแผนป้องกันและบรรเทาผลกระทบ

๗๓) นายอิทธิพงษ์...

๗๓) นายอิทธิพงษ์ ศรีวิเศษ
๗๔) นางสาวกรรณิการ์ สาสีทา
๗๕) นายธนาปกรณ์ พิมพ์ศรี
๗๖) นายพรชัย คุ่มม่วง
๗๗) นางสาวทัศนีย์ ไชยหาร
๗๘) นายธีรพงษ์ ศรีคำแหง
๗๙) นางสาวณัฐชา พรหมศิริ
๘๐) นางสาวลัดดาวัลย์ โพธิ์พันธ์
๘๑) นางสาวกมลวรรณ เจริญจันทร์
๘๒) นายพนรัตน์ จันทะคุณ
๘๓) นายสุวัฒน์ โหมชู
๘๔) นางสาวพรนัชชา กลิ่นอุณ
๘๕) นายณภสิทธิ์ ศรีพิมพ์
๘๖) นางสาวลลิตา จันทรส
๘๗) นายสงกรานต์ มาลัยทอง
๘๘) นางสาวสาวิตา แซ่เตียว
๘๙) นายศักดิ์ดนัย นุ่มนัม
๙๐) นายวรพงษ์ นนทจันทร์
๙๑) นางสาวชนาภา มากะมาต
๙๒) นางสาวธนธรณ์ คุณานุพันธ์ชัย
๙๓) นายวิระยุทธ สาระภักดิ์
๙๔) นางสาวธิดา วีระพันธุ์วิวัฒน์
๙๕) นายกฤษณ์ พงศ์สถาพร
๙๖) นายณัฐชัย พรหมอารักษ์
๙๗) นายชินนทร์ พานแก้ว
๙๘) นายปรัชชาพล โสภา
๙๙) นายธีรจันทร์ แสนงาม
๑๐๐) นางสาวอนรรณ ลาพรม
๑๐๑) นายอาทิตย์ อุดมผล
๑๐๒) นายปรวร บุณนาค
๑๐๓) นายอิทธิเดช ใจบุญ
๑๐๔) นายคณิน พงษ์อัคราบุร
๑๐๕) นางสาวสุตารัตน์ จันทะประทีป
๑๐๖) นายเสกสรรค์ เอมกลิ่นบัว

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IAE สหนาฏคต
INDEPENDENT ANALYST AND ENGINEERING
CONSULTANT COMPANY LIMITED


(นางจินดา เลขาศรีนทร์)

ผู้อำนวยการกองวิจัยและประเมินภัยพิบัติ
ปฎิบัติการตามแผนป้องกันและบรรเทาผลกระทบ

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท ยูนิเทค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๔๕
ที่ อก ๐๓๑๐(๑)/ ๑๘๗ ๙ ลงวันที่ ๐๙ กุมภาพันธ์ ๒๕๖๕

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๕๗ รายการ

น้ำเสีย 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, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) 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, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) 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, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
15	Cyanide	1) Distillation, Colorimetric Method ⁽⁴⁾ 2) Flow Injection Analysis Method ⁽⁴⁾

16 o,p'-DDT...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
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	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
26	Formaldehyde	Distillation, Colorimetric Method ⁽³⁾
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	1) Colorimetric Method ⁽⁴⁾ 2) Extraction, Direct Air-Acetylene Flame Method ⁽⁴⁾
31	Lead	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
32	Manganese	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) 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, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

36 Oil & Grease...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
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 ⁽⁸⁾
42	Total Dissolved Solids	Dried at 180 °C ⁽⁴⁾
43	Total Kjeldahl Nitrogen	Semi-Micro-Kjeldahl Method ⁽⁴⁾
44	Total Suspended Solids	Dried at 103-105 °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, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

น้ำได้ดิน 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⁾
2	Acetone	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
3	Aldrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

4 Anthracene...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
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	1) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) 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⁾
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...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
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⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
24	Carbazole	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 Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
29	Chlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

30 Chlorodibromomethane...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
30	Chlorodibromomethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
31	Chloroform	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
33	Chromium	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
34	Chromium (III)	1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽⁴⁾
35	Chromium (VI)	1) Colorimetric Method ⁽⁴⁾ 2) Extraction, Air-Acetylene Flame Method ⁽⁴⁾
36	Chrysene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
37	Cyanide	Distillation, Colorimetric Method ⁽⁴⁾
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
39	DDD	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
40	DDE	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
41	DDT	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

42 Dibenz(a,h)anthracene...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
42	Dibenz(a,h)anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
43	Di-n-butyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
44	1,2-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
45	1,3-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
46	1,4-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
47	3,3'-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
48	1,1-Dichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
49	1,2-Dichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
50	1,1-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
51	cis-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
52	trans-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
54	1,2-Dichloropropene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
55	1,3-Dichloropropane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
56	1,3-Dichloropropene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
57	Dieldrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

58 Diethyl phthalate...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
58	Diethyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
63	Di-n-Octyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
64	Endosulfan	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
65	Endrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
66	Ethylbenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
67	Fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
68	Fluorene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
69	Heptachlor	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

70 Heptachlor epoxide...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
70	Heptachlor epoxide	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
71	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
72	Hexachloro-1,3-butadiene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
73	n-Hexane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
74	α-HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
75	β-HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
76	γ-HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
77	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
79	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
81	Lead	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

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82 Manganese...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
82	Manganese	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
83	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽⁴⁾
84	Methanol	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
85	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
86	Methyl bromide	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
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, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) 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⁾

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96 Polychlorinated Biphenyls...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
96	Polychlorinated Biphenyls - PCB 1016 - PCB 1221 - PCB 1232 - PCB-1242 - PCB-1248 - PCB-1254 - PCB-1260	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
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⁾
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⁾

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
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 ^(11,21) 2) Purge and Trap, Gas Chromatographic/Mass spectrometric Method ^(11,21)
110	TPH (C ₈ - C ₁₆)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(9,21)
111	TPH (C ₁₆ - C ₃₅)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(9,21)
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⁾
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⁾

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
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, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

อากาศเสีย (ปล่องระบาย) จำนวน 25 รายการ

ลำดับ	สารมลพิษ	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⁾ 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⁾

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10 Dioxins/Furans...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
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⁾
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⁾

สิ่งบ่งชี้...

สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 35 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
2	Antimony	Digestion, Inductively Coupled Plasma Method ^(7,13)
3	Arsenic	1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(2,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,15) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
6	Cadmium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
8	Chromium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13)

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3) Digestion,...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
9	Chromium (III)	3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13) 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation ^(2,6,14,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation ^(2,6,13,16) 3) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,14,16) 4) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,13,16)
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method ^(2,16) 2) Alkaline Digestion, Colorimetric Method ^(8,16)
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
12	Copper	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)

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15 DDE...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
17	Dieldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
20	Lead	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(2,17) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13)

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3) Digestion,...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
		3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁸⁾ 4) Digestion, Inductively Coupled Plasma Method ^(7,13) 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ⁽¹⁹⁾
23	Methoxychlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
24	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
25	Nickel	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
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	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)

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- 2,2',4,5,5'...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
27	- 2,2',4,5,5'- Pentachlorobiphenyl	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(12,9,28) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) Electrometric Method ^(31,32)
	- 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',4,4',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	
28	pH	
29	Selenium	

30 Silver...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
30	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13)
31	Thallium	2) Digestion, Inductively Coupled Plasma Method ^(7,13) 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13)
32	Toxaphene	2) Digestion, Inductively Coupled Plasma Method ^(7,13) 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22)
33	Trichloroethylene	2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 1) Waste Extraction, Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(2,12,25)
34	Vanadium	2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13)
35	Zinc	2) Digestion, Inductively Coupled Plasma Method ^(7,13) 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)

ดิน จำนวน 125 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
2	Acetone	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(2,25)

3 Aldrin...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
3	Aldrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
4	Anthracene	2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
5	Antimony	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26)
6	Arsenic	2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
7	Atrazine	Digestion, Inductively Coupled Plasma Method ^(7,13)
8	Barium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,15)
9	Benzo(a)anthracene	2) Digestion, Inductively Coupled Plasma Method ^(7,13)
10	Benzene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
11	Benzo(b)fluoranthene	Digestion, Inductively Coupled Plasma Method ^(7,13)
12	Benzo(k)fluoranthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24)
13	Benzoic acid	2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
14	Benzo(a)pyrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24)
		2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)

15 Benzo(g,h,i)perylene...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
15	Benzo(g,h,i)perylene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
16	Beryllium	2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
17	Bis(2-chloroethyl)ether	Digestion, Inductively Coupled Plasma Method ^(7,13)
18	Bis(2-ethylhexyl)phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
19	Bromodichloromethane	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
20	Bromoform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
21	Butanol	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
22	Butyl benzyl phthalate	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
23	Cadmium	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
24	Carbazole	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14)
25	Carbon disulfide	2) Digestion, Inductively Coupled Plasma Method ^(7,13)
26	Carbon tetrachloride	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
27	Chlordane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
28	p-Chloroaniline	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
29	Chlorobenzene	2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
30	Chlorodibromomethane	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)

31 Chloroform...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
31	Chloroform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
32	2-Chlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
33	Chromium	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
34	Chromium (III)	1) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,14,16) 2) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,13,16)
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method ^(8,16)
36	Chrysene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
37	Cyanide	Extraction, Distillation, Colorimetric Method ^(28,29,30)
38	2,4-D	Ultrasonic Extraction, Gas Chromatographic Method ⁽²⁷⁾
39	DDD	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
40	DDE	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
41	DDT	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
42	Dibenz(a,h)anthracene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)

43 Di-n-butyl phthalate...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
43	Di-n-butyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
47	3,3'-Dichlorobenzidine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
53	2,4-Dichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
54	1,2-Dichloropropene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
57	Dieldrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
58	Diethyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
59	2,4-Dimethylphenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)

60 2,4-Dinitrophenol...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
60	2,4-Dinitrophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
61	2,4-Dinitrotoluene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
62	2,6-Dinitrotoluene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
63	Di-n-Octyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
64	Endosulfan	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
65	Endrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
67	Fluoranthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
68	Fluorene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
69	Heptachlor	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
70	Heptachlor epoxide	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)

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71 Hexachlorobenzene...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
71	Hexachlorobenzene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
73	n-Hexane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
74	α -HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
75	β -HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
76	γ -HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
77	Hexachlorocyclopentadiene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
78	Hexachloroethane	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
79	Indeno(1,2,3-cd)pyrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
80	Isophorone	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
81	Lead	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
82	Manganese	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)

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83 Mercury...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
83	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁸⁾ 2) Digestion, Inductively Coupled Plasma Method ^(7,13) 3) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ⁽¹⁹⁾
84	Methanol	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
85	Methoxychlor	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
86	Methyl bromide	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
87	Methylene chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
88	2-Methylphenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
89	2-Methylnaphthalene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
90	Methyl tert-butyl ether	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
91	Naphthalene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
92	Nickel	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
93	Nitrobenzene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
94	N-Nitrosodiphenylamine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
95	N-Nitrosodi-n-propylamine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
96	Polychlorinated Biphenyls - Aroclor 1016 - 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',4,4',5- Heptachlorobiphenyl - 2,2',3,4,4',5,5'- Heptachlorobiphenyl - 2,2',3,4,4',5',6- Heptachlorobiphenyl	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23)

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
97	- 2,2',3,4',5,5',6-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl Pentachlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
98	Phenanthrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
99	Phenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
100	Pyrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
101	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,22) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
102	Silver	Digestion, Inductively Coupled Plasma Method ^(7,13)
103	Styrene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
106	Toluene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
107	Toxaphene	Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
108	TPH (C ₅ -C ₆)	1) Purge and Trap, Gas Chromatographic Method ^(12,21) 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
109	TPH (C ₉ -C ₁₆)	Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
110	TPH (C ₁₆ -C ₃₅)	Ultrasonic Extraction, Gas Chromatographic Method ^(10,21)
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)

112 1,1,1-Trichloroethane...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
115	2,4,5-Trichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
116	2,4,6-Trichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
117	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
118	Vanadium	Digestion, Inductively Coupled Plasma Method ^(7,13)
119	Vinyl acetate	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
120	Vinyl chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
121	m-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
122	o-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
123	p-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
124	Xylene (Total)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
125	Zinc	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)

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