

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์

รายการเครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม

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)	ฝุ่นละออง (Particulate), ฝุ่นทุกขนาด ฝุ่นละอองขนาดเล็กกว่า 10 ไมครอน (PM10)	Mettler-Toledo	AB204-S/FACT / B108115858	National Food Institute, Ministry of Industry, Thailand	2502228-001-01	19 Mar 25	18 Mar 26	-
2	Analytical Balance (Readability 0.001 mg)	ฝุ่นละอองขนาดเล็กกว่า 2.5 ไมครอน (PM2.5) ฝุ่นขนาดที่เข้าถึงและสะสมในถุงลมปอดได้	Mettler-Toledo	XP6 / B322373893	National Food Institute, Ministry of Industry, Thailand	2502228-002-01	20 Mar 25	19 Mar 26	-
Equipment for Water Quality Analysis									
3	pH Meter	ความเป็นกรด-ด่าง อุณหภูมิ	Mettler-Toledo	SevenCompact S220/ C113432421	National Food Institute, Ministry of Industry, Thailand	2403175-001-01	25 Jun 24	24 Jun 25	-
4	Conductivity Meter	ความเค็ม ความนำไฟฟ้า	Mettler-Toledo	SevenDirect SD30/ C441872132	DKSH (Thailand) Ltd.	C24250010	15 Jan 25	14 Jan 26	-
5	Analytical Balance (Readability 0.01 mg)	ของแข็งแขวนลอย ของแข็งละลายทั้งหมด	Mettler-Toledo	XSR205DU / C210685394	National Food Institute, Ministry of Industry, Thailand	2502226-002-01	20 Mar 25	19 Mar 26	-
6	Hot Air Oven		Memmert	UF55 / B216.1666	National Food Institute, Ministry of Industry, Thailand	2500116-001-01	8 Oct 24	7 Oct 25	-
7	Analytical Balance (Readability 0.1 mg)	น้ำมันและไขมัน	Mettler-Toledo	AB-204S/FACT / 1129361010	United Analyst and Engineering Consultant. Co.,Ltd (UAE)	250422-1-BL002-25	23 Apr 25	22 Apr 26	-

รายการเครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Equipment for Water Quality Analysis									
8	UV-VIS Spectrophotometer	ฟอสฟอรัสทั้งหมด ไนโตรเจนทั้งหมด	Hitachi	U-5100 / 23A4-008	DQE Services Co.,Ltd.	SP24-028	10 Sep 24	9 Sep 25	-
9	UV-VIS Spectrophotometer	ซีโอดี ไนเตรท-ไนโตรเจน	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP25-001	3 Jan 25	3 Jan 26	-
10	BOD Incubator	บีโอดี	Arco	UC4-1320 / (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	25TM205	8 Feb 25	8 Feb 26	-
11	DO Meter		YSI	4010-2W / 20260326	Technology Promotion Association (Thailand-Japan)	24TW222	17 Oct 24	16 Oct 25	-
12	COD Reactor (Heating Block)	ซีโอดี	Hanna	HI839800-02 / H018500I	Hanna Instruments (Thailand) Ltd.	HIT-2510-0375	7 Mar 25	6 Mar 26	-
13	Digester Unit	ทีเคเอ็น	Velp	DKL20 / 213517	National Food Institute, Ministry of Industry, Thailand	2404228 001 01	26 Sep 24	25 Sep 25	-
14	Distillation Unit (Kjeldahl Method)		FOSS TECATOR	KT8100/ 91889052	FOSS South East Asia	13854	24 Feb 25	23 Feb 26	-

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No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Equipment for Water Quality Analysis									
15	Atomic Absorption Spectrophotometer (AAS)	สารหนู, ทองแดง, ค่าอัตราส่วนการดูดซับโซเดียม, ตะกั่ว, นิกเกิล, พรอท, แคดเมียม, แมงกานีส, แคลเซียม, แมกนีเซียม, อลูมิเนียม, เหล็ก	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	30 Jan 25	29 Jan 26	-
16	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	-
17	Cold Vapor Atomic Absorption Spectrophotometer (CVAAS)	ปรอท	Nippon Instrument Corporation	RA-4500 / 17780278	Coax Group Corporation Ltd.	Preventive Maintenance Report	9 Jul 24	8 Jul 25	-
18	Incubator	โคลิฟอร์มทั้งหมด พีคัลโคลิฟอร์มแบคทีเรีย	Memmert	IPP 260 / V618.0033	National Food Institute, Ministry of Industry, Thailand	2502229 003 01	19 Mar 25	18 Mar 26	-
19	Water Bath		Memmert	WNE 14 / L416.0606	National Food Institute, Ministry of Industry, Thailand	25051624-001-01	10 Feb 25	9 Feb 26	-
20	Auto Clave		ALP	CL-40L / 808763	National Food Institute, Ministry of Industry, Thailand	2502229 007 01	19 Mar 25	18 Mar 26	-
21	Analytical Balance		OHAUS	PX623 / C236754745	National Food Institute, Ministry of Industry, Thailand	2502227-001-01	19 Mar 25	18 Mar 26	-

รายการเครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม

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	Apex Instruments, USA.	XC-572-V 0707048	Envi Equipment Service Co., Ltd.	E24-060049	25 Jun 24	24 Jun 25	-
2	Pre-Test Console	Total Suspended Particulate	Apex Instruments, USA.	XC-572-V 0807047	Envi Equipment Service Co., Ltd.	E24-080074	26 Aug 24	25 Aug 25	-
3	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide	Testo	Testo 350 60899615	Entech Industrial Sulation Co., Ltd.	G 670490	17 Jul 24	16 Jul 25	-
4	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide	Testo	Testo 350 60723967	Entech Industrial Sulation Co., Ltd.	G 670643	13 Sep 24	12 Sep 25	-

รายการเครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Tisch Environmental, Inc.	TE-5025A 3383	Jiranatee Associates Co., Ltd.	COF-039-67	27 Sep 24	26 Sep 25	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	121-36-W/M -	Technology Promotion Association (Thailand-Japan)	25P112	19 Feb 25	18 Feb 26	-
3	Air Flow Meter	Particular Matter (PM _{2.5})	Mesa Labs	DeltaCal DC1 155895	Jiranatee Associates Co., Ltd.	CGF-010-67	16 Oct 24	15 Oct 25	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24P1856	4 Jun 24	3 Jun 25	-
5	Digital Thermo - Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Digicon	TH-02 435031148	Technology Promotion Association (Thailand-Japan)	24H1487	15 Jul 24	14 Jul 25	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050148	UAE Consultant Co., Ltd.	20092024	20 Sep 24	19 Sep 25	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050149	UAE Consultant Co., Ltd.	17092024	17 Sep 24	16 Sep 25	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050150	UAE Consultant Co., Ltd.	17092024	17 Sep 24	16 Sep 25	-

รายการเครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Ambient									
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778105	UAE Consultant Co.,Ltd.	26092024	26 Sep 24	25 Sep 25	-
10	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jun 23	6 Jun 31	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387061	UAE Consultant Co.,Ltd.	06092024	6 Sep 24	5 Sep 25	-
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387063	UAE Consultant Co.,Ltd.	19062024	19 Jun 24	18 Jun 25	-
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387065	UAE Consultant Co.,Ltd.	06092024	6 Sep 24	5 Sep 25	-
14	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920014	UAE Consultant Co.,Ltd.	04092024	4 Sep 24	3 Sep 25	-
15	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jun 23	6 Jun 31	-
16	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DT0072	Thai Meteorological Department	001/25	3 Jan 25	2 Jan 26	-

รายการเครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Ambient									
17	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	01dB	CAL31 84065	Innovative Instrument Co.,Ltd.	24-ACT-087	25 Jun 24	24 Jun 25	-
18	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, $L_{Aeq\ 1\ hr}$, L_{Amax} , L_{A90} , L_{Adn}	Larson Davis	LxT2 0005299	Innovative Instrument Co.,Ltd.	24-SLM-240	11 Jul 24	10 Jul 25	-
19	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, $L_{Aeq\ 1\ hr}$, L_{Amax} , L_{A90} , L_{Adn}	Larson Davis	LxT2 0005372	Innovative Instrument Co.,Ltd.	24-SLM-229	9 Jul 24	8 Jul 25	-
20	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, $L_{Aeq\ 1\ hr}$, L_{Amax} , L_{A90} , L_{Adn}	Larson Davis	LxT2 0005341	Innovative Instrument Co.,Ltd.	24-SLM-232	10 Jul 24	9 Jul 25	-
Water									
1	pH Meter	pH	Horiba	LAQUA-PH210 HA1G0008	Technology Promotion Association (Thailand-Japan)	24CH1153/1	18 Sep 24	17 Sep 25	-
2	DO Meter	DO	Horiba	LAQUA-DO210 HE1D0010	Technology Promotion Association (Thailand-Japan)	24TW200	18 Sep 24	17 Sep 25	-
3	Conductivity Meter	Conductivity	YSI	Pro30 17A102921	Technology Promotion Association (Thailand-Japan)	24CH1158	18 Sep 24	17 Sep 25	-

รายการเครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Workplace									
1	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6695	Innovative Instrument Co.,Ltd.	24-ACT-122	10 Sep 24	9 Sep 25	-
2	Sound Level Meter	$L_{Aeq\ 8\ hrs}$ L_{Amax}	Rion, Japan	NL-42 00558208	Sithiporn Associates Co., Ltd.	ACL25026	13 Jan 25	12 Jan 26	-
3	Sound Level Meter	$L_{Aeq\ 8\ hrs}$ L_{Amax}	Rion, Japan	NL-42 00558212	Sithiporn Associates Co., Ltd.	ACL25115	28 Jan 25	27 Jan 26	-
4	Sound Level Meter	$L_{Aeq\ 8\ hrs}$ L_{Amax}	Rion, Japan	NL-42 00208876	Sithiporn Associates Co., Ltd.	ACL25018	13 Jan 25	12 Jan 26	-
5	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 143225	Innovative Instrument Co.,Ltd.	24-NDM-177	16 Jul 24	15 Jul 25	-
6	Primary Flow Calibrator	Calibrate personal pump	TSI,Inc	4146 41462327002	Innovative Instrument Co., Ltd.	24-AFM-156	19 Aug 24	18 Aug 25	-
7	Aneroid Barometer	Total Dust Respirable Dust	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24P1370	22 Apr 24	21 Apr 25	-
8	Aneroid Barometer	Total Dust Respirable Dust	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	25P1359	17 Apr 25	16 Apr 26	-

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No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Workplace									
9	Digital Thermo - Hygrometer	Total Dust Respirable Dust	Digicon	TH-02 435031148	Technology Promotion Association (Thailand-Japan)	24H1487	15 Jul 24	14 Jul 25	-
10	Light Meter	Lux	Extech Instrument, Taiwan	407026 A 062335	Innovative Instrument Co., Ltd.	24-LXM-199	1 Aug 24	31 Jul 25	-
11	Thermal Environment Monitor	Heat Meter	Quest Technologies, Inc	QuesTemp 34 TEK120020	Innovative Instrument Co.,Ltd.	24-TPM-371	15 Aug 24	14 Aug 25	-
12	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPQ020022	Innovative Instrument Co.,Ltd.	24-TPM-369	15 Aug 24	14 Aug 25	-


Calibration Certificate

Certificate No.: 2502228-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

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Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: AB204-S/FACT
Serial No.: B108115858
ID No.: UAE.AIR.016/2555
Order No.: 2502228
Operation No.: 2502228-001
Date of Receipt: 19 March 2025
Date of Calibration: 19 March 2025

Calibrated by Mr.Yothin Charoensuk
Scientist

Approved by 
(Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 25 March 2025

The uncertainties are for a confidence probability of approximately 95%

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

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

Calibration Report

Certificate No.: 2502228-001-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AB204-S/FACT

Resolution: 0.0001 g

Serial No.: B108115858

ID No.: UAE.AIR.016/2555

Capacity: 220 g

Date of Calibration: 19 March 2025

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Environment Condition: Ambient Temperature: 21.1 ± 0.6 °C Relative Humidity: 55 ± 0.75 %

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	B505567572	TCS	M24041005	19 April 2025

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 017/23	Quality Reborn	QR25-542	10 February 2026

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

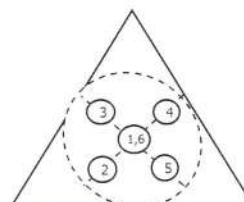
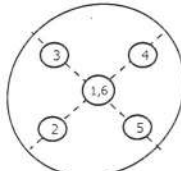
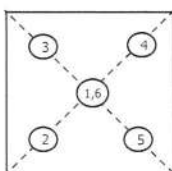
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000079
200	0.000067

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)
100.0002	100.0000	99.9998	100.0002	100.0003	100.0001	0.0004

for N. niphad

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

Calibration Report

Certificate No.: 2502228-001-01

Equipment: Electronic Balance
Model: AB204-S/FACT
Serial No.: B108115858
Capacity: 220 g

Manufacturer: METTLER TOLEDO

Resolution: 0.0001 g

ID No.: UAE.AIR.016/2555

Date of Calibration: 19 March 2025

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Calibration Results: (Continued)

Calibration Range: 0-200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor <i>k</i>
Unload	0.00000	0.0000	0.0000	0.000096	2.00
0.1	0.10001	0.1000	0.0000	0.000096	2.00
1	1.00000	0.9999	0.0001	0.000097	2.00
3	3.00003	3.0000	0.0000	0.000098	2.00
5	5.00002	4.9999	0.0001	0.000098	2.00
10	10.00001	10.0000	0.0000	0.000099	2.00
20	20.00003	20.0000	0.0000	0.00011	2.00
50	50.00003	50.0001	-0.0001	0.00012	2.00
70	70.00006	70.0000	0.0001	0.00014	2.00
100	100.00006	100.0000	0.0001	0.00016	2.00
150	150.00009	150.0001	0.0000	0.00021	2.00
200	200.00013	200.0001	0.0000	0.00028	2.00

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

----- End -----

for N. nignobot

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




Calibration Certificate

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

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

Calibrated by Mr.Yothin Charoensuk
Scientist

Approved by 
(Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 25 March 2025

The uncertainties are for a confidence probability of approximately 95%

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

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



Calibration Report

Certificate No.: 2502228-002-01

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XP6

Resolution: 0.000001 g

Serial No.: B322373893

ID No.: UAE.AIR.019/2556

Capacity: 6.1 g

Date of Calibration: 20 March 2025

Page 2 of 3

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

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	B505567572	TCS	M2404100S	19 April 2025
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 017/23	Quality Reborn	QR25-0542	10 February 2026

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

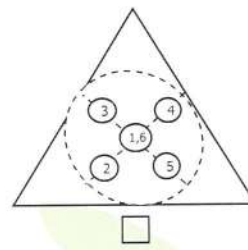
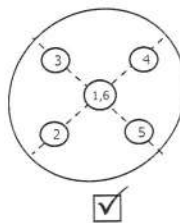
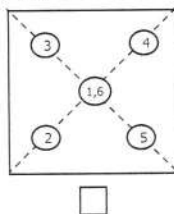
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
3	0.00000079
6	0.00000067

2. Off-Center Error:

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

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
2.000018	2.000017	2.000014	2.000014	2.000024	2.000019	0.000006

Calibration Report

Certificate No.: 2502228-002-01

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XP6

Resolution: 0.000001 g

Serial No.: B322373893

ID No.: UAE.AIR.019/2556

Capacity: 6.1 g

Date of Calibration: 20 March 2025

Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-6 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor <i>k</i>
Unload	0.0000000	0.000000	0.000000	0.0000032	2.00
0.001	0.0010030	0.001002	0.000001	0.0000032	2.00
0.01	0.0100030	0.010003	0.000000	0.0000034	2.00
0.05	0.0499960	0.050001	-0.000005	0.0000044	2.00
0.10	0.1000110	0.100011	0.000000	0.0000057	2.00
0.15	0.1500070	0.150010	-0.000003	0.0000071	2.00
0.17	0.1700130	0.170012	0.000001	0.0000077	2.00
0.20	0.2000110	0.200015	-0.000004	0.0000065	2.00
1.50	1.5000190	1.500017	0.000002	0.000017	2.00
3.00	3.0000260	3.000017	0.000009	0.000019	2.00
4.50	4.5000610	4.500023	0.000038	0.000023	2.00
6.00	6.0000180	6.000014	0.000004	0.000023	2.00

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

----- End -----

for N. Niyudat

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

Calibration Certificate

Certificate No.: 2403175-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: METTLER ROLEDO
Model: SevenCompact S220
Serial No.: C113432421
ID No.: UAE.WAT.009/2564
Order No.: 2403175
Operation No.: 2403175-001
Date of Receipt: 13 June 2024
Date of Calibration: 25 June 2024

Calibrated by Mr.Pheraphat Tuanjit
Scientist

Approved by 
(Mr.Nuttapol Niyomchat)

Specialist, Division of Calibration Laboratory

Date of Issue: 28 June 2024

Responsible for the Technical Management Team

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

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

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



Calibration Report

Certificate No.: 2403175-001-01

Equipment: pH Meter **Resolution:** 0.01 pH ; 1 mV

Manufacturer: METTLER ROLEDO **Model:** SevenCompact S220

Serial No.: C113432421 **Type:** Bench top

ID No.: UAE.WAT.009/2564

Date of Calibration: 25 June 2024 Page 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute

Environment Condition: **Ambient Temperature:** (22.5 ± 1.5) °C **Relative Humidity:** (50 ± 3) %

Condition of Equipment: Good Condition

Condition of this Results of Calibration

1. Calibration Method W-CC-002 : In house method based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	24E1752	30 May 2025
2.2 Digital Thermometer	2709007	Fluke	CC 660570-01	30 October 2024
2.3 Thermo-Hygro Meter	NFI.BTH 019/23	testo	QR24-0492	4 March 2025
Certified Reference Material	Lot. No.	Manufacturer	Ref N	Expire Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	873608	CPAchem	PH216.L5	16 February 2025
2.5 pH buffer 6.865 (Primary pH buffer Solution)	873609	CPAchem	PH217.L5	16 February 2025
2.6 pH buffer 10.01 (Primary pH buffer Solution)	949189	CPAchem	PH220.L5	30 November 2024
2.7 pH buffer 7.00 (Standard pH buffer Solution)	C03109	HACH LANGE GmbH	S11M004	16 October 2025

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

3.1 Instruments No.2.1	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0008
3.2 Instruments No.2.2	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061
3.3 Instruments No.2.3	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0292
3.4 Certified Reference Material No.2.4 to 2.6	traceable to	Primary measurement method- Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
3.5 Certified Reference Material No.2.7	traceable to	PTB Certificate Nr. PTB-PHOA-563/30504/23 and Certificate Nr. PTB-PHOB-555/30620/22 (PTB: Physikalisch-Technische Bundesanstalt, Braunschweig, Germany)

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

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

N. Nigudat

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

Calibration Report

Certificate No.: 2403175-001-01

Equipment: pH Meter **Resolution:** 0.01 pH ; 1 mV

Manufacturer: METTLER ROLEDO **Model:** SevenCompact S220

Serial No.: C113432421 **Type:** Bench top

ID No.: UAE.WAT.009/2564

Date of Calibration: 25 June 2024

Page 3 of 5

Calibration Results:

1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0	414.122	414	0.00	0.58	2.00
2	295.815	296	2.00	0.58	2.00
4	177.463	177	4.00	0.58	2.00
6	59.160	59	6.00	0.58	2.00
7	0.001	0	7.00	0.58	2.00
8	-59.159	-59	8.00	0.58	2.00
10	-177.462	-177	10.00	0.58	2.00
12	-295.813	-296	12.00	0.58	2.00
14	-414.121	-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 ROLEDO **Model:** InLab Expert Pro-ISM

Serial No.: 4114099 **ID.No.:** N/A

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

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.00	176	-	0.0071	2.00
7.001	7.00	1	98.60	0.0086	2.00
9.997	10.00	-174	98.60	0.0092	2.00
6.865	6.86	9	-	0.0075	2.00

N. ingudant

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

Calibration Report

Certificate No.: 2403175-001-01

Equipment: Digital Thermometer with RTD (pH Meter)

Resolution: 0.1 °C **Model:** SevenCompact S220

Serial No.: C113432421 **ID No.:** UAE.WAT.009/2564

Manufacturer: METTLER TOLEDO

Date of Calibration: 25 June 2024

Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute

Environment Condition: **Ambient Temperature** 23 °C ± 1 °C

Relative Humidity 50 % ± 5 %

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	1521	A85997	TE 670101-01	16-Dec-2024	NATIONAL FOOD INSTITUTE
Platinum Resistance Thermometer (PRT)	385	509201			

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

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

6. Condition of Calibrated item : Good

7. Result of Calibration :

☒

Without adjustment

☐

After adjustment

Calibration Report

Certificate No.: 2403175-001-01

Equipment: Digital Thermometer with RTD (pH Meter)

Resolution: 0.1 °C Model: SevenCompact S220

Serial No.: C113432421 ID No.: UAE.WAT.009/2564

Manufacturer: METTLER TOLEDO

Date of Calibration: 25 June 2024

Page 5 of 5

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 : InLab Expert Pro-ISM S/N : 4114099
- Dimension of probe : Diameter 12 mm., Length 120 mm.,
- Sheath material : Teflon

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
14.9	14.998	0.1	0.099
25.2	24.998	-0.2	0.099
35.3	34.997	-0.3	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 -----

N. Inprasit

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





Certificate of Calibration

Equipment: CONDUCTIVITY METER Certificate No.: C24250010
Model: SevenDirect SD30 Issued Date: 15 January 2025
Serial No. (or ID.): C441872132 (UAE.WAO.017/2567) Job No.: WO-00057642
Manufacturer: METTLER TOLEDO Page: 1 of 2
Electrode Serial No. 5824370998 Model : InLab 731-ISM Brand : METTLER TOLEDO
Condition: In Condition

Customer: United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District,
Phrakhanong District, Bangkok, THAILAND 10260

Environment Condition: Temperature 21.7 °C ± 0.2 °C
Humidity 48.8 %RH ± 2.1 %RH

Calibration Place: United Analyst and Engineering Consultant Co., Ltd. (Calibration Laboratory)
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District,
Phrakhanong District, Bangkok, THAILAND 10260

Calibration By: Mr.Atachai Ngamchanat

Calibration Date: 15 January 2025

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. 1066606, 1066608, 1066610



(Mr. Atachai Ngamchanat)

Person in charge



(Miss Kaewkan Suradech)

Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

DKSH Technology Limited

2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260

2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth – in Asia and Beyond.

เอกสารไม่ควบคุม

CAL-FM-C24-09: 12 Sep 2022

Calibration Results:**Before Adjustment**

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
25.000 $\mu\text{S/cm}$	24.8 $\mu\text{S/cm}$	0.200 $\mu\text{S/cm}$	2.00	0.28 $\mu\text{S/cm}$
1413.1 $\mu\text{S/cm}$	1398.4 $\mu\text{S/cm}$	14.7 $\mu\text{S/cm}$	2.00	11 $\mu\text{S/cm}$
111.3 mS/cm	109.5 mS/cm	1.8 mS/cm	2.00	0.81 mS/cm

After Adjustment ; at 1413.1 $\mu\text{S/cm}$

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
25.000 $\mu\text{S/cm}$	25.1 $\mu\text{S/cm}$	-0.100 $\mu\text{S/cm}$	2.00	0.28 $\mu\text{S/cm}$
1413.1 $\mu\text{S/cm}$	1413.1 $\mu\text{S/cm}$	0.0 $\mu\text{S/cm}$	2.00	11 $\mu\text{S/cm}$
111.3 mS/cm	110.2 mS/cm	1.1 mS/cm	2.00	0.81 mS/cm

The End of Certificate


Calibration Certificate

Certificate No.: 2502226-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C210685394
ID No.: UAE.WAO.010/2565
Order No.: 2502226
Operation No.: 2502226-002
Date of Receipt: 19 March 2025
Date of Calibration: 20 March 2025

Calibrated by Mr.Yothin Charoensuk
Scientist

Approved by 
(Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 25 March 2025

The uncertainties are for a confidence probability of approximately 95%

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

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

Calibration Report

Certificate No.: 2502226-002-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Resolution: 0.00001 g / 0.0001 g

Serial No.: C210685394

ID No.: UAE.WAO.010/2565

Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025

Page 2 of 4

Environment Condition: Ambient Temperature: 21.2 ± 0.6 °C Relative Humidity: 48 ± 3.5 %

Place of Calibration: 208 Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	B505567572	TCS	M2404100S	19 April 2025

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 017/23	Quality Reborn	QR25-0542	10 February 2026

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

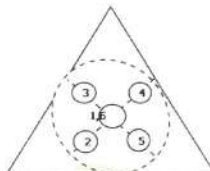
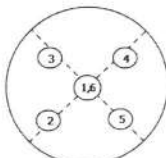
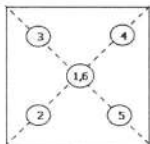
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.0000042
80	0.0000042
100	0.0000000
200	0.0000000

2. Off-Center Error:

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

The balance reading obtained is given in the table.



1 (g)	2 (g)	3 (g)	4 (g)	5 (g)	6 (g)	(Maximum Difference) (g)
100.0001	100.0001	100.0001	100.0001	100.0001	100.0001	0.0000

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

Calibration Report

Certificate No.: 2502226-002-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Resolution: 0.00001 g / 0.0001 g

Serial No.: C210685394

ID No.: UAE.WAO.010/2565

Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025

Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0-80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 82 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.000000	0.00000	0.00000	0.0000087	2.00
0.001	0.001003	0.00100	0.00000	0.0000090	2.00
0.005	0.005002	0.00501	-0.00001	0.0000092	2.00
0.01	0.010003	0.01002	-0.00002	0.0000089	2.00
0.05	0.049996	0.05001	-0.00001	0.0000096	2.00
0.1	0.100011	0.10002	-0.00001	0.000011	2.00
0.5	0.500016	0.50004	-0.00002	0.000014	2.00
1	1.000003	1.00005	-0.00005	0.000016	2.00
2	2.000023	2.00006	-0.00004	0.000017	2.00
5	5.000015	5.00006	-0.00005	0.000020	2.00
10	10.000009	10.00005	-0.00004	0.000026	2.00
20	20.000030	20.00007	-0.00004	0.000037	2.00
30	30.000039	30.00009	-0.00005	0.000050	2.00
50	50.000028	50.00008	-0.00005	0.000068	2.00
80	80.000067	80.00013	-0.00006	0.00011	2.00



Calibration Report

Certificate No.: 2502226-002-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Resolution: 0.00001 g / 0.0001 g

Serial No.: C210685394

ID No.: UAE.WAO.010/2565

Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025

Page 4 of 4

Calibration Results: (Continued)

Calibration Range: >80-200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: >80 - 200 g ; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor <i>k</i>
90	90.00010	90.0002	-0.0001	0.00015	2.00
100	100.00006	100.0001	0.0000	0.00016	2.00
110	110.00007	110.0002	-0.0001	0.00017	2.00
120	120.00009	120.0002	-0.0001	0.00018	2.00
130	130.00010	130.0002	-0.0001	0.00019	2.00
140	140.00013	140.0002	-0.0001	0.00019	2.00
150	150.00009	150.0002	-0.0001	0.00021	2.00
160	160.00010	160.0002	-0.0001	0.00022	2.00
170	170.00012	170.0002	-0.0001	0.00023	2.00
200	200.00013	200.0002	-0.0001	0.00028	2.00

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

----- End -----

for N. important

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



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.Yothin Charoensuk
Scientist

Approved by 
(Mr.Pheraphat Tuanjit)

Manager, Division of Calibration Laboratory

Date of Issue: 15 October 2024

Responsible for the Technical Management Team

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

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

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



Calibration Report

Certificate No.: 2500116-001-01

Equipment: CHAMBER (Hot Air Oven)

Model: UF55 Serial No.: B216.1666

Resolution: 0.1 °C ID No.: UAE.WAO.027/2559

Manufacturer: MEMMERT

Date of Calibration: 8 October 2024

Page 2 of 3

Location: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Environment Condition:
Ambient Temperature (30.3 ± 1) °C
Relative Humidity (55 ± 1) %
Line Voltage (230 ± 3) Volt

Condition of this results of Calibration:

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

2. Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY57003188	TE 670486-01	8 June 2025	NATIONAL FOOD INSTITUTE
	RTD	CH#201-209/ RTD#201-209			

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

UUC Description :

Time of Record 1 Hour 9 Minute At 104.0,140.0 and 180.0 °C
Fresh air Damper - Open Position -
X Close Fan 40%
- Not Available

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




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 3 of 3

Calibration point: 104.0, 140.0 and 180.0 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	29.3	54	227.0
MAX	31.2	56	232.0

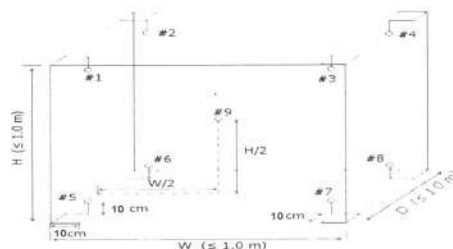


Table 1 : Reporting of Temperature

Calibration point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
104.0	103.89	103.66	103.88	103.89	104.40	103.98	103.70	104.10	104.15	0.53
140.0	139.85	139.53	139.87	139.88	140.67	140.00	139.60	140.25	140.23	0.73
180.0	179.63	179.22	179.71	179.76	181.03	180.06	179.41	180.87	180.39	0.90

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
104.0	104.0	104.0	104.0	0.15	0.49	0.88
140.0	140.0	140.0	140.0	0.13	0.71	1.2
180.0	180.0	180.0	180.0	0.13	1.2	1.9

Note The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity) "

UUC* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.

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

----- End -----

Handwritten signature



Certificate of Calibration

Certificate No.: 250422-1-BL002-25

Code No.: BL002-25

Page: 1 of 3

Customer Name: United Analyst and Engineering Consultant Co., Ltd.
Address: 3 Soi Udom suk 41, Sukhumvit Rd., Bang Chak, Phar Khanong, Bangkok 10260

Equipment: Electronic Balance
Manufacturer: Mettler Toledo
Model: AB204-S/FACT
Serial No.: 1129361010
Asset No. : UAE.WAS.002/2552

Building : N/A Floor : 1 Room : 107

Received Date: April 22, 2025
Date of Calibration : April 23, 2025

Calibration Conditions:	Temperature	22.8 °C	to	23.4 °C
	Humidity	54.8 %	to	68.9 %
	Pressure	756.6 mmHg	to	758.2 mmHg

Calibrated by: Sakkarin Srirahang

Approved by: Suwit Chotnok

Signature:



Issued Date: April 25, 2025

Note : 1) The Uncertainties are for a confidence probability of approximately 95%

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

3) This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the United Analyst and Engineering Consultant Co.,Ltd. (UAE)

เอกสารไม่ควบคุม

Certificate No.: 250422-1-BL002-25

Code No.: BL002-25

Page: 2 of 3

Equipment: Electronic Balance
Model: AB204-S/FACT
Serial No.: 1129361010
Max. Capacity: 220 g
Calibration Date: April 23, 2025
Condition As-Received: In Condition

Manufacturer: Mettler Toledo
Readability: 0.0001 g
ID No.: UAE.WAS.002/2552

Condition of Equipment:

Condition of This Result of Calibration:

1. Calibration Method: This instrument was calibrated by method UAE.CP.CAL.006 In-House Method based on UKAS Lab 14 : 2022

2. Reference Standards:

Reference Standard:	Model	Serial No.	Calibrated By	Certificate No.	Traceability	Due Date
Standard Weight Class E2 (OIML)	1 mg to 1 kg	B749109122	AMARC	25-009359	Mettler-Toledo	21-Jan-27
Standard Weight Class F1 (OIML)	1 mg to 200 g	11119512	AMARC	24-013840	Mettler-Toledo	04-Feb-26
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Traceability	Due Date
Thermo-Hygro-Baro Meter	MHB-382SD	AK.46457	SUCCESS	SG-H-00997/67	Success Gateway	21-Nov-25
Thermo-Hygro-Baro Meter	MHB-382SD	AK.46457	TPA	25P795	TPA	25-Feb-26

3. This certification is traceable to SI Unit

4. This certification was certified only for the indtrument we calibrated

5. This result of calibration wae found accurate as show on date and place of calibration only.

6. Through the reference standard laboratory of AMARC 25-009359 Calibration 0152

Calibraton Result:

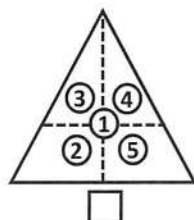
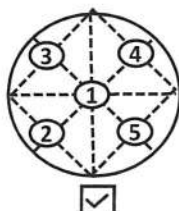
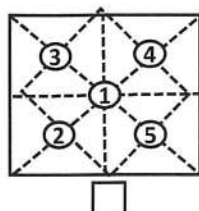
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
200*	0.000045

2. Eccentric or off-center loading

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

The Balance reading obtained is given in the table.



1 (g)	2 (g)	3 (g)	4 (g)	5 (g)	Maximum Difference (g)
100.0000	99.9996	99.9997	100.0003	100.0005	0.0005

เอกสารไม่ควบคุม

Certificate No.: 250422-1-BL002-25

Code No.: BL002-25

Page: 3 of 3

Equipment: Electronic Balance

Model: AB204-S/FACT

Serial No.: 1129361010

Max. Capacity: 220 g

Calibration Date: April 23, 2025

Manufacturer: Mettler Toledo

Readability: 0.0001 g

ID No.: UAE.WAS.002/2552

Calibration Result: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Error of indication from nominal or conventional mass value:

Nominal Value (g)	Reference Value (g)	Indication (g)	Correction (g)	Uncertainty (\pm mg)	Coverage Factor <i>k</i>
Unload	0.0000000	0.0000	0.0000	0.10	2.05
0.01	0.0100025	0.0099	0.0001	0.10	2.05
0.05	0.0500056	0.0500	0.0000	0.10	2.05
0.1	0.1000012	0.0999	0.0001	0.10	2.05
0.5	0.5000133	0.5000	0.0000	0.10	2.05
1	1.0000105	1.0000	0.0000	0.10	2.05
10	10.000010	10.0000	0.0000	0.11	2.04
40	40.000076	40.0000	0.0000	0.14	2.00
50	50.000056	50.0000	0.0001	0.13	2.00
80	80.000107	80.0000	0.0001	0.18	2.00
100	100.000109	99.9999	0.0002	0.17	2.00
120	120.00015	119.9999	0.0003	0.21	2.00
150	150.000165	149.9998	0.0003	0.24	2.00
160	160.000175	159.9997	0.0005	0.26	2.00
200	200.000129	199.9998	0.0004	0.30	2.00

4. Effect of Tare test:

Tare Load (g)	Test Load (g)	Indication (g)	Correction (g)
100	20.000041	19.9999	0.0001
	40.000076	39.9998	0.0002
	60.000066	59.9997	0.0003
	80.000107	79.9999	0.0002
	100.000168	100.0004	-0.0003

Remark:

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

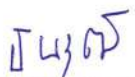
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o---o-End-o---

CERTIFICATE OF CALIBRATION

Certificate No. : SP24-028

Page 1 of 5

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)**Address :** 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260**Location of calibration :** Laboratory 315**Equipment :** UV-Vis Spectrophotometer**Manufacturer :** HITACHI**Model :** U-5100**Serial No. :** 23A4-008**ID No. :** UAE.WAS.010/2567**Received Date :** 10 September 2024**Calibration Date :** 10 September 2024**Issue Date :** 13 September 2024**Condition Instrument :** Good**Calibrated by :**

(Mr.Tanawut Rittidach)

Technical Manager

Approved by :

(Ms. Chonthicha Sangngern)

Quality Manager

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

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

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP24-028

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °CRelative 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 Sarna Scientific Limited

Spectral Band Width of UUC : 5.0 nm.**Scan Speed of UUC :** 40**Scan Interval of UUC :** 0.1 nm.**Resolution of UUC :** Photometric 0.001 Abs.

Wavelength 0.1 nm.

REPORT OF CALIBRATION

Certificate No. : SP24-028

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.044	0.0044	0.0029	2.00
	2.1876	2.190	-0.0024	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.557	0.0025	0.0034	2.00
	1.0239	1.021	0.0029	0.0035	2.00
	2.1230	2.121	0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.519	0.0040	0.0029	2.00
	0.9633	0.961	0.0023	0.0028	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.515	0.0031	0.0031	2.00
	1.0002	0.997	0.0032	0.0033	2.00
	1.9973	1.996	0.0013	0.0085	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.549	0.0027	0.0030	2.00
	1.0803	1.078	0.0023	0.0029	2.00
	2.0373	2.031	0.0063	0.0081	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.557	0.0021	0.0031	2.00
	1.0518	1.049	0.0028	0.0029	2.00
	1.9274	1.923	0.0044	0.0080	2.00

REPORT OF CALIBRATION

Certificate No. : SP24-028

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.743	0.0039	0.0056	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.862	0.0054	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.291	0.0009	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.639	0.0040	0.0055	2.00

REPORT OF CALIBRATION

Certificate No. : SP24-028

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor <i>k</i>
241.00	240.4	0.60	0.18	2.00
279.30	278.7	0.60	0.18	2.00
288.90	288.5	0.40	0.18	2.00
334.50	334.2	0.30	0.18	2.00
361.40	361.1	0.30	0.18	2.00
418.40	418.0	0.40	0.18	2.00
447.20	446.7	0.50	0.18	2.00
459.30	459.6	-0.30	0.18	2.00
537.00	536.6	0.40	0.18	2.00
638.00	637.4	0.60	0.18	2.00
441.29	440.8	0.49	0.18	2.00
479.88	479.6	0.28	0.18	2.00
513.75	513.5	0.25	0.18	2.00
528.59	528.6	-0.01	0.18	2.00
575.10	574.9	0.20	0.18	2.00
585.56	585.3	0.26	0.20	2.00
684.70	684.1	0.60	0.18	2.00
740.51	740.0	0.51	0.20	2.00
747.61	747.2	0.41	0.18	2.00
807.04	806.3	0.74	0.18	2.00
879.68	878.9	0.78	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

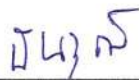
which for a normal distribution corresponds to a coverage probability of approximately 95%

- End of Certificate -

CERTIFICATE OF CALIBRATION

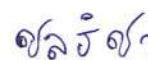
Certificate No. : SP25-001

Page 1 of 5

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)**Address :** 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260**Location of calibration :** Laboratory 213**Equipment :** UV-Vis Spectrophotometer**Manufacturer :** Hitachi**Model :** U-2900**Serial No. :** 21E22-009**ID No. :** UAE.WAT.051/2564**Received Date :** 3 January 2025**Calibration Date :** 3 January 2025**Issue Date :** 8 January 2025**Condition Instrument :** Good**Calibrated by :**

(Mr.Tanawut Rittidach)

Technical Manager

Approved by :

(Ms. Chonthicha Sangngern)

Quality Manager

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

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

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REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °CRelative humidity 55 ± 20 %RH**Calibration method :** In-house method CP-01 Based on ASTM E275-08**Certified Reference Materials :**

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

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

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

Spectral Band Width of UUC : 1.5 nm.**Scan Speed of UUC :** 200 nm/min**Scan Interval of UUC :** 0.1 nm.**Resolution of UUC :** Photometric 0.001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.578	0.0000	0.0031	2.00
	1.0484	1.045	0.0034	0.0029	2.00
	2.1876	2.192	-0.0044	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.560	-0.0005	0.0034	2.00
	1.0239	1.023	0.0009	0.0035	2.00
	2.1230	2.125	-0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.521	0.0020	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.977	-0.0017	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.518	0.0001	0.0031	2.00
	1.0002	0.998	0.0022	0.0033	2.00
	1.9973	1.993	0.0043	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.552	-0.0003	0.0030	2.00
	1.0803	1.079	0.0013	0.0030	2.00
	2.0373	2.032	0.0053	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.559	0.0001	0.0031	2.00
	1.0518	1.050	0.0018	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.744	0.0029	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.863	0.0044	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.290	0.0019	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.640	0.0030	0.0055	2.00

REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor <i>k</i>
241.72	241.1	0.62	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.3	0.51	0.18	2.00
334.06	333.8	0.26	0.18	2.00
360.93	360.6	0.33	0.18	2.00
418.59	418.2	0.39	0.18	2.00
445.94	445.5	0.44	0.18	2.00
453.66	453.4	0.26	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.6	-0.01	0.18	2.00
637.98	637.7	0.28	0.18	2.00
431.38	431.1	0.28	0.18	2.00
472.50	472.3	0.20	0.18	2.00
513.47	513.4	0.07	0.18	2.00
528.88	528.9	-0.02	0.18	2.00
573.17	573.3	-0.13	0.18	2.00
585.35	585.1	0.25	0.20	2.00
684.40	684.5	-0.10	0.18	2.00
740.72	741.0	-0.28	0.20	2.00
748.55	748.8	-0.25	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.6	-0.32	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- End of Certificate -

เอกสารไม่ควบคุม



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



Certificate of Calibration

Cert. No.: 25TM205

Page : 1 of 3

Equipment : BOD Incubator

Manufacturer : Arco

Model : UC4-1320

Serial No. : 13URC4S013201

ID No. : UAE.WAO.015/2561

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

Location : Lab. Floor 2

Received Order : 08 February 2025

Calibration Date : 08 February 2025

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Krisda Malee

Approved by :

Approved Signatory

() Chakrit Waewwanjua

() Suwit Imjai

(✓) Kunchit Promprat

Issue Date : 21 February 2025

The Uncertainties are for a confidence probability of approximately 95%

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

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Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2502-0166OC-1

Cert. No.: 25TM205

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:-

<u>Instrument</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Traceable</u>	<u>Due Date</u>
1) Data Acquisition	MY57013823	24LM71	TPA	12 May 2025

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.

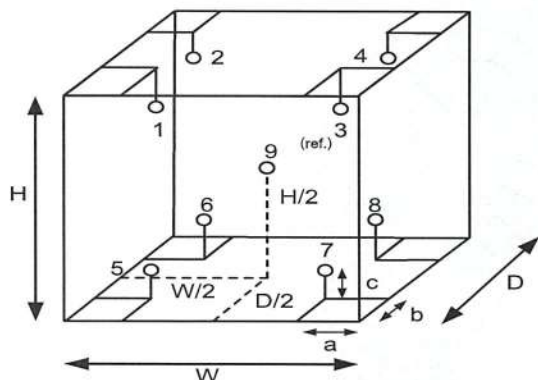
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	25
REL.Humid. (%)	49	52
AC Supply (Volt)	221	220



Position :	Ref. Std. ID No.:
1	21-17RTD-01
2	21-17RTD-02
3	17RTD-03
4	24-17RTD-04
5	17RTD-05
6	17RTD-06
7	17RTD-07
8	23-17RTD-08
9 (ref.)	23-17RTD-09

Probe Installation Details :

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

Dimension of Chamber :

D = 0.62 m
W = 1.2 m
H = 1.2 m
Capacity = 0.89 m³

เอกสารไม่ควบคุม



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2502-0166OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 25TM205

Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>
20.0	20.0	19.9	0.36	0.56	0.99	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.841	19.714	20.110	19.862	19.747	19.710	19.676	19.789	19.695	0.54

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


534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

TEL. 0-2717-3000 FAX. 0-2719-9484

Certificate of Testing

Cert.No.: 24TW222

Page.: 1 of 2

Equipment : DO Meter
Manufacturer : YSI
Model : 4010-2W
Serial No. : 20260326
ID No. : UAE.WAO.060/2563
Received Date : 16 October 2024
Test Date : 17 October 2024
Reference : 2410-0532DSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
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 : Walalak Sirithean

Approved by : _____
Approved Signatory
() Unnopphol Harachai
() Ponpan Paipim
(✓) Saithip Meangmai
Issue Date : 17 October 2024

เอกสารไม่ควบคุม



Cert.No.: 24TW222

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).

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	24MM131	04 July 2025

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate 5-Hydrate AR	KEMAUS	2203162447	99.6%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 22M102385

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.18	8.24	0.0071

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

-o0o-

เอกสารไม่ควบคุม

Certificate No. : HIT-2510-0375

Page : 1 of 2

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater

Meter Model : HI839800-02 **Serial No. :** H018500I

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 :** RE250401

Ambient Temperature : (25 ± 2)°C **Relative Humidity :** (50 ± 15) % RH

Customer name : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,
Phrakhanong, Bangkok 10260

Received date : 5 March 2025

Calibrate date : 7 March 2025

Issue date : 7 March 2025

Calibrated Location : Hanna Instruments (Thailand) Ltd.

Calibration Procedure : This calibrator was conducted by using in-house: calibration procedure
CP-04 by using certified reference standard instruments.

Calibrated by : ☒ Mr. Pichit Petthong
☐ Mr. Channarong Soinak

Approved by : 
Mr. Anan Suwanchaisakul

Authorized Signatory

 **HANNA**
Instruments
(Thailand) Limited

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	WK2407-141-1	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HT-771SD	AI.07155	25H171	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	150.4	0.47

Unit : °C

(1A)	(2A)	(3A)	(4A)	(5A)
150.407	150.377	150.269	150.402	150.422
(1B)	(2B)	(3B)	(4B)	(5B)
150.426	150.394	150.644	150.690	150.542
(1C)	(2C)	(3C)	(4C)	(5C)
150.477	150.303	150.627	150.257	150.176
(1D)	(2D)	(3D)	(4D)	(5D)
150.462	150.456	150.199	150.406	150.102
(1E)	(2E)	(3E)	(4E)	(5E)
150.185	150.513	150.235	150.460	150.442

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

Verification Certificate

Certificate No.: 2404228-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 4

Equipment: Digestion Unit (Heating Block)
Manufacturer: VELP SCIENTIFICA
Model: DKL20
Serial No.: 213517
ID No.: UAE.WAS.005/2555
Order No.: 2404228
Operation No.: 2404228-001
Date of Receipt: 26 August 2024
Date of Calibration: 26-27 August 2024

Calibrated by Mr.Worapob Sookthong
Scientist

Approved by

(Mr.Pheraphat Tuanjit)

Manager, Division of Calibration Laboratory

Date of Issue: 30 August 2024

Responsible for the Technical Management Team

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

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

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



Verification Report

Certificate No.: 2404228-001-01

Equipment: Digestion Unit (Heating Block)

Model: DKL20 Serial No.: 213517

Resolution: 1 °C ID No : UAE.WAS.005/2555

Manufacturer: VELP SCIENTIFICA

Date of Calibration: 26-27 August 2024

Page 2 of 4

Location: Dry Laboratory (312), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Environment Condition:

Ambient Temperature (29 ± 1) °C

Relative Humidity (60 ± 2) %

Line Voltage (224 ± 1) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert standard thermocouples type R into its Digestion blocks and Calibration according to NFI Method W-TE-026 based on BS 4309 : 1968
 - 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 Thermocouple	34970A	MY44045576/MY41194453	TC24/0063	5-Jun-2025	N.M. Technical Center Laboratory
	Type R	R/CH1 to R/CH3			

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

UUC* Description

Time of Record 1 Hour 6 Minute At 380 °C

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



Verification Report

Certificate No.: 2404228-001-01

Equipment: Digestion Unit (Heating Block)

Model: DKL20 Serial No.: 213517

Resolution: 1 °C ID No : UAE.WAS.005/2555

Manufacturer: VELP SCIENTIFICA

Date of Calibration: 26-27 August 2024

Page 3 of 4

Calibration point: 380 °C

Calibration result:

Table1 : Reporting of Temperature

Block No.	UUC* Setting (°C)	UUC* Reading (°C)	Stability (±°C)	Standard Thermometer (°C)	Uncertainty (±°C)
1	380	380	0.21	380.14	2.0
2	380	380	0.21	380.70	2.0
3	380	380	0.12	381.17	2.0
4	380	380	0.12	379.82	2.0
5	380	380	0.20	381.01	2.0
6	380	380	0.16	380.48	2.0
7	380	380	0.19	379.35	2.0
8	380	380	0.25	380.27	2.0
9	380	380	0.17	382.28	2.0
10	380	380	0.35	380.98	2.0
11	380	380	0.30	380.35	2.0
12	380	380	0.23	382.38	2.0
13	380	380	0.17	378.95	2.0
14	380	380	0.18	379.69	2.0
15	380	380	0.16	382.06	2.0
16	380	380	0.14	380.14	2.0
17	380	380	0.16	381.09	2.0
18	380	380	0.15	382.71	2.0
19	380	380	0.25	381.32	2.0
20	380	380	0.25	381.21	2.0

Note:

- UUC* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

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




Verification Report

Certificate No.: 2404228-001-01

Equipment: Digestion Unit (Heating Block)

Model: DKL20 Serial No.: 213517

Resolution: 1 °C ID No.: UAE.WAS.005/2555

Manufacturer: VELP SCIENTIFICA

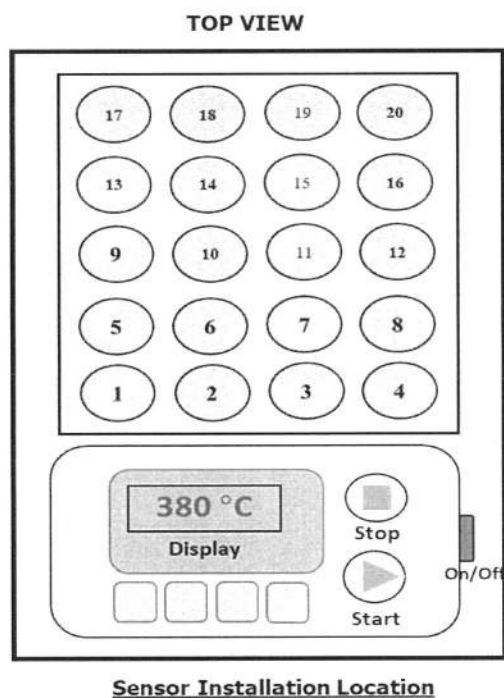
Date of Calibration: 26-27 August 2024

Calibration point: 380 °C

Calibration result: Continued

Page 4 of 4

Figure 1. Location of Reference Standard and Block Diagram of Digestion Unit



----- End -----



FOSS

FOSS South East Asia

3388 Sirinrat Building, 25th – 26th Floor, Unit No. 3388/90,
Rama IV Road, Klongton , Klongtoey, Bangkok, Thailand 10110

Customer Service Report

Report No.:

13854

Date:

24 February 2025

Customer:

VAE

Job No.:

11735

Address:

Bangkok

Instrument:

KT8100

Serial:

91889052

Start
Finish

Travel To Customer (Hrs)

07:00

09:00

2hrs

Labour (Hrs)

09:00-12:00

13:00-14:00

0hrs

Travel From Customer (Hrs)

15:00

17:00

2hrs

Job Type

Application		Special		Standard	
Distributor	<input checked="" type="checkbox"/>	Courtesy Visit	<input checked="" type="checkbox"/>	Installation	<input checked="" type="checkbox"/>
Digital Service	<input checked="" type="checkbox"/>	PMA Onboarding	<input checked="" type="checkbox"/>	Quote	<input checked="" type="checkbox"/>
Internal	<input checked="" type="checkbox"/>	Warranty	<input checked="" type="checkbox"/>	Repair	<input checked="" type="checkbox"/>
Investigate	<input checked="" type="checkbox"/>	Sales Support	<input checked="" type="checkbox"/>	Remote	<input checked="" type="checkbox"/>
				Training	<input checked="" type="checkbox"/>
				In House	<input checked="" type="checkbox"/>
				PM	<input checked="" type="checkbox"/>
				Health Check Visit	<input checked="" type="checkbox"/>

PMA Type

Smartcare

☒

Smartcare Pro

☒

Fosscore

☒

Smartcare Advance

☒

Fosscore Pro

☒

N/A

☒

Details of Work / Test

APM KT8100 12mo

- test before PM
- cleaning KT8100, 36 mo replace
- flushing Alkali pump
- test operation
 - Distillation 80 - 80 ml
 - Distillation 6 min 150 - 170 ml
 - Alkali 50 - 50 ml
 - all pass

Instrument Ready for Use

OK

☒

Not OK*

☒

Part No:

Batch

Description

Qty

60031810

08-01-2024

FOSS PM kit KT8100 36mo

1

I confirm this report is accurate and complete

Signed FOSS



Signed Customer

Suphakorn P.

Name

Name

Email:

Customer Contact.:

*Remark:

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Please scan QR code



Request No. 25-67 / 0275

MTC. ACL.No. 358 / 67

CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"

Model AA240FS, Serial No. MY13160001

2. Working standard solution "Inorganic Ventures"

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

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

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

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

2. Estimation Uncertainty 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 Suladda

(Miss Sutadda Deawtong)

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.

FM.BL.MTC.002 Rev.4

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Thailand
Tel. (66) 0 2259 5111 Fax. (66) 0 2259 5217
E-mail : sumalee@tistr.or.th

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CALIBRATION DATA

1. Noise Level

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

Continue 2 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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E-mail : sumalee@tistr.or.th

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2. Precision

Element	Conc. (mg/l)	Absorbance										Ave. Abs.	SD	%RSD
Cd	0.02	0.0078	0.0076	0.0069	0.0075	0.0071	0.0070	0.0076	0.0074	0.0077	0.0067	0.007	0.0004	5.15
	0.30	0.1008	0.1007	0.0999	0.0997	0.1000	0.0996	0.1008	0.1002	0.1005	0.0999	0.100	0.0005	0.46
	0.70	0.2301	0.2306	0.2277	0.2305	0.2310	0.2295	0.2290	0.2293	0.2305	0.2296	0.230	0.0010	0.42
Cr	0.10	0.0094	0.0093	0.0093	0.0098	0.0094	0.0095	0.0090	0.0090	0.0094	0.0090	0.009	0.0003	2.75
	0.30	0.0241	0.0236	0.0221	0.0238	0.0231	0.0226	0.0231	0.0223	0.0230	0.0231	0.023	0.0006	2.75
	0.70	0.0500	0.0500	0.0500	0.0524	0.0499	0.0511	0.0509	0.0512	0.0515	0.0504	0.051	0.0008	1.63
Cu	0.05	0.0061	0.0062	0.0064	0.0061	0.0069	0.0069	0.0061	0.0062	0.0064	0.0061	0.006	0.0003	5.00
	0.30	0.0419	0.0411	0.0402	0.0407	0.0405	0.0404	0.0399	0.0400	0.0399	0.0400	0.040	0.0006	1.58
	0.70	0.0960	0.0960	0.0960	0.0959	0.0947	0.0955	0.0952	0.0952	0.0951	0.0955	0.096	0.0005	0.48
Fe	0.10	0.0096	0.0101	0.0103	0.0100	0.0099	0.0096	0.0106	0.0099	0.0105	0.0102	0.010	0.0003	3.38
	0.50	0.0424	0.0415	0.0428	0.0427	0.0421	0.0426	0.0413	0.0430	0.0421	0.0419	0.042	0.0006	1.33
	1.00	0.0830	0.0839	0.0847	0.0834	0.0832	0.0820	0.0839	0.0838	0.0837	0.0845	0.084	0.0008	0.92
Pb	0.20	0.0078	0.0074	0.0078	0.0078	0.0076	0.0078	0.0077	0.0078	0.0078	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	0.0547	0.0546	0.0544	0.0544	0.0549	0.0547	0.055	0.0004	0.64
Mn	0.05	0.0116	0.0107	0.0110	0.0103	0.0108	0.0108	0.0112	0.0107	0.0109	0.0108	0.011	0.0003	3.15
	0.30	0.0650	0.0649	0.0649	0.0651	0.0646	0.0646	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
Ni	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	0.0443	0.0433	0.0438	0.0444	0.0430	0.0437	0.0444	0.0437	0.0438	0.0434	0.044	0.0005	1.09
	1.00	0.0812	0.0820	0.0834	0.0829	0.0818	0.0829	0.0831	0.0835	0.0816	0.0819	0.082	0.0008	0.99
Zn	0.05	0.0374	0.0377	0.0373	0.0377	0.0374	0.0377	0.0373	0.0371	0.0371	0.0374	0.037	0.0002	0.61
	0.30	0.1985	0.1993	0.1975	0.1992	0.1979	0.1988	0.1995	0.1985	0.1974	0.2004	0.199	0.0009	0.47
	0.70	0.4027	0.4031	0.4019	0.4021	0.4023	0.3981	0.4042	0.4025	0.3993	0.3997	0.402	0.0019	0.48

Continue 3 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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เอกสารไม่ควบคุม

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

Sumalee

Continue 4 / 5

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Request No. 25-67 / 0275

4 / 5

MTC. ACL. No. 358 / 67

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

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

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

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

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

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

Sumalee

Continue 5 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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Request No. 25-67 / 0275

5 / 5

MTC. ACL. No. 358 / 67

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

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

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

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

Remark : The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 ($k = 2$) which gives a level of confidence of approximately 95%

Calibrated by Atipat

(Mr. Atipat Ratana)

Approved by Suladda

(Miss Suladda Deawtong)

Director of Analytical Chemistry Laboratory

Issued Date : 11 March 2024

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

End of Certificate

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Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES Preventive Maintenance



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

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

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

Introduction

Customer Information

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

Important Customer Web Links

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

Service Engineer's Responsibilities

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

Instrument Maintenance

System Information

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

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

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 8015A	MY 18030001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

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

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components and implementation of Service Notes
- ☒ Check for required firmware/software updates and verify with customers if they would like them installed.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. *ป.18*
- ☒ Ask the customer to remove any samples from the ICP-OES sample introduction area, auto sampler or around the ICP-OES.

Preventive Maintenance Procedures

Record Pre-PM instrument performance

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

Clean and inspect ICP-OES system

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

Agilent Water Recirculator

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

SPS 3 Auto Sampler

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

SPS 4 Auto sampler

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

AVS 4, 6, 7 Advanced Valve System

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

ICP-OES adjustment

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

Record Post-PM instrument performance

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

Restore Instrument

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

Service Review

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

Test Results

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	1500.8	2217.4	4124.8	6965.9
Mn 257.610 nm SRBR	3915.0	7492.2	13017.8	31121.6
Al 396.152 nm SBR	7.7	10.7	9.7	21.1
K 766.491 nm SBR	5.7	28.1	4.8	45.3

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

Instrument Test Results Table

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

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

ICP-OES Status Results Table

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

Measurement	Standby Mode		Plasma On	
Mains Voltage	231.411	VAC	226.871	VAC
Mains Current	0.081	A	0.105	A
Instrument Temperature	22.1	°C	23.5	°C
RF Air Flow (sensor speed)	14.0	Hz	19.0	Hz
Plasma Exhaust Temperature	No measurement		63.8	°C
Water Flow Oscillator	No measurement		1.34	L/min
Water Flow Detector	0.86	L/min	0.81	L/min
Water Inlet Temperature	19.7	°C	19.7	°C
Polychromator Temperature	35.0	°C	35.0	°C
CCD Temperature	-40.1	°C	-39.8	°C
Thermal Stabilizer	35.0	°C	35.0	°C
Argon Supply Pressure	648.92	kPa	591.55	kPa
Purge Gas Supply Pressure*1	646.66	kPa	612.41	kPa
Option Gas Supply Pressure*1	-	kPa	-	kPa
Nebulizer Flow	No measurement		0.70	L/min
Nebulizer Back Pressure	No measurement		158.43	kPa
Plasma Gas Flow	No measurement		11.91	L/min
Auxiliary Gas Flow	No measurement		1.00	L/min
RF Power	No measurement		1204.7	W
RF Supply Current	No measurement		7.858	A
RF Supply Voltage	No measurement		204.417	V

*1 If option installed

Consumed PM Parts

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

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

☒ Section Not Applicable.

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

Signature Page

Service Engineer Comments (optional)

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

Service Verification

Service Request Number:

6007197100

Service Engineer Name:

Kanyakorn S.

Service Engineer Signature:

Kanyakorn S.

Total number of pages in this document:

14

Date Service Completed:

04 Nov 2024

Customer Name:

Aphorn Onkong

Customer Signature:

Aphorn Onkong

Report Summary

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

Result Summary

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

Resolution Test**Pass**

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.98
As (188.980 nm)	≤ 8.20	6.17
C (193.027 nm)	≤ 11.50	8.30
Mo (202.032 nm)	≤ 8.20	6.38
Cr (206.158 nm)	≤ 13.40	8.98
Zn (213.857 nm)	≤ 8.70	6.60
Pb (220.353 nm)	≤ 9.50	7.09
Co (228.615 nm)	≤ 17.20	11.67
Ba (230.424 nm)	≤ 9.40	7.20
Mn (257.610 nm)	≤ 13.30	9.43
Mn (260.568 nm)	≤ 20.30	14.11
Cr (267.716 nm)	≤ 11.00	8.04
Cu (324.754 nm)	≤ 25.00	18.97
Cu (327.395 nm)	≤ 14.20	11.23
Sr (338.071 nm)	≤ 33.50	24.30
Ba (455.403 nm)	≤ 44.00	33.47
Sr (460.733 nm)	≤ 36.00	17.23
Ba (493.408 nm)	≤ 36.00	25.37
Ba (614.171 nm)	≤ 42.00	25.54
Ar (675.283 nm)	≤ 74.00	56.51
K (766.491 nm)	≤ 80.00	65.86

Sensitivity Test**Fail****Radial**

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	104.1	793.0	50.8
Se (196.026 nm)	≥ 41.0	SRBR	87.6	862.0	79.7
Zn (213.857 nm)	≥ 1421.0	SRBR	1500.8	41823.3	749.0
Pb (220.353 nm)	≥ 46.0	SRBR	170.7	2432.0	174.9
Mn (257.610 nm)	≥ 3518.0	SRBR	3915.0	264700.2	4420.0
Al (396.152 nm)	≥ 3.4	SBR	7.7	48454.6	5563.2
Ba (493.408 nm)	≥ 34.0	SBR	45.9	1966719.7	41903.8
K (766.491 nm)	≥ 1.8	SBR	5.7	99038.2	14687.7

Axial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	126.5	1498.8	119.0
Se (196.026 nm)	≥ 159.0	SRBR	112.0	1773.6	197.8
Zn (206.200 nm)	≥ 234.0	SRBR	466.0	6784.2	199.7
Zn (213.857 nm)	≥ 1743.0	SRBR	2217.4	95597.6	1789.7
Cd (214.439 nm)	≥ 4227.0	SRBR	1919.3	68724.6	1236.4
Pb (220.353 nm)	≥ 320.0	SRBR	332.6	7929.5	499.0
Mn (257.610 nm)	≥ 10625.0	SRBR	7492.2	991238.3	16911.7
Cr (267.716 nm)	≥ 1048.0	SRBR	2254.6	129706.6	3150.9
Cu (324.754 nm)	≥ 19.0	SBR	26.9	290746.3	10407.5
Al (396.152 nm)	≥ 6.0	SBR	10.7	211329.2	18005.0
Ba (493.408 nm)	≥ 60.0	SBR	49.3	6956460.4	138336.9
K (766.491 nm)	≥ 24.0	SBR	28.1	1395190.2	47996.2

Precision Test**Pass****Radial**

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.73
Se (196.026 nm)	≤ 2.60	0.95
Zn (213.857 nm)	≤ 1.50	0.31
Pb (220.353 nm)	≤ 2.60	0.73
Mn (257.610 nm)	≤ 1.50	0.39
Al (396.152 nm)	≤ 1.50	0.39
Ba (493.408 nm)	≤ 1.50	0.87
K (766.491 nm)	≤ 1.50	0.32

Axial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	1.21
Se (196.026 nm)	≤ 1.50	0.84
Zn (206.200 nm)	≤ 1.50	0.56
Zn (213.857 nm)	≤ 1.50	0.96
Cd (214.439 nm)	≤ 1.50	0.26
Pb (220.353 nm)	≤ 1.50	0.51
Mn (257.610 nm)	≤ 1.50	0.97
Cr (267.716 nm)	≤ 1.50	0.22
Cu (324.754 nm)	≤ 1.50	0.24
Al (396.152 nm)	≤ 1.50	0.33
Ba (493.408 nm)	≤ 1.50	0.40
K (766.491 nm)	≤ 1.50	0.65

Report Summary

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Post Test_PM_Kanyakorn S.
Test Completed On	11/4/2024 11:07:24 AM

Result Summary

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

Optics Test

	Radial	Axial
Intensity	3184054	3177175
Wavelength	737.212	737.212

Resolution Test		Pass
Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.97
As (188.980 nm)	≤ 8.20	6.14
C (193.027 nm)	≤ 11.50	8.33
Mo (202.032 nm)	≤ 8.20	6.33
Cr (206.133 nm)	≤ 13.40	9.06
Zn (213.837 nm)	≤ 8.70	6.70
Pb (220.353 nm)	≤ 9.50	7.03
Co (228.615 nm)	≤ 17.20	11.72
Ba (230.424 nm)	≤ 9.40	7.32
Mn (257.610 nm)	≤ 13.30	9.44
Mn (260.568 nm)	≤ 20.30	14.21
Cr (267.716 nm)	≤ 11.00	7.94
Cu (324.754 nm)	≤ 25.00	18.99
Cu (327.395 nm)	≤ 14.20	11.27
Sr (338.071 nm)	≤ 33.50	24.40
Ba (455.403 nm)	≤ 44.00	33.50
Sr (460.733 nm)	≤ 36.00	17.31
Ba (493.408 nm)	≤ 36.00	25.44
Ba (614.171 nm)	≤ 42.00	25.16
Ar (675.283 nm)	≤ 74.00	56.15
K (766.491 nm)	≤ 80.00	65.56

Sensitivity Test**Fail****Radial**

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	130.6	977.1	50.4
Se (196.026 nm)	≥ 41.0	SRBR	106.0	958.7	70.2
Zn (213.857 nm)	≥ 1421.0	SRBR	4124.8	44037.7	113.4
Pb (220.353 nm)	≥ 46.0	SRBR	207.2	2554.7	136.2
Mn (257.610 nm)	≥ 3518.0	SRBR	13017.8	271846.6	434.7
Al (396.152 nm)	≥ 3.4	SBR	9.7	50615.5	4717.0
Ba (493.408 nm)	≥ 34.0	SBR	133.7	2069203.0	15359.3
K (766.491 nm)	≥ 1.8	SBR	4.8	100199.5	17235.5

Axial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	174.9	1566.7	73.0
Se (196.026 nm)	≥ 159.0	SRBR	167.0	1863.4	110.2
Zn (206.200 nm)	≥ 234.0	SRBR	740.9	6836.0	83.1
Zn (213.857 nm)	≥ 1743.0	SRBR	6965.9	101568.1	211.7
Cd (214.439 nm)	≥ 4227.0	SRBR	5781.0	72852.9	158.1
Pb (220.353 nm)	≥ 320.0	SRBR	501.0	8464.3	267.7
Mn (257.610 nm)	≥ 10625.0	SRBR	31121.6	1006637.8	1044.0
Cr (267.716 nm)	≥ 1048.0	SRBR	4424.8	132202.9	880.8
Cu (324.754 nm)	≥ 19.0	SBR	68.7	302907.8	4345.6
Al (396.152 nm)	≥ 6.0	SBR	21.1	218771.0	9892.3
Ba (493.408 nm)	≥ 60.0	SBR	250.6	7137380.9	28367.3
K (766.491 nm)	≥ 24.0	SBR	45.3	1435050.6	31025.0

Precision Test**Pass****Radial**

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.81
Se (196.026 nm)	≤ 2.60	0.98
Zn (213.857 nm)	≤ 1.50	0.22
Pb (220.353 nm)	≤ 2.60	0.37
Mn (257.610 nm)	≤ 1.50	0.27
Al (396.152 nm)	≤ 1.50	0.25
Ba (493.408 nm)	≤ 1.50	0.53
K (766.491 nm)	≤ 1.50	0.15

Axial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.81
Se (196.026 nm)	≤ 1.50	0.65
Zn (206.200 nm)	≤ 1.50	0.79
Zn (213.857 nm)	≤ 1.50	0.81
Cd (214.439 nm)	≤ 1.50	0.35
Pb (220.353 nm)	≤ 1.50	0.33
Mn (257.610 nm)	≤ 1.50	1.02
Cr (267.716 nm)	≤ 1.50	0.32
Cu (324.754 nm)	≤ 1.50	0.51
Al (396.152 nm)	≤ 1.50	0.37
Ba (493.408 nm)	≤ 1.50	0.68
K (766.491 nm)	≤ 1.50	0.74

Report Summary

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Post Test_PM_Kanyakorn S.
Test Completed On	11/4/2024 11:30:15 AM

Result Summary

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

Subsystem Communications Test	Pass
-------------------------------	------

Air Flow Test	Pass
---------------	------

30% Air Flow (relative speed)	75% Air Flow (relative speed)
15.00	19.00

Water Flow Test	Pass
-----------------	------

RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.30	0.81	20.55

Gas Flows Test**Pass**

Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	154.65	2.00	2.00	110.92
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	115.38	18.00	17.97	21.48

RF Generator Test**Pass**

RF Power Supply Test	Passed
RF Power Supply (V)	128.554
RF Oscillator Test	Passed
RF Oscillator Frequency (MHz)	25.834
Work Coil Current (A)	44.660
RF Power Supply Current (A)	1.999

Camera Test**Pass**

	Integration Time (ms)	Standard Deviation	Status
Electronic Offset Test	1000	5.228	Passed
Dark Current Test	6000	1.168	Passed
Array Test	5	0.024	Passed
Linearity Test		0.118	Passed

Report Summary

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	change mirror
Test Completed On	11/6/2024 10:35:26 AM

Result Summary

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

Resolution Test**Pass**

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.79
As (188.980 nm)	≤ 8.20	5.80
C (193.027 nm)	≤ 11.50	8.15
Mo (202.032 nm)	≤ 8.20	5.90
Cr (206.158 nm)	≤ 13.40	8.85
Zn (213.857 nm)	≤ 8.70	6.77
Pb (220.353 nm)	≤ 9.50	6.61
Co (228.615 nm)	≤ 17.20	11.79
Ba (230.424 nm)	≤ 9.40	7.25
Mn (257.610 nm)	≤ 13.30	9.47
Mn (260.568 nm)	≤ 20.30	14.50
Cr (267.716 nm)	≤ 11.00	7.91
Cu (324.754 nm)	≤ 25.00	18.72
Cu (327.395 nm)	≤ 14.20	11.09
Sr (338.071 nm)	≤ 33.50	25.39
Ba (455.403 nm)	≤ 44.00	33.09
Sr (460.793 nm)	≤ 36.00	18.54
Ba (493.408 nm)	≤ 36.00	25.74
Ba (614.171 nm)	≤ 42.00	25.23
Ar (675.283 nm)	≤ 74.00	58.92
K (766.491 nm)	≤ 80.00	63.16

Sensitivity Test**Pass****Radial**

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	110.5	868.9	54.3
Se (196.026 nm)	≥ 41.0	SRBR	88.3	934.7	91.3
Zn (213.857 nm)	≥ 1421.0	SRBR	3535.4	44017.7	153.9
Pb (220.353 nm)	≥ 46.0	SRBR	184.5	2492.3	159.8
Mn (257.610 nm)	≥ 3518.0	SRBR	11099.6	249595.3	503.6
Al (396.152 nm)	≥ 3.4	SBR	8.7	50274.4	5172.0
Ba (493.408 nm)	≥ 34.0	SBR	124.5	1903164.1	15166.0
K (766.491 nm)	≥ 1.8	SBR	6.9	110041.4	13991.2

Axial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	253.3	3744.3	196.3
Se (196.026 nm)	≥ 159.0	SRBR	206.7	4199.7	347.2
Zn (206.200 nm)	≥ 234.0	SRBR	923.0	12282.3	172.1
Zn (213.857 nm)	≥ 1743.0	SRBR	6398.3	157551.5	601.7
Cd (214.439 nm)	≥ 4227.0	SRBR	5069.2	99873.7	385.2
Pb (220.353 nm)	≥ 320.0	SRBR	389.0	10641.1	658.6
Mn (257.610 nm)	≥ 10625.0	SRBR	21190.4	985528.7	2153.6
Cr (267.716 nm)	≥ 1048.0	SRBR	3054.1	131797.6	1811.5
Cu (324.754 nm)	≥ 19.0	SBR	36.3	301401.4	8082.9
Al (396.152 nm)	≥ 6.0	SBR	10.8	228359.5	19280.5
Ba (493.408 nm)	≥ 60.0	SBR	106.5	6460421.5	60122.8
K (766.491 nm)	≥ 24.0	SBR	30.2	1639840.6	52562.1

Precision Test**Pass****Radial**

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	1.56
Se (196.026 nm)	≤ 2.60	1.16
Zn (213.857 nm)	≤ 1.50	0.50
Pb (220.353 nm)	≤ 2.60	0.74
Mn (257.610 nm)	≤ 1.50	0.63
Al (396.152 nm)	≤ 1.50	0.54
Ba (493.408 nm)	≤ 1.50	0.78
K (766.491 nm)	≤ 1.50	0.44

Axial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.82
Se (196.026 nm)	≤ 1.50	0.82
Zn (206.200 nm)	≤ 1.50	0.35
Zn (213.857 nm)	≤ 1.50	0.34
Cd (214.439 nm)	≤ 1.50	0.44
Pb (220.353 nm)	≤ 1.50	0.48
Mn (257.610 nm)	≤ 1.50	0.83
Cr (267.716 nm)	≤ 1.50	0.53
Cu (324.754 nm)	≤ 1.50	0.69
Al (396.152 nm)	≤ 1.50	0.56
Ba (493.408 nm)	≤ 1.50	1.29
K (766.491 nm)	≤ 1.50	0.74

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY Ltd.

Automatic Mercury Analyzer

Model RA-4500


Preventive Maintenance Report


Serial No. : 17780278

Soft version : Ver 2.0.7

ROM version : Ver 2.0.1

Date : 09 July 2024

PM by : 
(Pradit M.)

Approved by : 
(Kitichai S.)



Coax Group Corporation Ltd.

1131/62,64,325-331 Nakornchaisri road,

Kwang Thanon Nakornchaisri, Dusit, Bangkok 10300 Thailand

Tel. 02-2435263, 02-6682436 Fax. 02-2437386

เอกสารไม่ควบคุม

Inspection result

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

Counter

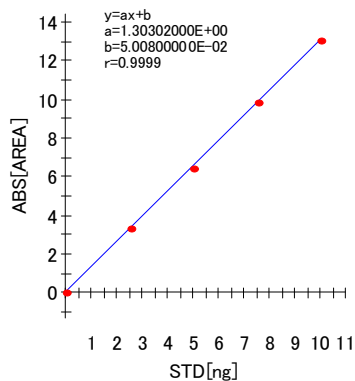
Maintenance ✕

MAIN	SC	Counter	Parameter
Measurement Count	20577(22-08-08)	<input type="button" value="Clear"/>	P1 tube[H](2000h) 0h00m(24-07-08) <input type="button" value="Clear"/>
Mercury Exhaust Filter Amount[mq](1500mq)	1(22-08-08)	<input type="button" value="Clear"/>	P2 tube[H](2000h) 0h01m(24-07-08) <input type="button" value="Clear"/>
Lamp Active time(5000h)	1h13m(24-07-08)	<input type="button" value="Clear"/>	P3 tube[H](2000h) 0h00m(24-07-08) <input type="button" value="Clear"/>
Membrane Filter Usage Time(2000h)	0h58m(24-07-08)	<input type="button" value="Clear"/>	P4 tube[H](2000h) 0h00m(24-07-08) <input type="button" value="Clear"/>
Main Pump tube(750h)	0h58m(24-07-08)	<input type="button" value="Clear"/>	P5 tube[H](2000h) 0h00m(24-07-08) <input type="button" value="Clear"/>
Heating Lamp Time	580h23m(22-08-08)	<input type="button" value="Clear"/>	P6 tube[H](2000h) 0h00m(24-07-08) <input type="button" value="Clear"/>
			P7 tube[H](2000h) 0h02m(24-07-08) <input type="button" value="Clear"/>

Exit

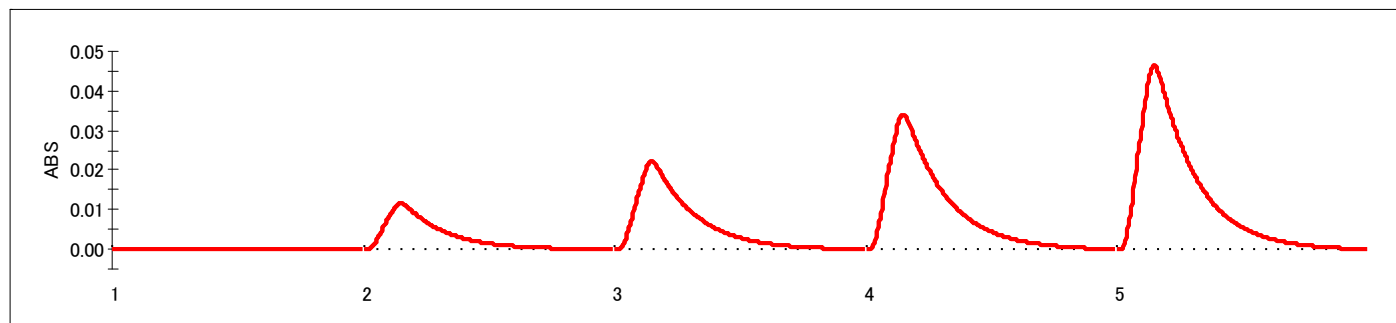
Title : Preventive Maintenance RA-4500 sn:17780278
 Date : 2024-07-09
 Name : Coax Group
 Memo : Calibration Curve 0-10ng

Calib



STD

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

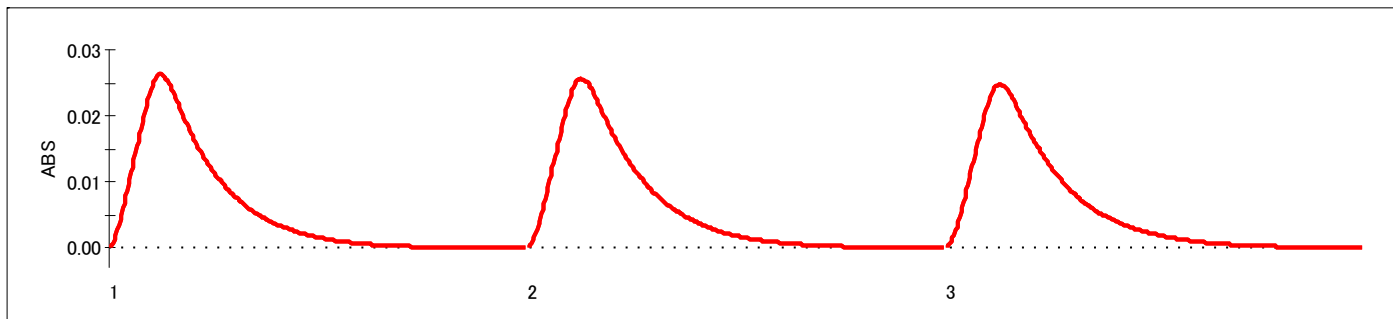


SMP

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

Statistics

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



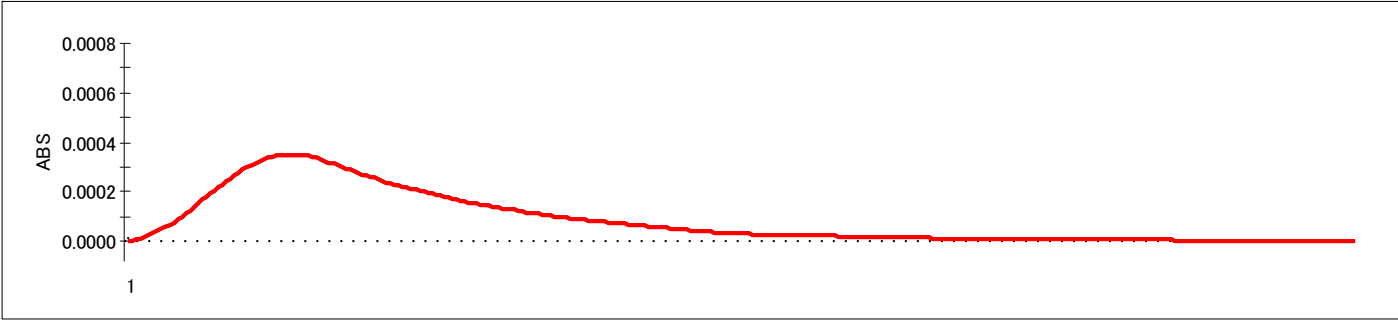
Self Check

Heat check:PASS!! (26.3degC[05:00] -> 30.3degC[02:29])
 Sensor check:PASS!! (53- 10= 43)
 Leak check:PASS!! (0.19L/min)
 Sig/Ref check:PASS!! (Sig:4.00V, Ref:4.02V)
 Drift check:PASS!! (0.0000061 - -0.0000179 = 0.0000240)

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

SMP

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



Calibration Certificate

Certificate No.: 2502229-003-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakanong, Bangkok 10260

Page 1 of 3

Equipment: CHAMBER (Incubator)

Manufacturer: MEMMERT

Model: IPP260

Serial No.: V618.0033

ID No.: UAE.MIC.021/2561

Order No.: 2502229

Operation No.: 2502229-003

Date of Receipt: 19 March 2025

Date of Calibration: 19 March 2025

Calibrated by Mr.Yothin Charoensuk
Scientist

Approved by


(Mr.Pheraphat Tuanjit) (for)

Manager, Division of Calibration Laboratory

Date of Issue: 25 March 2025

Responsible for the Technical Management Team

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

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

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



Calibration Report

Certificate No.: 2502229-003-01

Equipment: CHAMBER (Incubator)

Model: IPP260 Serial No.: V618.0033

Resolution: 0.1 °C ID No.: UAE.MIC.021/2561

Manufacturer: MEMMERT

Date of Calibration: 19 March 2025

Page 2 of 3

Location: 302, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Environment Condition:

Ambient Temperature (23.0 ± 1) °C

Relative Humidity (59 ± 1) %

Line Voltage (223 ± 3) Volt

Condition of this results of Calibration:

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

2. Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY57003188	TE 670486-01	8 June 2025	NATIONAL FOOD INSTITUTE
	RTD	CH#301-309/ RTD#301-309			

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

UUC Description :

Time of Record 1 Hour 9 Minute At 22.0 and 25.0 °C

Fresh air Damper ☐ Open Position ☐

☒ Close Fan ☐

☐ Not Available

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

P. Jueghantit
25 March 2025



Calibration Report

Certificate No.: 2502229-003-01

Equipment: CHAMBER (Incubator)

Model: IPP260 Serial No.: V618.0033

Resolution: 0.1 °C ID No.: UAE.MIC.021/2561

Manufacturer: MEMMERT

Date of Calibration: 19 March 2025

Page 3 of 3

Calibration point: 22.0 and 25.0 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	22.7	58	220.0
MAX	23.3	60	225.0

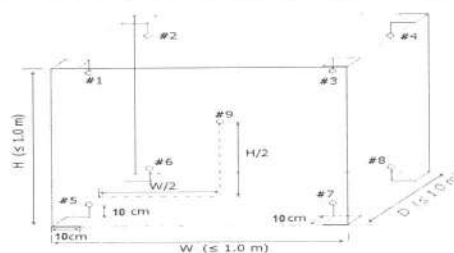


Table 1 : Reporting of Temperature

Calibration point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
22.0	22.18	22.18	22.16	22.19	21.94	21.95	21.96	21.98	22.08	0.27
25.0	25.51	25.32	25.29	25.34	25.05	25.02	25.04	25.09	25.15	0.27

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
22.0	22.0	22.0	22.0	0.026	0.14	0.29
25.0	25.0	25.0	25.0	0.035	0.36	0.55

Note The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity) "

UUC* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.

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

----- End -----

P. Jongsakul
25 March 2025



Calibration Certificate

Certificate No.: 2501624-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakanong, Bangkok 10260

Page 1 of 3

Equipment: Water Bath
Manufacturer: MEMMERT
Model: WNE14
Serial No.: L416.0606
ID No.: UAE.MIC.002/2560
Order No.: 2501624
Operation No.: 2501624-001
Date of Receipt: 10 February 2025
Date of Calibration: 10 February 2025

Calibrated by Mr.Worapob Sooktong
Scientist
WB

Date of Issue: 19 February 2025

Approved by


(Mr.Pheraphat Tuanjit) (for)

Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

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

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

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



Calibration Report

Certificate No.: 2501624-001-01

Equipment:

Water Bath

Model: WNE14

Serial No.: L416.0606

Resolution: 0.1 °C

ID No.: UAE.MIC.002/2560

Manufacturer: MEMMERT

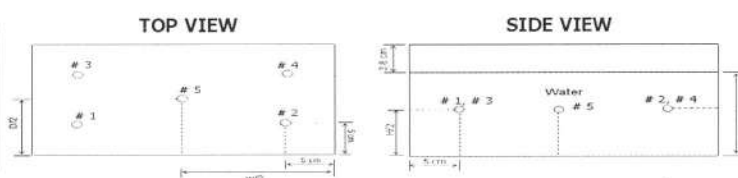
Date of Calibration: 10 February 2025

Page 3 of 3

Calibration point: 44.5 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	25.7	52	223.0
Max	26.3	65	225.0



Sensor Installation Location

Table1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.5 is REF)					Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	
44.5	44.55	44.46	44.48	44.47	44.48	0.18

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
44.5	44.5	44.5	44.5	0.082	0.070	0.29

Note The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity)"

UUC* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.

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

----- End -----

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

P. Jongsakul
19 Feb. 2025



Calibration Report

Certificate No.: 2501624-001-01

Equipment: Water Bath

Model: WNE14 Serial No.: L416.0606

Resolution: 0.1 °C ID No.: UAE.MIC.002/2560

Manufacturer: MEMMERT

Date of Calibration: 10 February 2025 Page 2 of 3

Location: 302 Microbiology Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Environment Condition:

Ambient Temperature (26 ± 1) °C

Relative Humidity (59 ± 7) %

Line Voltage (224 ± 1) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert 5 standard thermometer into its liquid bath and calibration according to W-TE-011 based on ASTM E715-80 (2022): Standard Specification for Gravity-Convection and Forced-Circulation Water Baths.
 - The temperature scale used is 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	MY59002902	TE 670478-01	4-May-25	NATIONAL FOOD INSTITUTE
	RTD	RTD#301-305 / CH#301-305			

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

UUC Description:

Time of Record 1 Hour 9 Minute At 44.5 °C

7. Result of Calibration :
- | | |
|-------------------------------------|--------------------|
| <input checked="" type="checkbox"/> | Without adjustment |
| <input type="checkbox"/> | After adjustment |

P. Jengharit
19 Feb. 2025

Calibration Certificate

Certificate No.: 2502229-007-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakanong, Bangkok 10260

Page 1 of 3

Equipment: Autoclave
Manufacturer: ALP
Model: CL-40L
Serial No.: 808763
ID No.: UAE.MIC.026/2563
Order No.: 2502229
Operation No.: 2502229-007
Date of Receipt: 19 March 2025
Date of Calibration: 19 March 2025

Calibrated by Mr.Jerawut Prapawuttipong
Scientist

Approved by



(Mr.Pheraphat Tuanjit) (for)

Manager, Division of Calibration Laboratory

Responsible for the Technical Management Team

Date of Issue: 25 March 2025

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

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

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



Calibration Report

Certificate No.: 2502229-007-01
Equipment: Autoclave
Model: CL-40L Serial No.: 808763
Resolution: 0.1 °C ID No.: UAE.MIC.026/2563
Manufacturer: ALP
Date of Calibration: 19 March 2025

Page 2 of 3

Location: LABORATORY, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Environment Condition: Ambient Temperature (23 ± 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)	HiTemp140-PT	S35646	TE 670370-01	23-Mar-25	NATIONAL FOOD INSTITUTE
	HiTemp140-PT	S33753	TE 670371-01	23-Mar-25	NATIONAL FOOD INSTITUTE
	HiTemp140-PT	S29973	TE 670372-01	23-Mar-25	NATIONAL FOOD INSTITUTE

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- This standard does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical.
- Condition of Calibrated item : Good

UUC Description : Setting program function sterilization : STERILIZE/NORMAL

Time of sterilization 15 Minute At 115.0 aand 121.0 °C

8. Result of Calibration :

☒

Without adjustment

☐

After adjustment

P. Jengharit
25 March 2025



Calibration Report

Certificate No.: 2502229-007-01

Equipment: Autoclave

Model: CL-40L

Serial No.: 808763

Resolution: 0.1 °C

ID No.: UAE.MIC.026/2563

Manufacturer: ALP

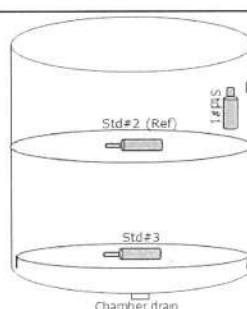
Date of Calibration: 19 March 2025

Page 3 of 3

Calibration point: 115.0 and 121.0 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	22.0	55	224
Max	24.0	65	226



Standard at Position

Std#1 = Attached to the load temperature probe, within 20 mm.
Std#2 = In the upper half of the chamber
Std#3 = In the chamber drain, within 100 mm.

Table1 : 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	115.32	115.46	115.22	0.64
121.0	121.31	121.53	121.31	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)	MPa			
115.0	115.0	115.1	115.0	0.08	0.11	0.12	0.26
121.0	121.0	121.1	121.0	0.12	0.13	0.15	0.29

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

P. Jongsakul
25 March 2025



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 Preeyaporn Jaengkarnkit)

Vice President, Department of Laboratory Services
Responsible for the Technical Management Team

Date of Issue: 23 April 2024

The uncertainties are for a confidence probability of approximately 95%

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

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



Calibration Report

Certificate No.: 2402419-001-01

Equipment:

Electronic Balance

Manufacturer: OHAUS

Model: PX623

Resolution: 0.001 g

Serial No.: C236754745

ID No.: UAE.MIC.055/2565

Capacity: 620 g

Date of Calibration: 19 April 2024

Page 2 of 3

Environment Condition: Ambient Temperature: 26.0 ± 0.3 °C Relative Humidity: 57 ± 8.4 %

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500g	15882	TCS	M2311182S	28 November 2024

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

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

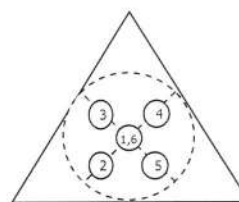
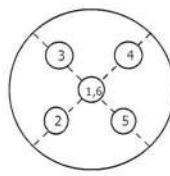
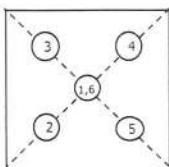
1. Repeatability of Reading:

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

2. Off-Center Error:

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

The balance reading obtained is given in the table.



1 (g)	2 (g)	3 (g)	4 (g)	5 (g)	6 (g)	(Maximum Difference) (g)
200.000	200.002	200.001	199.999	200.000	200.000	0.002

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

P. Jenghantit
23 April 2024

Calibration Report

Certificate No.: 2402419-001-01

Equipment: Electronic Balance

Manufacturer: OHAUS

Model: PX623

Resolution: 0.001 g

Serial No.: C236754745

ID No.: UAE.MIC.055/2565

Capacity: 620 g

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 <i>k</i>
Unload	0.0000	0.000	0.000	0.00093	2.00
1	1.0000	1.000	0.000	0.00093	2.00
5	5.0000	5.000	0.000	0.00093	2.00
10	10.0000	10.000	0.000	0.00093	2.00
20	20.0000	20.000	0.000	0.00093	2.00
50	50.0000	50.001	-0.001	0.00093	2.00
100	100.0000	100.001	-0.001	0.00094	2.00
200	200.0000	200.001	-0.001	0.0011	2.00
300	300.0000	300.003	-0.003	0.0011	2.00
400	399.9999	400.003	-0.003	0.0012	2.00
500	499.9999	500.003	-0.003	0.0013	2.00
600	599.9999	600.002	-0.002	0.0014	2.00

P. Jenghant
23 April 2024

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

----- End -----

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



Envi Equipment Service Co., Ltd.

110/254 Moo 3, Tumbon Bang Rak Phatthana, Amphur Bang Bua Thong, Nonthaburi 11110

Tel. 098 362 9152, 089 478 7885

E-mail: sales@envi-ees.com

Certificate No.: E24-060049

Page.: 1 of 6

CERTIFICATE OF CALIBRATION

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

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

Description of Equipment : Console meter

Manufacturer : Apex Instrument

Model Number : XC-572-V

Serial Number : 0707048

ID./Control No. : UAE.EFM. 154/2550

Environment Conditions : **Temperature** (25 ± 2) °C
: **Humidity** (50 ± 15) % RH

Cal. Date : 25/06/2024

Issue Date : 25/06/2024

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 (IS).

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 Fuekhuad)

Technical Manger

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	25/06/2024	09:05 AM	Std Temp	293	K
Console Serial Number	0707048	Calibration Reference No.		SER24-060019		Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure		754.41	mmHg	K ₁	0.386	
DGM Serial Number	00005715	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)	(P _m)	(V _{mi})	(V _{mf})	(t _{mi})	(t _{mf})	(V _{wi})	(V _{wf})	(t _{wi})	(t _{wf})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
12.25	13.0	1006.591	1006.731	30	30	224.31426	224.45480	28	28
12.30	13.0	1006.731	1006.871	30	30	224.45480	224.59514	28	28
8.57	26.0	1006.878	1007.018	29	29	224.60216	224.74278	28	28
8.57	26.0	1007.018	1007.158	29	29	224.74278	224.88286	28	28
13.85	40.0	1007.166	1007.446	29	29	224.89090	225.16890	27	27
14.03	40.0	1007.446	1007.726	30	30	225.16890	225.44958	27	27
10.45	70.0	1007.743	1008.023	30	30	225.46640	225.74430	26	26
10.43	70.0	1008.023	1008.303	30	30	225.74430	226.02136	26	26
9.15	90.0	1008.315	1008.595	30	30	226.03294	226.30764	26	26
9.15	90.0	1008.595	1008.875	30	30	226.30764	226.58212	26	26



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	
Console Model Number	XC-572-V
Console Serial Number	0707048
DGM Model Number	SK25EX
DGM Serial Number	00005715

Calibration Conditions			
Date	Time	25/06/2024	09:05 AM
Calibration Reference No.	SER24-060019		
Barometric Pressure	754.41	mmHg	
Calibration Meter Gamma	1.001		

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K ₁	0.386	
Console Leak Check	PASS	

Calibration Data								
Results								
Standardized Data				Dry Gas Meter				
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate		
(V _{m(std)})	(Q _{m(std)})	(V _{w(std)})	(Q _{w(std)})	Value	Variation	Std & Corr	.0212 m ³ _{std} /min	Variation
m ³	m ³ /min	m ³	m ³ /min	(Y)	(ΔY)	(Q _{m(std)(corr)})	(ΔH _@)	(ΔH _@)
						m ³ /min	mm H ₂ O	
0.135	0.011	0.136	0.011	1.004	0.012	0.011	46.115	-0.256
0.135	0.011	0.136	0.011	1.002	0.011	0.011	46.625	0.254
0.136	0.016	0.136	0.016	1.003	0.011	0.016	45.168	-1.203
0.136	0.016	0.135	0.016	0.999	0.008	0.016	45.517	-0.854
0.273	0.020	0.270	0.019	0.990	-0.001	0.019	46.444	0.073
0.273	0.019	0.272	0.019	1.000	0.008	0.019	46.776	0.405
0.274	0.026	0.271	0.026	0.987	-0.005	0.026	46.419	0.048
0.274	0.026	0.270	0.026	0.984	-0.008	0.026	46.552	0.181
0.275	0.030	0.267	0.029	0.974	-0.018	0.029	47.010	0.639
0.275	0.030	0.267	0.029	0.973	-0.019	0.029	47.085	0.714
				0.991	Y Average		46.371	ΔH _@ 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 $\Delta H_{@}$, 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	
Console Model Number	XC-572-V
Console Serial Number	0707048
DGM Model Number	SK25EX
DGM Serial Number	00005715

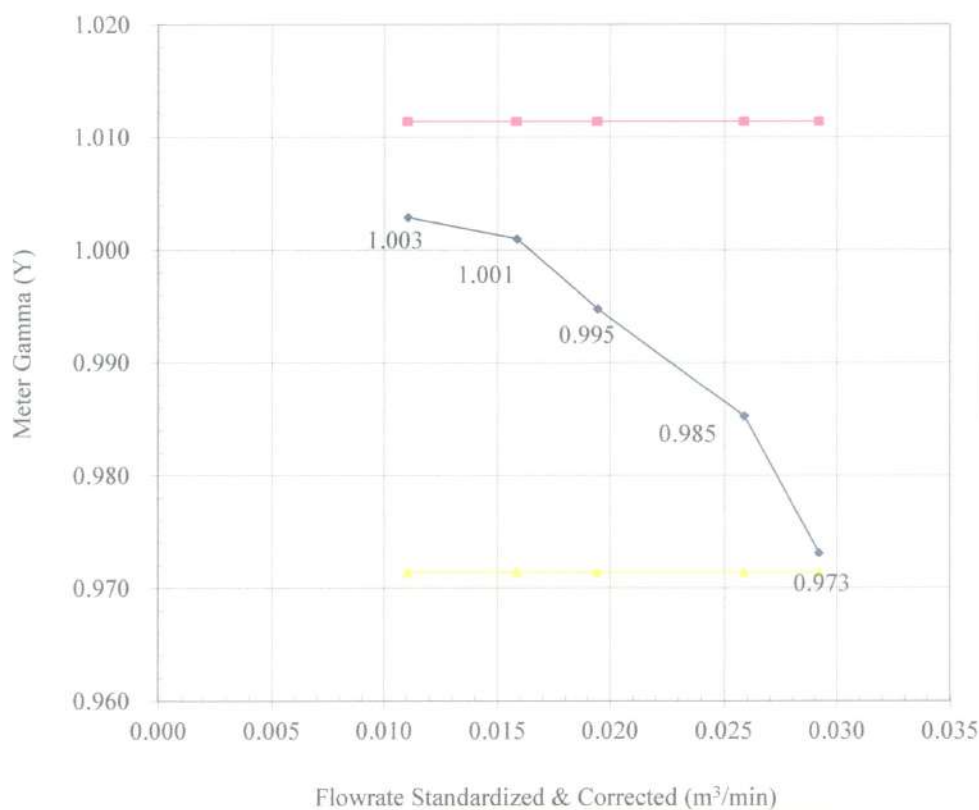
Calibration Conditions			
Date	Time	25/06/2024	09:05 AM
Calibration Reference No.	SER24-060019		
Barometric Pressure	754.41	mmHg	
Calibration Meter Gamma	1.001		

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K ₁	0.386	
Console Leak Check	PASS	

Calibration Date: 25-6-2024

Calibration Reference No: SER24-060019

Meter Gamma vs Flowrate



Console Serial: 0707048

Console Model: XC-572-V



เอกสารไม่ควบคุม

Meter Console Information	
Console Model Number	XC-572-V
Console Serial Number	0707048
DGM Model Number	SK25EX
DGM Serial Number	00005715

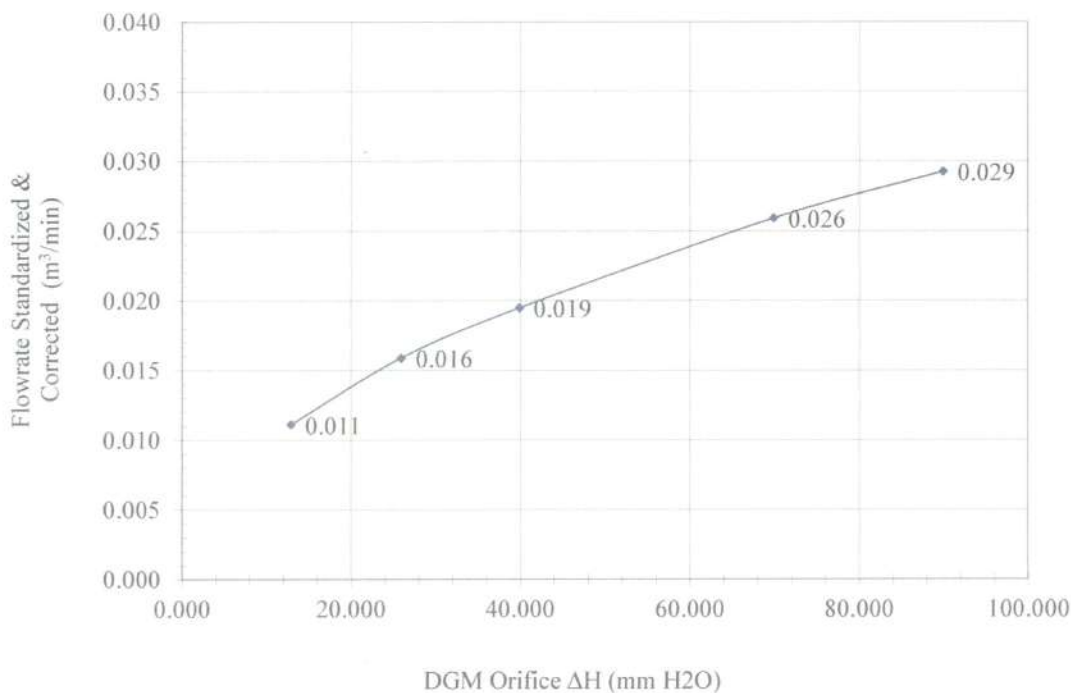
Calibration Conditions			
Date	Time	25/06/2024	09:05 AM
Calibration Reference No.		SER24-060019	
Barometric Pressure		754.41	mmHg
Calibration Meter Gamma		1.001	

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K ₁	0.386	
Console Leak Check		PASS

Calibration Date: 25-6-2024

Calibration Reference No: SER24-060019

Meter Pressure vs Flowrate



Console Serial: 0707048

Console Model: XC-572-V



เอกสารไม่ควบคุม

THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information	
Console Model Number	XC-572-V
Console Serial Number	0707048
DGM Model Number	SK25EX
DGM Serial Number	00005715
Meter Box Model Number	JENCO 765 KF
Meter Box Serial Number	JC 15588

Calibration Conditions			
Date	Time	25/06/2024	11:35 AM
Calibration Reference No.		SER24-060019	
Reference Thermometer		DIGICON	
Serial Number		183169105	

Results											
Console Thermocouple Simulator											
Channel and test point	Meter Box Channel Temperature Reading (°C)										
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	1038.0
Stack	-18.0	25.0	37.0	92.0	147.0	256.0	365.0	476.0	585.0	805.0	1024.0
Aux	-18.0	25.0	37.0	92.0	147.0						
Probe	-18.0	25.0	37.0	92.0	147.0						
Filter	-18.0	25.0	37.0	92.0	147.0						
Exit	-18.0	25.0	37.0								

Tolerance Range

Stack ± 1.50% Absolute
 Probe ± 3.0 °C
 Filter ± 3.0 °C

Meter ± 3.0 °C
 Exit ± 2.0 °C



เอกสารไม่ควบคุม

Envi Equipment Service Co., Ltd.

110/254 Moo 3, Tumbon Bang Rak Phatthana, Amphur Bang Bua Thong, Nonthaburi 11110

Tel. 098 362 9152, 089 478 7885

E-mail: sales@envi-ees.com

Certificate No.: E24-080074

Page.: 1 of 6

CERTIFICATE OF CALIBRATION

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

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

Description of Equipment : Console meter

Manufacturer : Apex Instrument

Model Number : XC-572-V

Serial Number : 0807047

ID./Control No. : UAE.ANV 212/2551

Environment Conditions : Temperature (25 ± 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 (IS).

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 Fuekhud)

Technical Manger

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	
Console Model Number	XC-572-V
Console Serial Number	0807047
DGM Model Number	SK25EX
DGM Serial Number	00003580

Calibration Conditions			
Date	Time	26/08/2024	01:10 PM
Calibration Reference No.		SER24-080032	
Barometric Pressure		755.91	mmHg
Calibration Meter Gamma		1.001	

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K ₁	0.386	
Console Leak Check		PASS

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



เอกสารไม่ควบคุม

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

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	26/08/2024	01:10 PM	Std Temp	293	K
Console Serial Number	0807047	Calibration Reference No.		SER24-080032		Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure		755.91		K ₁	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	.0212 m ³ _{std} /min	Variation
				Value	Variation	Std & Corr		
(V _{m(std)})	(Q _{m(std)})	(V _{w(std)})	(Q _{w(std)})	(Y)	(ΔY)	(Q _{m(std)})(corr)	(ΔH _@)	(ΔH _@)
m ³	m ³ /min	m ³	m ³ /min			m ³ /min	mm H ₂ O	
0.137	0.012	0.135	0.011	0.981	0.005	0.011	44.831	-0.558
0.137	0.012	0.134	0.011	0.977	0.001	0.011	45.071	-0.318
0.137	0.016	0.134	0.016	0.974	-0.003	0.016	46.259	0.870
0.137	0.016	0.133	0.016	0.971	-0.005	0.016	46.125	0.736
0.275	0.020	0.271	0.020	0.985	0.008	0.020	45.532	0.143
0.275	0.020	0.269	0.020	0.979	0.002	0.020	45.628	0.240
0.276	0.027	0.270	0.026	0.978	0.001	0.026	45.368	-0.021
0.276	0.027	0.269	0.026	0.976	-0.001	0.026	45.297	-0.092
0.277	0.031	0.270	0.030	0.973	-0.003	0.030	44.935	-0.454
0.277	0.031	0.269	0.030	0.971	-0.006	0.030	44.843	-0.546
				0.977	Y Average		45.389	ΔH@ 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_@, 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	
Console Model Number	XC-572-V
Console Serial Number	0807047
DGM Model Number	SK25EX
DGM Serial Number	00003580

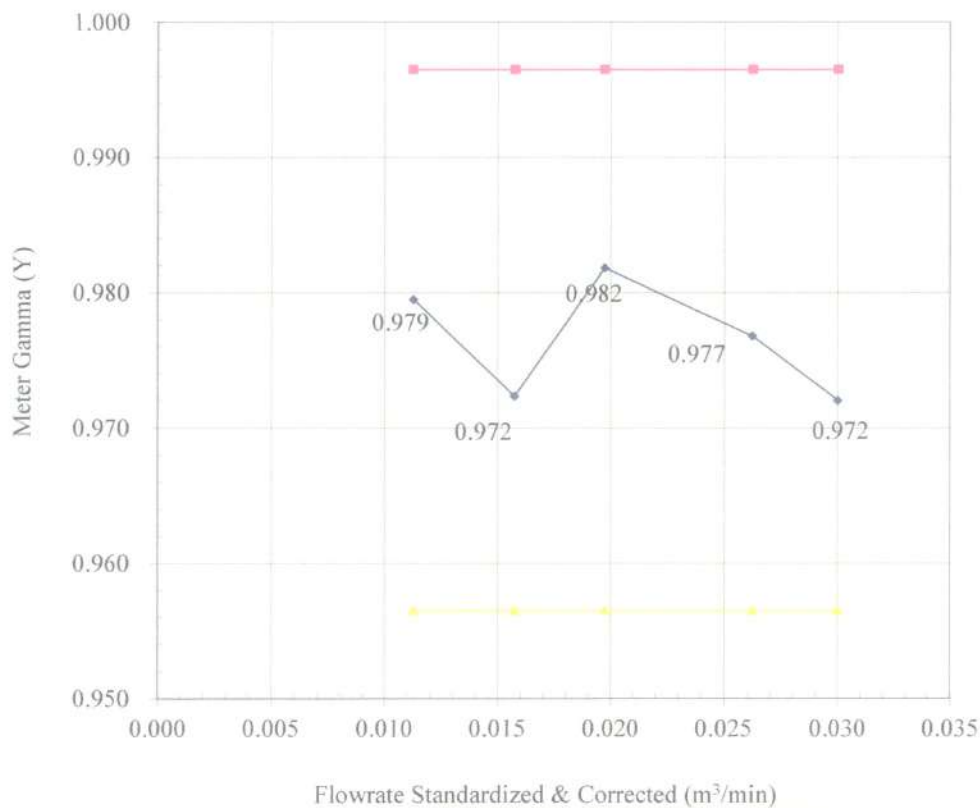
Calibration Conditions			
Date	Time	26/08/2024	01:10 PM
Calibration Reference No.	SER24-080032		
Barometric Pressure	755.91	mmHg	
Calibration Meter Gamma	1.001		

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K ₁	0.386	
Console Leak Check	PASS	

Calibration Date: 26-8-2024

Calibration Reference No: SER24-080032

Meter Gamma vs Flowrate



Console Serial: 0807047

Console Model: XC-572-V



เอกสารไม่ควบคุม

Meter Console Information	
Console Model Number	XC-572-V
Console Serial Number	0807047
DGM Model Number	SK25EX
DGM Serial Number	00003580

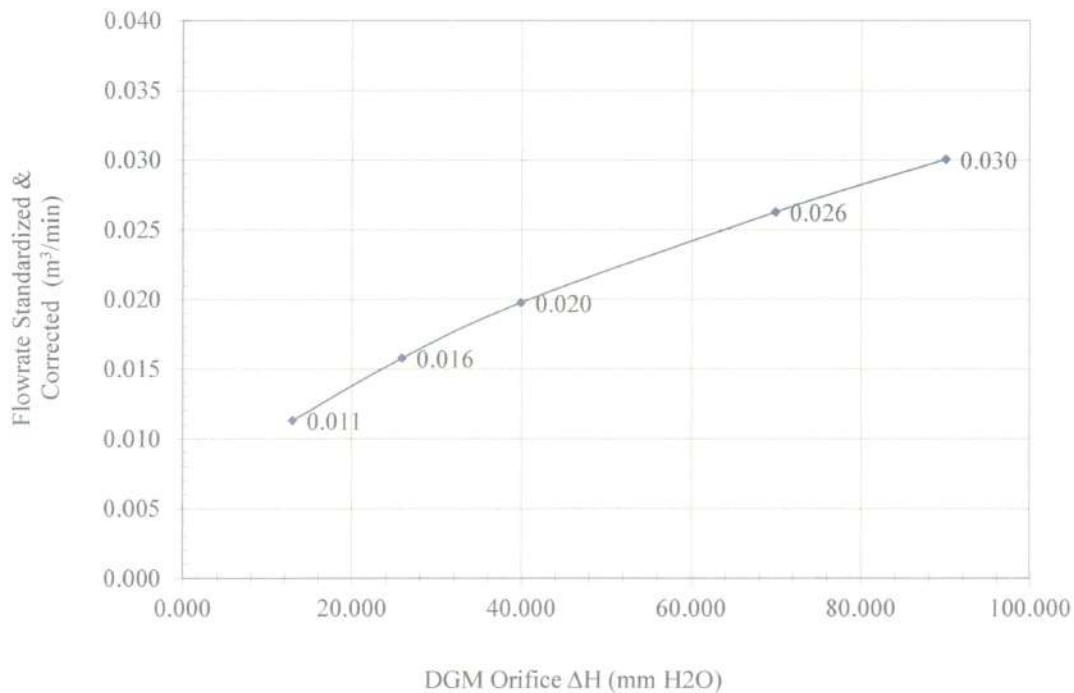
Calibration Conditions			
Date	Time	26/08/2024	01:10 PM
Calibration Reference No.	SER24-080032		
Barometric Pressure	755.91	mmHg	
Calibration Meter Gamma	1.001		

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K ₁	0.386	
Console Leak Check	PASS	

Calibration Date: 26-8-2024

Calibration Reference No: SER24-080032

Meter Pressure vs Flowrate



Console Serial: 0807047

Console Model: XC-572-V



เอกสารไม่ควบคุม

THERMOCOUPLES SYSTEM CALIBRATION

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

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

Results											
Console Thermocouple Simulator											
Channel and test point	Meter Box Channel Temperature Reading (°C)										
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	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



เอกสารไม่ควบคุม

Certificate No: G 670643

Date of issue : 13-Sep-24

Instrument description : Flue Gas Analyzer
Instrument model : Testo 350 New
Instrument serial no. : 60723967/609
Control unit serial no. : 03064673/609
ID no. or control no. : UAE.EFM.027/2559
Manufacturer : Testo SE & Co. KGaA
Probe description : -
Probe model : -
Probe serial no. : -
Customer name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Customer address : 81 SOI UDOMSUK41,SUKHUMVIT ROAD,BANGCHAK PRAKANONG BANGKOK 10260

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

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurent 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 reporduced 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 tracebility to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 13-Sep-24



Mr. Kwanchai Khamdoun

Calibration Technician



Mrs. Nongluck Wongsettee

Technical Manager

Certificate No.: G 670643

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen (O ₂) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O ₂) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.18 ppm	CG-0002-24	Nimt	11-Jan-29
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1007 ppm	1870/24	Linde	17-Jun-26
Nitrogen Dioxide (NO ₂) 30.68 ppm	2832/24	Linde	08-Sep-26
Nitrogen Dioxide (NO ₂) 81.32 ppm	3546/23	Linde	14-Jan-26
Nitrogen Dioxide (NO ₂) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide (NO) 30.01 ppm	CG-0014-23	Nimt	19-Feb-25
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (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 : 22.7 °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 (±)
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	2.56	8.0
NO ₂ (ppm)	81.32	80.2	-1.12	8.0
NO ₂ (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
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	598	-2.8	13

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

End of Report

Certificate No: G 670490

Date of issue : 17-Jul-24

Instrument description : Flue Gas Analyzer
Instrument model : Testo 350 New
Control unit serial no. : 03099401/701
Instrument serial no. : 60899615/701
ID no. or control no. : UAE.EFM. 006/2560
Manufacturer : Testo SE & Co. KGaA
Probe description : -
Probe model : -
Probe serial no. : -
Customer name : United Analyst and Engineering Consultant Co., Ltd.
Customer address : 81 Soi Udomsuk 41, Sukhumvit Rd., Bangchak, Phrakhanong, Bangkok 10260

Total pages of certificate : 2 Pages
Receiving no. : L-242678
Receiving date. : 15-Jul-24
Parameter of calibration : Gas Calibration(Oxygen 2.50,10.04,21.02 %vol, Carbon Monoxide 80.18,302,1007 ppm, Nitrogen Dioxide 30.34,81.32, 201.9 ppm, Nitric Oxide 30.01, 151.5, 322.5 ppm, Sulphur Dioxide 50.36, 100.8, 600.8 ppm)
Condition of UUC. : Used
Ambient condition : All of the Measurment ware caried out the stabilized labotary
Temperature : 23 ±5 °C
Humidity : 55 ± 15 %RH
Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210
Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurent 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 reporduced 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 tracebility to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 17-Jul-24



Mr. Kwanchai Khamdoun

Calibration Technician



Mrs. Nongluck Wongsettee

Technical Manager

Certificate No.: G 670490

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen (O ₂) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O ₂) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.18 ppm	CG-0002-24	Nimt	11-Jan-29
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1007 ppm	1870/24	Linde	17-Jun-26
Nitrogen Dioxide (NO ₂) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide (NO ₂) 81.32 ppm	3546/23	Linde	14-Jan-26
Nitrogen Dioxide (NO ₂) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide (NO) 30.01 ppm	CG-0014-23	Nimt	19-Feb-25
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (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 : 23.1 °C Humidity : 66.3 %RH Pressure : 1010.2 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1014.5 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O ₂ (%Vol)	2.50	2.55	0.05	0.15
O ₂ (%Vol)	10.04	10.12	0.08	0.20
O ₂ (%Vol)	21.02	21.13	0.11	0.30
CO (ppm)	80.18	81	0.82	3.0
CO (ppm)	302	303	1	6.0
CO (ppm)	1007	1009	2	12
NO ₂ (ppm)	30.34	32.5	2.16	8.0
NO ₂ (ppm)	81.32	82.7	1.38	8.0
NO ₂ (ppm)	201.9	202.8	0.9	12
NO (ppm)	30.01	31	0.99	8.0
NO (ppm)	151.5	153	1.5	8.0
NO (ppm)	322.5	324	1.5	12
SO ₂ (ppm)	50.36	50	-0.36	6.0
SO ₂ (ppm)	100.8	100	-0.8	6.0
SO ₂ (ppm)	600.8	603	2.2	13

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

End of Report



JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd
63/14-15, 67/35-36
Petchkasem 7,7/1, Rd. Watthapra, Bangkokyai,
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Tel: +6608680812
Mobile: +66863999453
E-mail: jnac-calibration@jiranatee.com
Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Flow measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : COF-039-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : TISCH
MODEL/TYPE : TE-5025A
SERIAL NUMBER : 3383
ID NUMBER : UAE.EFM.063/2560
CONDITION AS-RECEIVED : Used item
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong,
Bangkok 10260

RECEIVED DATE : 16 Sep 2024
MEASUREMENT DATE : 27 Sep 2024
ISSUE DATE : 27 Sep 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature	: 23.0 ± 3.0	°C
Relative Humidity	: 55.0 ± 15.0	%RH
Atmospheric Pressure	: 1010 ± 10	hPa

CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are 23.9°C and $49.0\% \text{RH}$.

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/IMC/W2-dp. The WI-CL-004 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of the measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0063-23.

Uncertainty of Measurement:

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

Calibrated by:

- ☐ Mr. Sorawit Thachalad
☒ Miss Jittraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

MEASUREMENT RESULTS:

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

Table 1: The results of Q Standard calibration data

Plate	Flow rate m^3/min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_{meter} mmHg	$\Delta p_{Orifice}$ inH ₂ O	Y	Standard Flow [Q_s] m^3/min
1	0.703	758.131	23.92	22.49	56.556	1.738	1.319	0.654
2	1.000	758.205	23.70	22.81	63.034	3.473	1.865	0.922
3	1.121	758.284	23.64	22.69	42.633	4.642	2.157	1.064
4	1.167	758.274	23.64	22.65	31.359	5.197	2.282	1.125
5	1.409	758.325	24.00	23.14	30.402	7.654	2.768	1.358

Slope (m): 2.05577
 Intercept (b): -0.02807
 Correlation coefficient (r): 0.99985
 Uncertainty ($k=2$): 0.015 m^3/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m^3/min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_{meter} mmHg	$\Delta p_{Orifice}$ inH ₂ O	Y	Standard Flow [Q_s] m^3/min
1	0.703	758.131	23.92	22.49	56.556	1.738	0.825	0.653
2	1.000	758.205	23.70	22.81	63.034	3.473	1.166	0.920
3	1.121	758.284	23.64	22.69	42.633	4.642	1.348	1.061
4	1.167	758.274	23.64	22.65	31.359	5.197	1.426	1.123
5	1.409	758.325	24.00	23.14	30.402	7.654	1.732	1.357

Slope (m): 1.28763
 Intercept (b): -0.01756
 Correlation coefficient (r): 0.99985
 Uncertainty ($k = 2$): 0.015 m^3/min

End of Certificate of Calibration



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

Certificate of Calibration

Certificate No. : 25P112

Page : 1 of 2

Equipment : U-Tube Manometer

Manufacturer: Dwyer

Model : 121-36-W/M

Serial No.:

ID No.: UAE.EFM.181/2561

Condition As-Received: Used Item

Received Date: 10 February 2025

Calibration Date: 19 February 2025

Reference: 2502-0083WSC

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

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1012 mbar

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

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

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

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Pressure Calibrator	PC106P	1189	MP-0113-24	10 Jul 2025

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

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Nopparat Phongam

Issue Date : 21 February 2025

Approved Signatory : Attapol P.

[] Phalinee Prabpaipal

[] Sura Suwannasri

☒ Attapol Panurach

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B 0250406



Cert.No.: 25P112

Page: 2 of 2

Result of calibration:- Without adjustment

Function:- Pressure Measurement

Increasing Pressure

Range : 0 inH₂O to 36 inH₂O

Scale Interval : 0.1 inH₂O (The Fifth Estimate)

Applied Pressure (inH ₂ O)	UUC Indication		ΔP (inH ₂ O)	Error (inH ₂ O)
	High-port side (inH ₂ O)	Low-port side (inH ₂ O)		
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-0.98	1.98	-0.02
4.00	2.00	-1.98	3.98	-0.02
6.00	3.00	-3.02	6.02	0.02
8.00	4.00	-4.02	8.02	0.02
10.00	5.00	-5.04	10.04	0.04
12.00	6.00	-6.04	12.04	0.04
14.00	7.00	-7.06	14.06	0.06
16.00	8.00	-8.06	16.06	0.06
18.00	9.00	-9.06	18.06	0.06
20.00	10.00	-10.06	20.06	0.06
22.00	11.00	-11.08	22.08	0.08
24.00	12.00	-12.08	24.08	0.08
26.00	13.02	-13.10	26.12	0.12
28.00	14.02	-14.10	28.12	0.12
30.00	15.02	-15.10	30.12	0.12
32.00	16.02	-16.10	32.12	0.12
34.00	17.02	-17.08	34.10	0.10
35.50	17.86	-17.92	35.78	0.28

The uncertainty of measurement was ± 0.11 inH₂O

* UUC = Unit Under Calibration

* ΔP = High-port side - Low-port side

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

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Attapol P.

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a 1037943



JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd
63/14-15, 67/35-36
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Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Flow measurement laboratory
Calibration services department.

CERTIFICATE OF CALIBRATION

Certificate No. : CGF-010-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Volumetric Air Flow Calibrator
MANUFACTURER : BGI Incorporated
MODEL/TYPE : DeltaCal DC1
SERIAL NUMBER : 155895
ID NUMBER : UAE.EFM.076/2560
CONDITION AS-RECEIVED : Used item
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udumsuk 41, Sukhumvit Road, Bangchak, Phrakhanong,
Bangkok 10260

RECEIVED DATE : 07 Oct 2024
MEASUREMENT DATE : 16 Oct 2024
ISSUE DATE : 16 Oct 2024

CONDITION OF THIS RESULT OF CALIBRATION:

- 1.The Unit Under Calibration was preconditioning 24 hours at ambient conditions prior to calibration being performed.
- 2.The Unit Under Calibration was reading under actual conditions.
- 3.Calibration condition:

Flow transmitting medium	: Air	
t_{Amb} average during calibration	: (23.9±0.7)	°C
H_{Amb} average during calibration	: (49.7±0.2)	%RH
P_{Amb} average during calibration	: (1010.40.39±0.6)	hPa

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

The Gas flow meter was calibrated against Standard Gas Flow Meter (Piston Prover) Model ML-800-44. The WI-CL-005 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through NIMT (National Institute of Metrology Thailand) via Certificate number: MW-0046-24.

Uncertainty of Measurement:

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

Calibrated by:

- ☐ Mr. Sorawit Thachalad
☒ Miss Jittrapor Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

MEASUREMENT RESULTS:

The Gas flow meter was calibrated by comparison method with the Standard Gas Flow Meter (Piston Prover). The air was used as a medium in the system.

Calibration in the range of : 15 L/min to 18.3 L/min ☒ Without adjustment ☐ With adjustment

The results of calibration and associated measurement uncertainties are reported in the table below.

Standard Reading	UUC Reading	Error	Uncertainty (k=2)
(L/min)	(L/min)	(%)	(%)
15.228	15.00	-1.52	0.48
16.084	15.82	-1.62	0.48
16.943	16.67	-1.64	0.48
17.802	17.50	-1.72	0.48
18.615	18.30	-1.69	0.48

End of Certificate of Calibration



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ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Temperature measurement laboratory
Calibration services department.



NSC – TISI – TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-179-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Temperature sensor with display
MANUFACTURER : BGI Incorporated
MODEL/TYPE : DeltaCal DC1
SERIAL NUMBER : 155895
ID NUMBER : UAE.EFM.076/2560
CONDITION AS-RECEIVED : Used item
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

RECEIVED DATE : 07 Oct 2024
MEASUREMENT DATE : 16 Oct 2024
ISSUE DATE : 16 Oct 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability:

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0047-24, Certificate number: ER-0101-23

Reference Used During Calibration:

1. Standard Temperature Probe
Model: STS-100 A500, Serial No.: 667682-09
2. Digital Temperature Indicator
Model: DTI-1000-A MK II, Serial No.: 671407-00591

Uncertainty of Measurement:

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

Calibrated by:

- ☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol
☐ Miss Ruangrumpai Phoommit



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

Function:

Table 1: This equipment was connected with Ambient temperature sensor probe (Ta) Model: - S/N: -
Dimension: Diameter 2.0 mm. Length 44.0 mm.

<u>Immersion Depth</u> (mm)	<u>Standard Reading</u> (°C)	<u>UUC Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
40	20.033	20.0	0.0	0.099
40	30.014	30.1	0.1	0.099
40	35.008	35.1	0.1	0.099
40	40.000	40.2	0.2	0.099
40	49.997	49.9	-0.1	0.099

Table 2: This equipment was connected with Filter temperature sensor probe (Tf) Model: - S/N: -
Dimension: Diameter 7.97 mm. Length 102 mm.

<u>Immersion Depth</u> (mm)	<u>Standard Reading</u> (°C)	<u>UUC Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
90	20.033	20.0	0.0	0.099
90	30.013	30.0	0.0	0.099
90	35.008	35.0	0.0	0.099
90	40.000	40.0	0.0	0.099
90	49.998	49.7	-0.3	0.099

UUC*: Unit Under Calibration

End of Certificate of Calibration



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ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Pressure measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CPR-026-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Digital barometer with display
MANUFACTURER : BGI by Mesa Labs
MODEL/TYPE : DeltaCal DC1
SERIAL NUMBER : 155895
ID NUMBER : UAE.EFM.076/2560
CONDITION AS-RECEIVED : Used item
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

RECEIVED DATE : 07 Oct 2024
MEASUREMENT DATE : 16 Oct 2024
ISSUE DATE : 16 Oct 2024

Calibration procedure:

The Digital barometer was calibrated against Digital pressure calibrator. The WI-CL-003 was used as a calibration guideline.

Traceability:

The measurement results are traceable to the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MP-0009-24

Uncertainty of Measurement:

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

CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date
Absolute Pressure Transducer	CPG2500	4100126P	MP-0009-24	27 Dec 2024

1. Calibration effort for calibration sequence C

2. The UUC* was installed in vertical orientation above reference standard instrument and center of UUC* was used as the reference level.

3. Calibration conditions:

4. Condition : ☒ Normal ☐ Abnormal
Pressure transmitting medium : Air
 ρ_{F1} (20°C, 1 bar) : 1.19 kg/m³
 H_{amb} : (55±15) %
 t_{amb} : (23±3) °C
 p_{amb} : (1010±10) mbar

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

Calibrated by:

☒ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager



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Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Pressure measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CPR-026-67

Page 2 of 2 Pages

MEASUREMENT RESULTS : ☐ Without adjustment ☒ With adjustment

CALIBRATION IN THE RANGE OF : 740 mmHg to 765 mmHg

The results of calibration and associated measurement uncertainties are reported in the table below.

STD (mmHg)	UUC* (mmHg)	Error (mmHg)	Uncertainty (k=2) (mmHg)
740.08	739.7	-0.3	0.49
745.08	744.8	-0.3	0.49
750.07	750.0	-0.1	0.44
755.06	755.0	-0.1	0.45
760.07	760.0	-0.1	0.45
765.06	765.0	-0.1	0.45

Note: UUC* Unit Under Calibration

: To convert the result in report unit to Pa should be multiply by 133.32

End of certificate



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



Certificate of Calibration

Certificate No. : 24P1856

Page : 1 of 2

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

Condition As-Received: Used Item

Received Date: 24 May 2024

Calibration Date: 04 June 2024

Reference: 2405-0919WSC

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

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1006 mbar

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

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

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Standard Barometer	DPI142	1422505046	MP-0094-24	03 May 2025

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

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew
Issue Date : 06 June 2024

Approved Signatory :

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

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B 0316956



Cert.No.: 24P1856

Page: 2 of 2

Result of calibration:- Without adjustment

Range : 720 mmHg to 800 mmHg

Function:- Absolute Pressure Measurement

Scale Interval : 1 mmHg (The Fifth Estimate)

Increasing Pressure

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

Decreasing Pressure

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

The uncertainty of measurement was ± 0.24 mmHg

* UUC = Unit Under Calibration

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

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Attapol P.

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a 1165502



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



Certificate of Calibration

Certificate No. : 24H1487

Page : 1 of 2

Equipment : Digital Thermo-Hygrometer
Manufacturer: Digicon
Model : TH-02A
Serial No.: 435031148
ID No.: UAE.EFM.006/2567

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: New Item

Received Date: 10 July 2024

Calibration Date: 15 July 2024
to 17 July 2024

Reference: 2407-0393WSC

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

Ambient Temperature: (25 \pm 3) °C

Relative Humidity: (50 \pm 20) %

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

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

Condition of this result of calibration

1.Reference standards instruments :

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

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

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

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

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

Calibrated by : Surasit Phansudnoi
Issue Date : 17 July 2024

Approved Signatory :

Viporn

[] Chakrit Waewwanjua

[✓] Viporn Tantiyawutti

[] Unnopphol Harachai

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Cert. No.: 24H1487

Page.: 2 of 2

Result of Calibration:- Without Adjustment

Function: Humidity Measurement.

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

Result of Calibration:- Without Adjustment

Function: Temperature Measurement.

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

UUC* : Unit Under Calibration

The reported uncertainty of measurement was 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 17, 2024

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : CM19050149

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	42.89
Nitric Oxide (NO)	46.77
Methane (CH ₄)	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB0159156
Expiration Date :	Nov 06, 2026

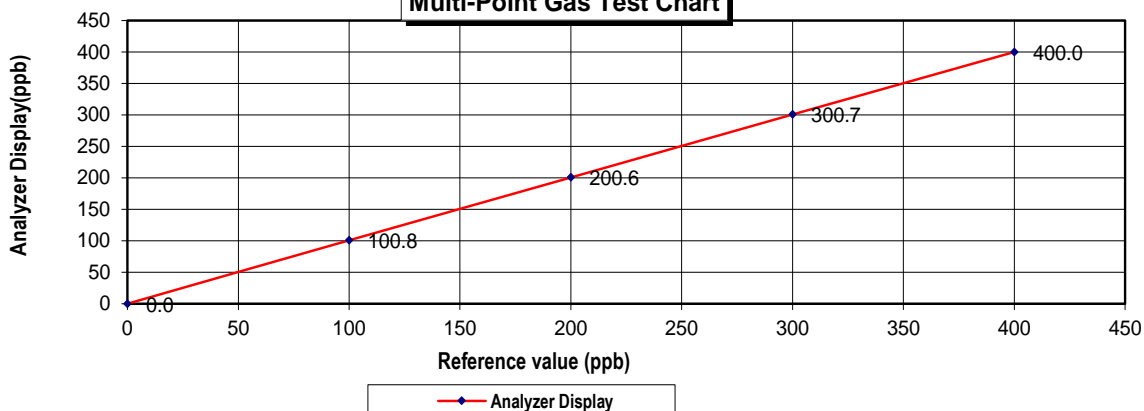
Dilutor Detail

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

Multi-point gas test data

	Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	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	200.6	0.60	0.30	0.30
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 (%)		0.27
:Acceptable Limit $\pm 5\%$						

Multi-Point Gas Test Chart



Calculate by

17 / 9 / 2567

Approve by

17 / Sep / 2024

MULTI-POINT GAS TEST REPORT

Test Date : Sep 20,2024

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : CM19050148

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	42.89
Nitric Oxide (NO)	46.77
Methane (CH ₄)	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB0159156
Expiration Date :	Nov 6,2026

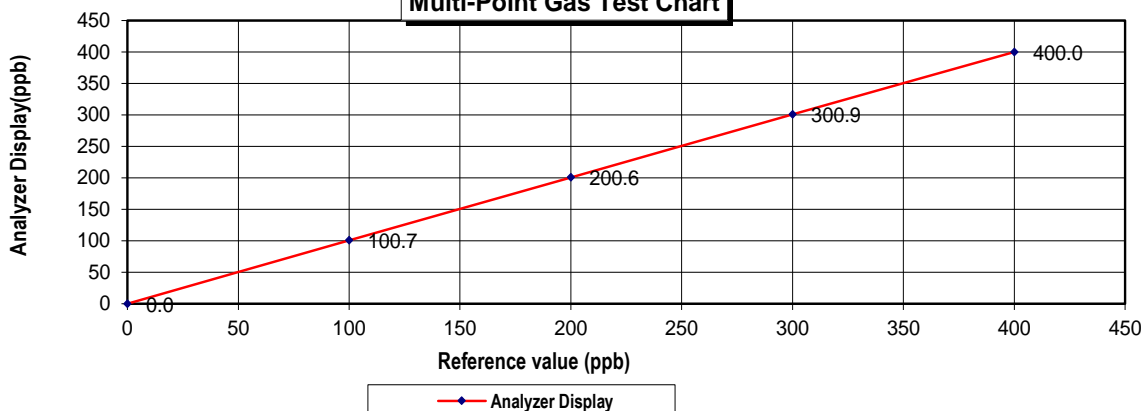
Dilutor Detail

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

Multi-point gas test data

	Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.7	0.70	0.70	0.70
Level 3	40.00%	200.0	200.6	0.60	0.30	0.30
Level 4	60.00%	300.0	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.26
:Acceptable Limit $\pm 5\%$						

Multi-Point Gas Test Chart



Calculate by

20 / 9 / 2567

Approve by

20 / Sep / 2024

MULTI-POINT GAS TEST REPORT

Test Date : Sep 17, 2024

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : CM19050150

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	42.89
Nitric Oxide (NO)	46.77
Methane (CH ₄)	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB0159156
Expiration Date :	Nov 06, 2026

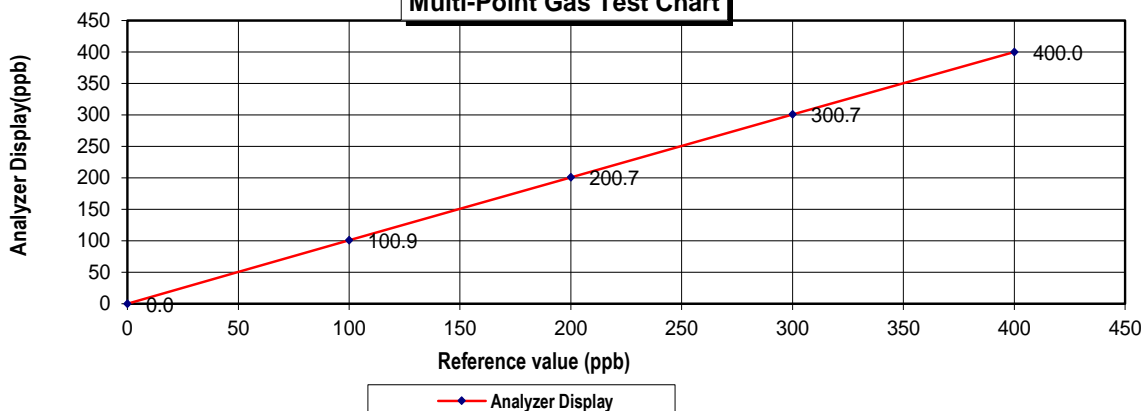
Dilutor Detail

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

Multi-point gas test data

	Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.9	0.90	0.89	0.89
Level 3	40.00%	200.0	200.7	0.70	0.35	0.35
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 (%)		0.29
:Acceptable Limit $\pm 5\%$						

Multi-Point Gas Test Chart



Calculate by

Grichai. G

17 / 9 / 2567

Approve by

P. K. K.

17 / Sep / 2024

MULTI-POINT GAS TEST REPORT

Test Date : Sep 26,2024

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1201778105

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	42.89
Nitric Oxide (NO)	46.77
Methane (CH ₄)	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB0159156
Expiration Date :	Nov 6,2026

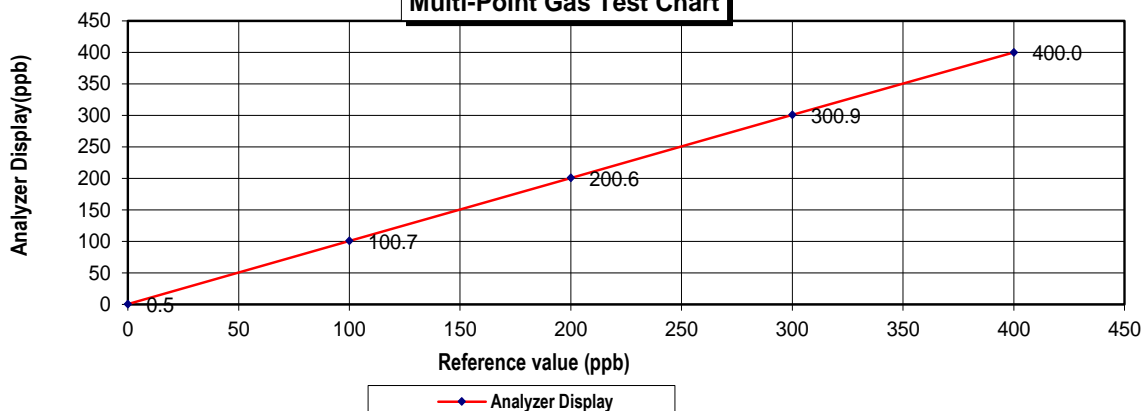
Dilutor Detail

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

Multi-point gas test data

	Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.5	0.50	0.50	0.50
Level 2	20.00%	100.0	100.7	0.70	0.70	0.70
Level 3	40.00%	200.0	200.6	0.60	0.30	0.30
Level 4	60.00%	300.0	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.36
:Acceptable Limit \pm 5%						

Multi-Point Gas Test Chart



Calculate by

Girichai G.
26 / 9 / 2567

Approve by

Pattana K.
26 / Sep / 2024

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)

LTD

Part Number: E05NI91E15A0014

Cylinder Number: EB0162121

Laboratory: 124 - Plumsteadville - PA

PGVP Number: A12023

Gas Code: CO,CO2,NO,NOX,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 Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

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

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	104202308	CC754364	98.36 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Jan 04, 2031
PRM	C2219101	APE1514048	100.19 PPM NITRIC OXIDE/NITROGEN	+/- 0.3%	Feb 28, 2025
GMIS	2023042525	CC754381	98.52 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Apr 25, 2031
PRM	12409	D913660	15.01 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Feb 17, 2023
GMIS	153400202002	EB0130037	9.693 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%	Sep 29, 2025
NTRM	160102-22	KAL003820	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Nov 01, 2027
CO	230601	CC745902	249.47 PPM CARBON MONOXIDE/NITROGEN	+/- 0.3%	Dec 09, 2028
NTRM	130606-02	CC411730	13.359 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 14, 2025

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

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR AUP2010245 CO2	FTIR	Jun 15, 2023
SIEMENS ULTRAMAT6E N1-C8-180	NDIR	Jun 14, 2023
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Jun 29, 2023
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Jun 15, 2023
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Jun 08, 2023


Approved for Release

MULTI-POINT GAS TEST REPORT

Test Date : Sep 6, 2024

Equipment : Gas Analyzer (SO₂)

Model : 43i

Manufacturer : Thermo SCIENTIFIC

Serial Number : CM22387061

Standard Gas Concentration

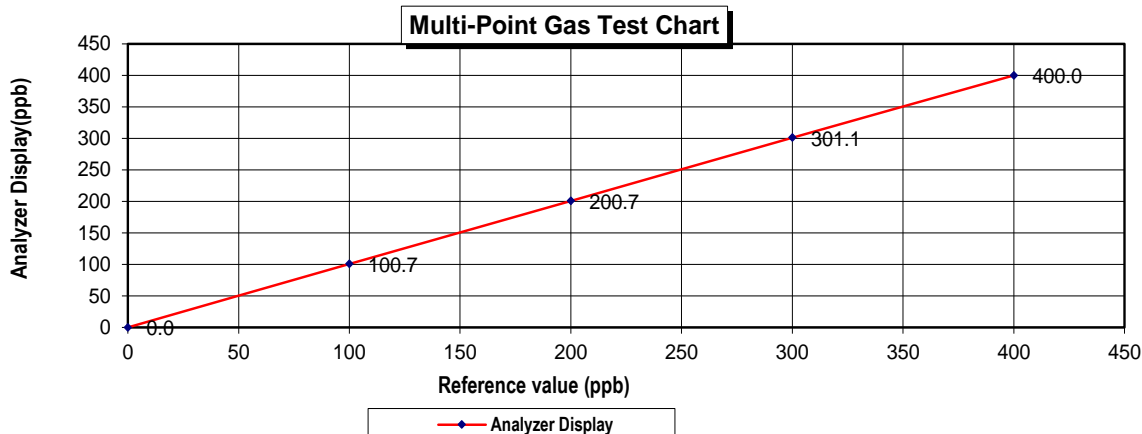
Sulphur Dioxide (SO ₂)	42.89
Nitric Oxide (NO)	46.77
Methane (CH ₄)	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB01159156
Expiration Date :	Nov 06, 2026

Dilutor Detail

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

Multi-point gas test data

	Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.7	0.70	0.70	0.70
Level 3	40.00%	200.0	200.7	0.70	0.35	0.35
Level 4	60.00%	300.0	301.1	1.10	0.37	0.37
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.28
:Acceptable Limit $\pm 5\%$						



Calculate by

6 / 9 / 2567

Approve by

6 / Sep / 2024

MULTI-POINT GAS TEST REPORT

Test Date : June 19, 2024

Equipment : Gas Analyzer (SO₂)

Model : 43i

Manufacturer : Thermo SCIENTIFIC

Serial Number : CM22387063

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	42.89
Nitric Oxide (NO)	46.77
Methane (CH ₄)	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB0159156
Expiration Date :	Nov 06, 2026

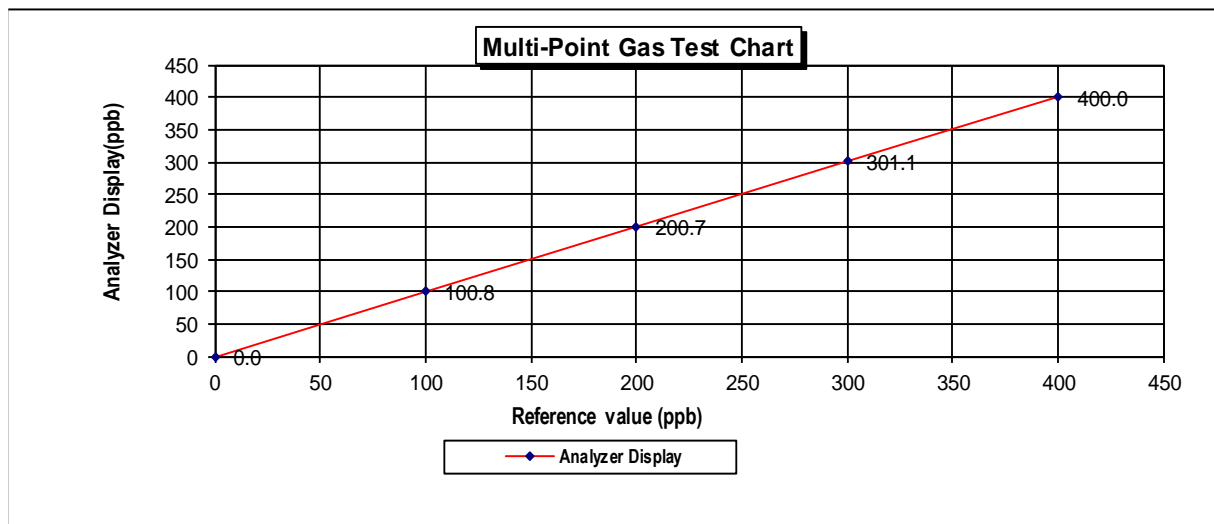
Dilutor Detail

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

Multi-point gas test data

	Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	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	301.1	1.10	0.37	0.37
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.30

:Acceptable Limit $\pm 5\%$



Calculate by

Sirichai S.

19 / 06 / 2567

Approve by

Pattana A.

19 / June / 2024

MULTI-POINT GAS TEST REPORT

Test Date : Sep 6, 2024

Equipment : Gas Analyzer (SO₂)

Model : 43i

Manufacturer : Thermo SCIENTIFIC

Serial Number : CM22387065

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	42.89
Nitric Oxide (NO)	46.77
Methane (CH ₄)	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB01159156
Expiration Date :	Nov 06, 2026

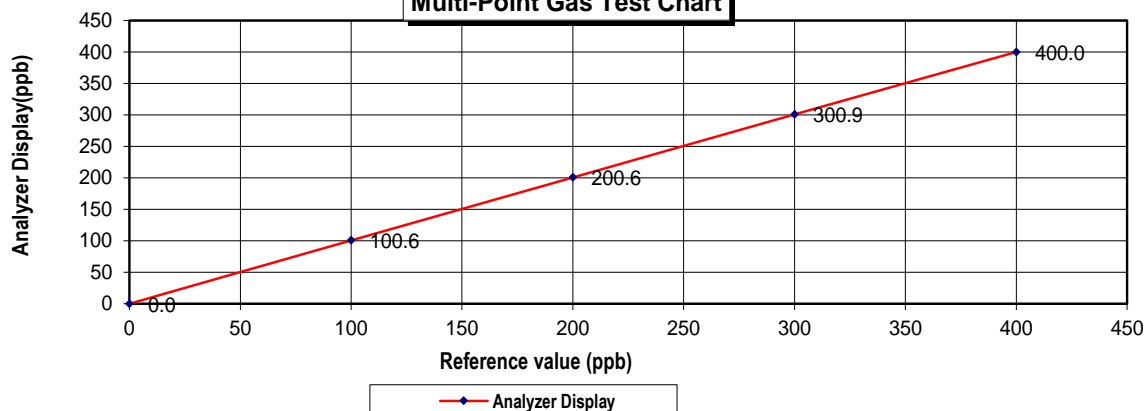
Dilutor Detail

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

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.6	0.60	0.60	0.60
Level 3	40.00%	200.0	200.6	0.60	0.30	0.30
Level 4	60.00%	300.0	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.24

Multi-Point Gas Test Chart



Calculate by

Grichai. G
.....
6 / 9 / 2567

Approve by

Petkom A.
.....
6 / 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

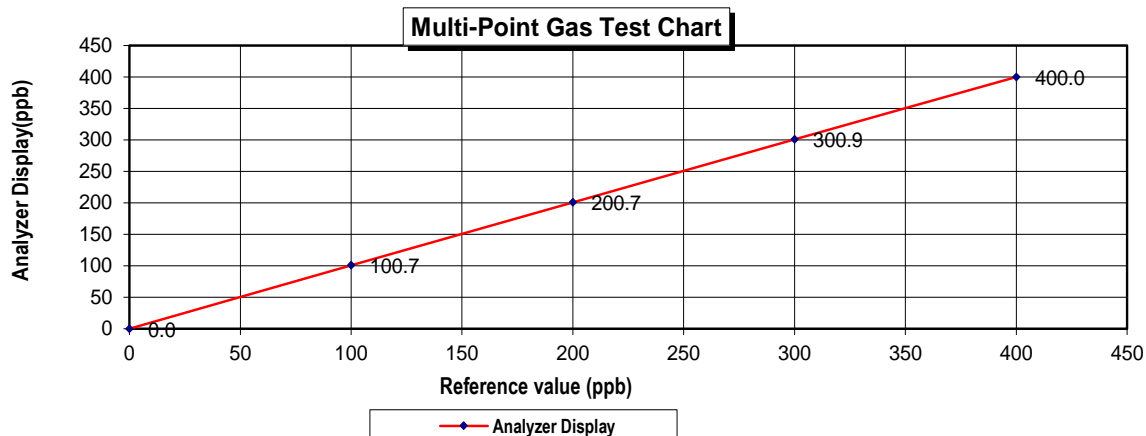
Sulphur Dioxide (SO ₂)	42.89
Nitric Oxide (NO)	46.77
Methane (CH ₄)	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB01159156
Expiration Date :	Nov 06, 2026

Dilutor Detail

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

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.7	0.70	0.70	0.70
Level 3	40.00%	200.0	200.7	0.70	0.35	0.35
Level 4	60.00%	300.0	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.27



Calculate by

4 / 9 / 2567

Approve by

4 / Sep / 2024

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CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)

LTD

Part Number: E05NI91E15A0014

Cylinder Number: EB0162121

Laboratory: 124 - Plumsteadville - PA

PGVP Number: A12023

Gas Code: CO,CO2,NO,NOX,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 Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

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

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	104202308	CC754364	98.36 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Jan 04, 2031
PRM	C2219101	APE1514048	100.19 PPM NITRIC OXIDE/NITROGEN	+/- 0.3%	Feb 28, 2025
GMIS	2023042525	CC754381	98.52 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Apr 25, 2031
PRM	12409	D913660	15.01 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Feb 17, 2023
GMIS	153400202002	EB0130037	9.693 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%	Sep 29, 2025
NTRM	160102-22	KAL003820	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Nov 01, 2027
CO	230601	CC745902	249.47 PPM CARBON MONOXIDE/NITROGEN	+/- 0.3%	Dec 09, 2028
NTRM	130606-02	CC411730	13.359 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 14, 2025

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

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR AUP2010245 CO2	FTIR	Jun 15, 2023
SIEMENS ULTRAMAT6E N1-C8-180	NDIR	Jun 14, 2023
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Jun 29, 2023
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Jun 15, 2023
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Jun 08, 2023


Approved for Release



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 3 January, 2025

Certification No. 001/25

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2111DR0072

Wind Sensor 2111DR0072

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1012.1 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

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

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

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

Serial Number 110730029 (sensor 120629586)

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

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

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

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. K4320001

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Signed :

Mr. Pisood Promsut





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 001/25

3 January, 2025

Page : 2 of 5

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	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	-	-	-	17.1	-0.08
20.02	-	-	-	20.1	-0.08

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

Calibrated by :

Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 001/25

3 January, 2025

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1012.05	1012	0.05
1011.25	1011	0.25
1012.92	1013	-0.08
1010.09	1010	0.09
1008.87	1009	-0.13
1010.43	1010	0.43
1011.39	1011	0.39
1011.05	1011	0.05
1010.72	1011	-0.28
1010.30	1010	0.30
1009.81	1010	-0.19
1008.93	1009	-0.07
1009.35	1009	0.35
1009.89	1010	-0.11
1010.57	1011	-0.43
1011.41	1011	0.41
1012.31	1012	0.31
1009.75	1010	-0.25
1010.67	1011	-0.33
1011.01	1011	0.01

Average

0.04

Calibrated by :

Watchapol

Mr. Watchapol Subwat

Mechanical Engineer



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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 001/25

3 January, 2025

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
759.10	759	0.10
758.50	759	-0.50
759.75	760	-0.25
757.63	758	-0.37
756.71	757	-0.29
757.88	758	-0.12
758.60	759	-0.40
758.35	758	0.35
758.10	758	0.10
757.79	758	-0.21
757.42	757	0.42
756.76	757	-0.24
757.07	757	0.07
757.48	757	0.48
757.99	758	-0.01
758.62	759	-0.38
759.29	759	0.29
757.37	757	0.37
758.06	758	0.06
758.32	758	0.32

Average

-0.01

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 001/25

3 January, 2025

Page : 5 of 5

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

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer



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Certificate of Calibration

Customer

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

Certificate No : 24-ACT-087

Request No : Req-2024-1365

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 1
Manufacturer : 01dB Range : 94 dB / 1000 Hz
Model : CAL31 Instrument Status : Used
Serial Number : 84065
ID : UAE.EFM.167/2561

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	EEL	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. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 25 June 2024

Certificate No : 24-ACT-087

Request No : Req-2024-1365

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)	Result
	Measured	Deviated value	Measured	Deviated value			
94 dB / 1000 Hz	93.78	-0.22	-	-	0.13	0.25	Pass

Frequency of Sound pressure level

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

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

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)	Acceptance limit Class 1 (± %)	Result
	Measured (%)	Measured (%)			
94 dB / 1000 Hz	0.14	-	0.40	2.5	Pass

Note :

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

- Acceptance limit was IEC60942:2017 Class 1

- The calibration results exclude the calibrator pressure correction

- The calibration results exclude the microphone volume correction

Certificate No : 24-ACT-087

Request No : Req-2024-1365

Decision Rule for Statements of Conformity

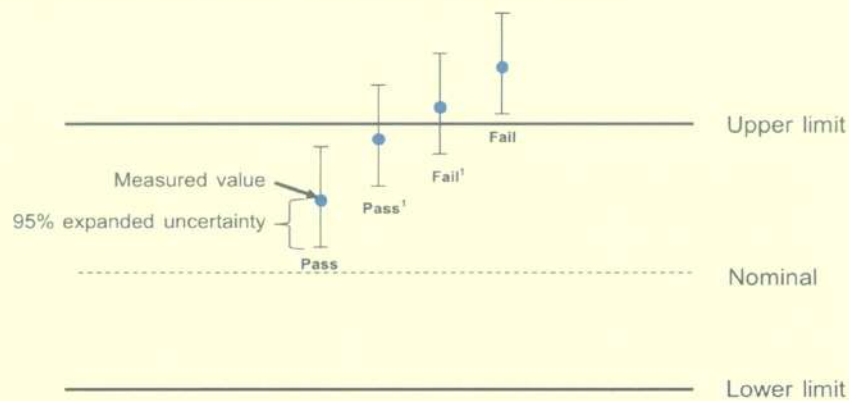
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



End of Calibration

Certificate of Calibration

Customer

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

Certificate No : 24-SLM-240

Request No : Req-2024-1459

Unit Under Calibration Details

Measurement item :	Sound Level Meter	Microphone Class :	2
Manufacturer :	Larson Davis	Microphone Model :	375A04
Model :	LxT2	Microphone S/N :	323471
Serial Number :	0005299	Preamplifier Model :	PRMLxT2C
ID :	UAE.EFM.114/2562	Preamplifier S/N :	071493
Resolution :	0.1 dB	Instrument Status :	Used

Calibration Environment and Details


Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$
Humidity : $50\% \text{RH} \pm 20\% \text{RH}$
Barometric Pressure : $1013 \text{ hPa} \pm 10 \text{ hPa}$
Received Date : 2 July 2024
Calibrated Date : 11 July 2024
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic


Reference Standard

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

Note

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

Calibrated By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 11 July 2024

Certificate No : 24-SLM-240

Request No : Req-2024-1459

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR	(± dB)	Limit	
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)		(± dB)	
1000 Hz 114 dB	113.76	115.3	1.54	113.8	+0.04	0.20	0.30	Pass

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

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting		
A	27.1	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting		
A	26.6	0.10
C	26.2	0.10
Z	30.6	0.10

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

UUC Setting	Deviation from various Frequency Weighting Responce curve			UNCERTAINTY	Acceptance	Result
FAST / 37-139	A	C	Z	(± dB)	Limit	
STD Setting	(dB)	(dB)	(dB)		(± dB)	
125 Hz	0.0	0.2	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	0.2	0.3	0.4	0.60	3.0	Pass
8000 Hz	-0.5	-0.4	-0.2	0.70	5.0	Pass

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

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

6. Frequency and time weightings at 1kHz

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

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
37-139 / A	REF	UUC	ERR			
UUC Time Response	(dB)	(dB)	(dB)	(± dB)	(± dB)	
Fast	114.00	114.0	0.0	0.20	0.10	Pass1
Slow	114.00	114.0	0.0		0.10	Pass1
Leq	114.00	114.0	0.0		0.10	Pass1

Certificate No : 24-SLM-240

Request No : Req-2024-1459

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	REF	UUC	ERR			
STD dB	(dB)	(dB)	(dB)	(± dB)	(± dB)	
139.00	139	139.0	0.0	0.30	1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
129.00	129	129.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	94.0	0.0		1.1	Pass
89.00	89	89.0	0.0		1.1	Pass
84.00	84	84.0	0.0		1.1	Pass
79.00	79	79.0	0.0		1.1	Pass
74.00	74	74.0	0.0		1.1	Pass
69.00	69	69.0	0.0		1.1	Pass
64.00	64	64.0	0.0		1.1	Pass
59.00	59	59.0	0.0		1.1	Pass
54.00	54	54.0	0.0		1.1	Pass
49.00	49	49.0	0.0		1.1	Pass
44.00	44	44.0	0.0		1.1	Pass
39.00	39	39.2	0.2		1.1	Pass
38.00	38	38.3	0.3		1.1	Pass
37.00	37	37.4	0.4		1.1	Pass
36.00	36	36.5	0.5		1.1	Pass

Certificate No : 24-SLM-240

Request No : Req-2024-1459

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
FAST / A	REF	UUC	ERR	(± dB)	Limit	
UUC Range	(dB)	(dB)	(dB)		(± dB)	
37-139	41.90	42.1	0.2	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
A / 37-139	Toneburst	Ref	UUC	ERR	(± dB)	Limit	
UUC Time Response	(ms)	(dB)	(dB)	(dB)		(± dB)	
Fast	200	135.0	134.9	-0.1	0.20	1.0	Pass
	2	118.0	117.9	-0.1		+1.0, -2.5	Pass
	0.25	109.0	108.8	-0.2		+1.5, -5.0	Pass
Slow	200	128.6	128.5	-0.1		1.0	Pass
	2	109.0	108.9	-0.1		+1.0, -5.0	Pass
SEL	200	129.0	129.0	0.0		1.0	Pass
	2	109.0	109.1	+0.1		+1.0, -2.5	Pass
	0.25	100.0	100.0	0.0		+1.5, -5.0	Pass

11. Peak C Sound level

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

Certificate No : 24-SLM-240

Request No : Req-2024-1459

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance Limit	Result
FAST / A / 37-139	UUC		(± dB)	
STD Setting	(dB)			
Positive one-half cycle	140.6			
Negative one-half cycle	140.7			
Deviated	-0.1	0.20	1.5	Pass

13. High Level Stability

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

Note :

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

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

Certificate No : 24-SLM-240

Request No : Req-2024-1459

Decision Rule for Statements of Conformity

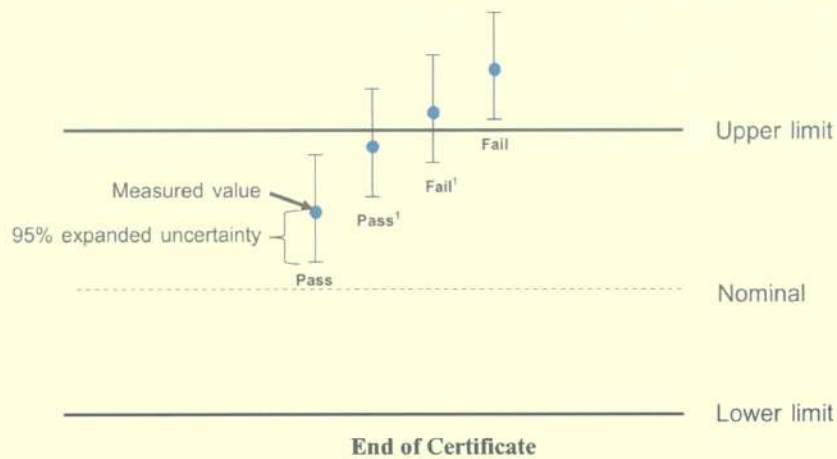
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



Certificate of Calibration

Customer

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

Certificate No : 24-SLM-229

Request No : Req-2024-1448

Unit Under Calibration Details

Measurement item :	Sound Level Meter	Microphone Class :	2
Manufacturer :	Larson Davis	Microphone Model :	375B02
Model :	LxT2	Microphone S/N :	11792
Serial Number :	0005372	Preamplifier Model :	PRMLxT2B
ID :	UAE.EFM.037/2563	Preamplifier S/N :	056132
Resolution :	0.1 dB	Instrument Status :	Used

Calibration Environment and Details


Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$
Humidity : $50\% \text{RH} \pm 20\% \text{RH}$
Barometric Pressure : $1013 \text{ hPa} \pm 10 \text{ hPa}$
Received Date : 1 July 2024
Calibrated Date : 9 July 2024
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic


Reference Standard

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

Note

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

Calibrated By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 9 July 2024

Certificate No : 24-SLM-229

Request No : Req-2024-1448

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / A / 37-139	Level (dB)	UUC	ERR	UUC	ERR			
Calibrator Setting		(dB)	(dB)	(dB)	(dB)			
1000 Hz 114 dB	113.76	114.7	0.94	113.8	+0.04	0.20	0.30	Pass

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

2. Self-generated noise, Microphone installed

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST / 37-139		
UUC Weighting		
A	32.0	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	31.8	0.10
C	31.7	0.10
Z	35.0	0.10

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

UUC Setting	Deviation from various Frequency Weighting Responce curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A	C	Z			
	(dB)	(dB)	(dB)			
FAST / 37-139						
STD Setting						
125 Hz	0.1	0.2	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	0.3	0.3	0.4	0.60	3.0	Pass
8000 Hz	0.3	0.3	0.5	0.70	5.0	Pass

Certificate No : 24-SLM-229

Request No : Req-2024-1448

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

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

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
FAST / 37-139	REF	UUC	ERR		Limit	
UUC Weighting	(dB)	(dB)	(dB)	(\pm dB)	(\pm dB)	Pass
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	Measured		UNCERTAINTY	Acceptance	Result
37-139 / A	REF	UUC	ERR		Limit	
UUC Time Response	(dB)	(dB)	(dB)	(\pm dB)	(\pm dB)	Pass
Fast	114.00	114.0	0.0	0.20	0.10	
Slow	114.00	114.0	0.0		0.10	
Leq	114.00	114.0	0.0		0.10	

Certificate No : 24-SLM-229

Request No : Req-2024-1448

7. Long Term Stability

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

8. Level linearity on the reference level range

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

Certificate No : 24-SLM-229

Request No : Req-2024-1448

9. Level linearity including the level range control

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

10. Tone burst response

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

11. Peak C Sound level

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

Certificate No : 24-SLM-229

Request No : Req-2024-1448

12. Overload indication

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

13. High Level Stability

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

Note :

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

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

Certificate No : 24-SLM-229

Request No : Req-2024-1448

Decision Rule for Statements of Conformity

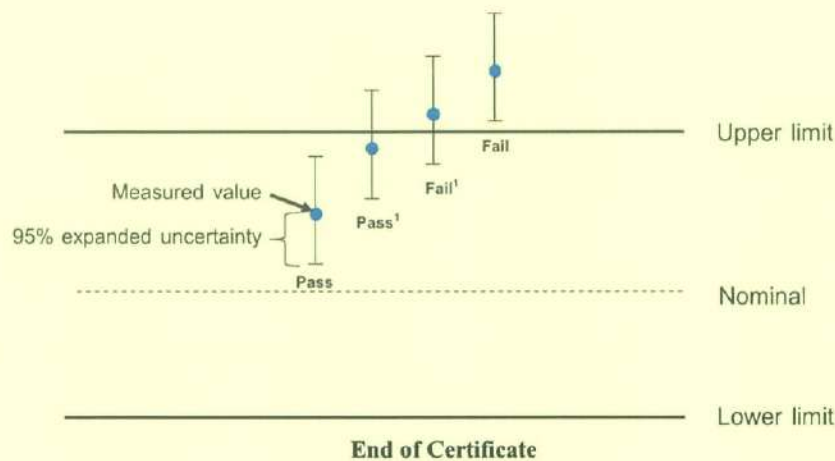
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



Certificate of Calibration

Customer

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

Certificate No : 24-SLM-232

Request No : Req-2024-1451

Unit Under Calibration Details

Measurement item :	Sound Level Meter	Microphone Class :	2
Manufacturer :	Larson Davis	Microphone Model :	375B02
Model :	LxT2	Microphone S/N :	11793
Serial Number :	0005341	Preamplifier Model :	PRMLxT2B
ID :	UAE.EFM.038/2563	Preamplifier S/N :	056133
Resolution :	0.1 dB	Instrument Status :	Used

Calibration Environment and Details


Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$
Humidity : $50\% \text{RH} \pm 20\% \text{RH}$
Barometric Pressure : $1013 \text{ hPa} \pm 10 \text{ hPa}$
Received Date : 1 July 2024
Calibrated Date : 10 July 2024
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic


Reference Standard

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

Note

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

Calibrated By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 10 July 2024

Certificate No : 24-SLM-232

Request No : Req-2024-1451

1. Indication at the calibration check frequency

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

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

2. Self-generated noise, Microphone installed

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

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

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

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

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

Certificate No : 24-SLM-232

Request No : Req-2024-1451

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

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

6. Frequency and time weightings at 1kHz

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

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance	Result
37-139 / A	REF	UUC	ERR		Limit	
UUC Time Response	(dB)	(dB)	(dB)		(± dB)	
Fast	114.00	114.0	0.0	0.20	0.10	Pass1
Slow	114.00	114.0	0.0		0.10	Pass1
Leq	114.00	114.0	0.0		0.10	Pass1

Certificate No : 24-SLM-232

Request No : Req-2024-1451

7. Long Term Stability

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

8. Level linearity on the reference level range

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

Certificate No : 24-SLM-232

Request No : Req-2024-1451

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
FAST / A	REF	UUC	ERR		Limit	
UUC Range	(dB)	(dB)	(dB)		(± dB)	
37-139	44.20	44.3	0.1	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY (± dB)	Acceptance	Result
A / 37-139	Toneburst	Ref	UUC	ERR		Limit	
UUC Time Response	(ms)	(dB)	(dB)	(dB)		(± dB)	
Fast	200	135.0	135.0	0.0	0.20	1.0	Pass
	2	118.0	117.8	-0.2		+1.0, -2.5	Pass
	0.25	109.0	108.5	-0.5		+1.5, -5.0	Pass
Slow	200	128.6	128.4	-0.2		1.0	Pass
	2	109.0	108.8	-0.2		+1.0, -5.0	Pass
SEL	200	129.0	129.0	0.0		1.0	Pass
	2	109.0	109.0	0.0		+1.0, -2.5	Pass
	0.25	100.0	99.7	-0.3		+1.5, -5.0	Pass

11. Peak C Sound level

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

Certificate No : 24-SLM-232

Request No : Req-2024-1451

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)	(± dB)	(± dB)	
Positive one-half cycle	143.2			
Negative one-half cycle	143.3			
Deviated	-0.1	0.20	1.5	Pass

13. High Level Stability

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

Note :

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

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

Certificate No : 24-SLM-232

Request No : Req-2024-1451

Decision Rule for Statements of Conformity

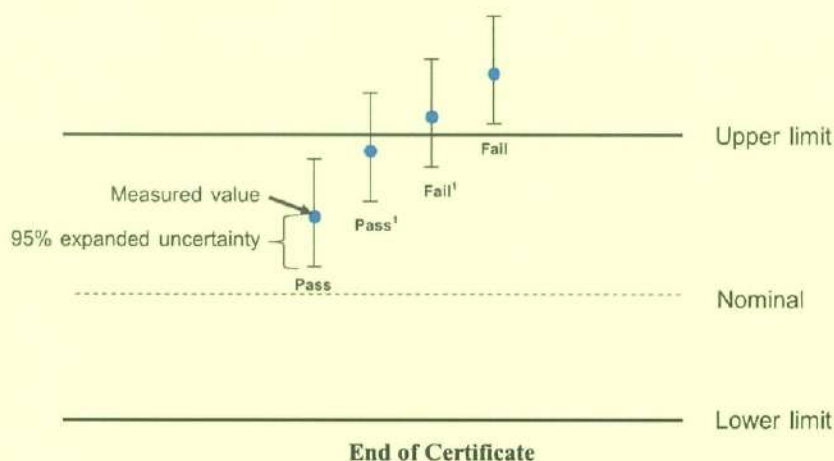
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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





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



Certificate of Calibration

Cert.No.: 24CH1153/1

Page.: 1 of 3

This Certificate was issued to replace to the Certificate No. 24CH1153

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA1G0008
ID No. : UAE.EFM.201/2564(EFM.pH.09/64)
Condition As-Received: Used Item
Received Date : 17 September 2024
Calibration Date : 18 September , 25 October 2024
Reference : 2409-0632WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

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

Calibrated by : Warakorn Lernagtrakul

Approved by : _____
Approved Signatory

() Unnophol Harachai
() Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 28 October 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.



Cert.No.: 24CH1153/1

Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

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

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

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

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.006	Hach Lenge GmbH	C03146	23 Feb 2026
pH 7.000	Hach Lenge GmbH	C03020	13 Dec 2024
pH 9.997	CPA chem	970853	25 Apr 2025

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: HA1G0008	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.0	7.02	0.058	2.00
	7.00	0.00	0.0	7.02	0.058	2.00
	10.00	-177.48	-177.5	10.01	0.058	2.00



Cert.No.: 24CH1153/1

Page.: 3 of 3

Calibration Results

Function : pH Measurement

Calibration Date : 18 September 2024

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (\pm)	Coverage factor k
pH Electrode S/N.: -	4.006	4.01	168.7	0.0077	2.00
	7.000	6.99	-3.2	0.0084	2.00
	7.000	7.00	-3.4	0.0092	2.05
	9.997	10.01	-174.4	0.011	2.05

Function : Temperature Measurement

Calibration Date : 25 October 2024

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652
- Serial No. : -
Dimension of probe
- Length : 103 mm.
- Diameter : 16 mm.
- Immersion Depth : 90 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (\pm °C)	Coverage factor k
20.0	20.001	20.0	-0.001	0.13	2.00
25.0	25.005	25.0	-0.005	0.13	2.00
45.0	45.004	44.9	-0.104	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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TEL. 0-2717-3000 FAX. 0-2719-9484

Certificate of Testing

Cert.No.: 24TW200

Page.: 1 of 2

Equipment :	DO Meter
Manufacturer :	Horiba
Model :	LAQUA-DO210
Serial No. :	HE1D0010
ID No. :	UAE.EFM.208/2564(EFM.DO.10/64)
Received Date :	17 September 2024
Test Date :	18 September 2024
Reference :	2409-0633WSC-1
Submitted by :	United Analyst and Engineering Consultant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, 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 :	Walalak Sirithean 
Approved by :	<hr/> Approved Signatory
() Unnopphol Harachai () Ponpan Paipim (✓) Saithip Meangmai	
Issue Date :	18 September 2024

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Cert.No.: 24TW200

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).

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	24MM131	04 July 2025

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate 5-Hydrate AR	KEMAUS	2203162447	99.6%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 9K1B0023

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.18	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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Certificate of Calibration

Cert. No.: 24LM150

Page.: 1 of 2

Equipment : DO Meter with Sensor

Manufacturer : Horiba

Model : LAQUA-DO210

Serial No. : HE1D0010

ID No. : UAE.EFM.208/2564(EFM.DO.10/64)

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

Location : TPA On Site Calibration Laboratory

Received Order : 17 September 2024
Calibrated Date : 18 September 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Warakorn Lerngagtrakul

Approved by :

Kunchit

Approved Signatory

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

Issue Date : 21 September 2024

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2409-0633WSC-2
Procedure Used :-

Cert. No.: 24LM150
Page.: 2 of 2

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Traceable</u>	<u>Due Date</u>
1) Digital Thermometer	2188080	2311216	TPA	11 Oct 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 : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 9K1B0023

<u>Calibration Point</u> (°C)	<u>Immersion Depth</u> (mm)	<u>Standard Temperature</u> (°C)	<u>UUC* Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (± °C)	<u>Coverage Factor</u> <i>k</i>
25.0	80	25.002	25.0	-0.002	0.16	2.00
30.0	80	30.003	30.0	-0.003	0.16	2.00
35.0	80	35.004	35.0	-0.004	0.16	2.00

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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Certificate of Calibration

Cert.No.: 24CH1158

Page.: 1 of 3

Equipment : Conductivity Meter
Manufacturer : YSI
Model : Pro30
Serial No. : 17A102921
ID No. : UAE.EFM.123/2560(ENV.SCT.03/60)
Condition As-Received: Used Item
Received Date : 17 September 2024
Calibration Date : 18 September 2024
Reference : 2409-0635WSC-2
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature : $(25 \pm 2.5) ^\circ\text{C}$
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 : Warakorn Lerngagtrakul
Approved by : _____
Approved Signatory
() Unnopphol Harachai
() Ponpan Paipim
(✓) Saithip Meangmai
Issue Date : 23 September 2024

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 24CH1158

Page.: 2 of 3

Condition of this result of calibration

1. Reference Standard Instrument :-

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1) Thermometer	9549224	130RC003	24I426	24 Apr 2025
2) Ref. Std.Thermometer	2188080	130RC044	231216	10 Oct 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

<u>Conductivity Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
1412.9 $\mu\text{S/cm}$	CPA Chem	1005307	15 June 2025
12.880 mS/cm	CPA Chem	940112	02 Nov 2024

- Control Conductivity calibration solution temperature by Water bath (25 ± 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 1412.9 $\mu\text{S/cm}$

Conductivity Electrode Serial No.: 17A100315

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
1412.9 $\mu\text{S/cm}$	1317 $\mu\text{S/cm}$	1414 $\mu\text{S/cm}$	9.2 $\mu\text{S/cm}$	2.00
12.880 mS/cm	10.60 mS/cm	11.99 mS/cm	0.086 mS/cm	2.00

Remark : - UUC* = Unit Under Calibration

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Cert.No.: 24CH1158

Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

This equipment was connected with Temperature Probe;

- Model : PRO 30 COND-T
- Serial No. : 17A100315

Dimension of probe;

- Length : 95 mm
- Diameter : 2.5 mm
- Immersion Depth : 90 mm

Calibration Result : Without adjustment

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)	Coverage factor <i>k</i>
25.0	25.003	24.7	-0.303	0.13	2.00
30.0	30.002	29.7	-0.302	0.13	2.00
35.0	35.002	34.7	-0.302	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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Certificate of Calibration

Customer

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

Certificate No : 24-ACT-122
Request No : Req-2024-1898

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 : 6695
ID : UAE.EFM.140/2565

Calibration Environment and Details


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


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

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

Note

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

Calibrated By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 10 September 2024

Certificate No : 24-ACT-122

Request No : Req-2024-1898

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 2 (± dB)	Result
	Measured	Deviated value	Measured	Deviated value			
94 dB / 1000 Hz	93.89	-0.11	-	-	0.13	0.40	Pass
114 dB / 1000 Hz	113.93	-0.07	-	-	0.13	0.40	Pass

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 2 (± %)	Result
	Measured (Hz)	Deviated	Measured (Hz)	Deviated			
94 dB / 1000 Hz	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 (%)			
94 dB / 1000 Hz	0.28	-	0.40	3.0	Pass
114 dB / 1000 Hz	0.32	-	0.40	3.0	Pass

Note :

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

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

Certificate No : 24-ACT-122

Request No : Req-2024-1898

Decision Rule for Statements of Conformity

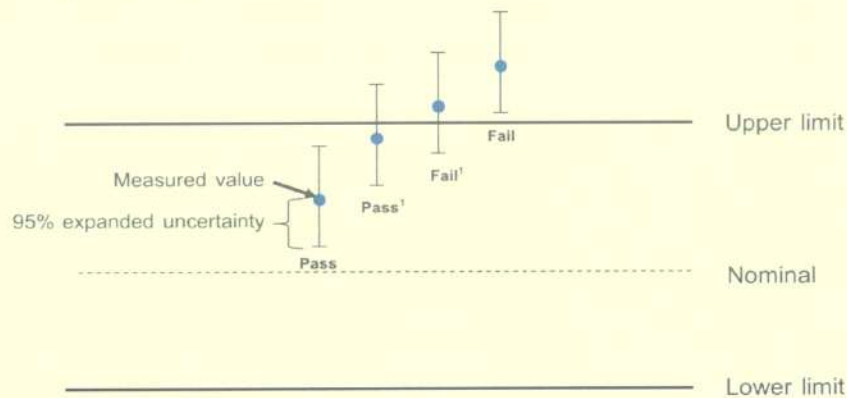
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



End of Calibration

Cert. No. : ACL25026

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00558208 / 200079 / 11458
ID No.: UAE.EFM.040/2558

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

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

Calibrated by :

Nathakorn Pisutpaisan

Approved by :


(Thanakul Petchurai)

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

เอกสารไม่ควบคุม

Cert. No. : ACL25026
Job No. : VC68AC0056
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

เอกสารไม่ควบคุม
T. Ketchan

Cert. No. : ACL25026
Job No. : VC68AC0056
Pages : 3 of 8

Summary of Measurement Result :

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

Cert. No. : ACL25026
Job No. : VC68AC0056
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.4

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

Frequency Weighting	Weighting (dB)
A - weight	11.3
C - weight	17.5
Flat	23.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	0.8	0.9	0.9	±5.0

Cert. No. : ACL25026
Job No. : VC68AC0056
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.1	0.1	0.1	±1.5
250	0.1	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	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	94.1	0.1	

เอกสารไม่ควบคุม
K. Ketch

Cert. No. : ACL25026

Job No. : VC68AC0056

Pages : 6 of 8

7. Level linearity on the reference level range

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

เอกสารไม่ควบคุม
T. Kelch

Cert. No. : ACL25026
Job No. : VC68AC0056
Pages : 7 of 8

8. Level linearity including the level range control

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

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

9. Tone burst response

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

Cert. No. : ACL25026
Job No. : VC68AC0056
Pages : 8 of 8

10. Peak C sound level

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

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

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	±1.5

12. High level stability

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

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

End of Calibration Certificate

เอกสารไม่ควบคุม
T. Ketchan

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiphorn.com

SITHIPORN
associates



Cert. No. : ACL25115

Pages : 1 of 8

Calibration Certificate

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

Condition As Found : GOOD

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

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

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

Calibrated by :

Nathakorn Pisutpaisan

Approved by :


(Thanakul Petchurai)

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เอกสารไม่ควบคุม

Cert. No. : ACL25115
Job No. : VC68AC0061
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

เอกสารไม่ควบคุม

T. Petch

Cert. No. : ACL25115
Job No. : VC68AC0061
Pages : 3 of 8

Summary of Measurement Result :

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

เอกสารไม่ควบคุม
T. Rejch.

Cert. No. : ACL25115
Job No. : VC68AC0061
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.1

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

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

3. Acoustical signal tests of frequency weightings

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

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

เอกสารไม่ควบคุม
S. Petcha.

Cert. No. : ACL25115

Job No. : VC68AC0061

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

เอกสารไม่ควบคุม

T. P. S. Ch.

Cert. No. : ACL25115

Job No. : VC68AC0061

Pages : 6 of 8

7. Level linearity on the reference level range

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

เอกสารไม่ควบคุม

T. Petchu

Cert. No. : ACL25115
Job No. : VC68AC0061
Pages : 7 of 8

8. Level linearity including the level range control

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

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.9	-0.1	±1.1

9. Tone burst response

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

เอกสารไม่ควบคุม
T. Re Foh

Cert. No. : ACL25115

Job No. : VC68AC0061

Pages : 8 of 8

10. Peak C sound level

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

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

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	±1.5

12. High level stability

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

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

End of Calibration Certificate

เอกสารไม่ควบคุม

T. Petch...

Cert. No. : ACL25018

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

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

Calibrated by :

Nathakorn Pisutpaisan

Approved by :


(Thanakul Petchurai)

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

เอกสารไม่ควบคุม

Cert. No. : ACL25018
Job No. : VC68AC0056
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

เอกสารไม่ควบคุม
F. Ketch.

Cert. No. : ACL25018

Job No. : VC68AC0056

Pages : 3 of 8

Summary of Measurement Result :

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

เอกสารไม่ควบคุม
T. Ketch.

Cert. No. : ACL25018
Job No. : VC68AC0056
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
20.6

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

Frequency Weighting	Weighting (dB)
A - weight	16.3
C - weight	22.1
Flat	28.0

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	0.4	0.4	0.4	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	1.7	1.7	1.7	±5.0

Cert. No. : ACL25018
Job No. : VC68AC0056
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

เอกสารไม่ควบคุม

J. Kech

Cert. No. : ACL25018

Job No. : VC68AC0056

Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.1	0.1	± 1.1
30.0	30.2	0.2	± 1.1
29.0	29.2	0.2	± 1.1
28.0	28.2	0.2	± 1.1
27.0	27.3	0.3	± 1.1
26.0	26.4	0.4	± 1.1
25.0	25.5	0.5	± 1.1

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F. Ketch

Cert. No. : ACL25018
Job No. : VC68AC0056
Pages : 7 of 8

8. Level linearity including the level range control

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

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.1	0.1	±1.1

9. Tone burst response

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

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[Signature]

Cert. No. : ACL25018
Job No. : VC68AC0056
Pages : 8 of 8

10. Peak C sound level

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

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

11. Overload indication

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

เอกสารไม่ควบคุม
[Signature]

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 24-NDM-177
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260 Request No : Req-2024-1551

Unit Under Calibration Details

Measurement item : Noise Dosimeter Microphone Class : 2
Manufacturer : SVANTEK Microphone Model : SV27
Model : SV 104 Microphone S/N : 139831
Serial Number : 143225 Preamplifier Model : -
ID : UAE.EFM.143/2566 Preamplifier S/N : -
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 5 July 2024
Calibrated Date : 16 July 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

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

Note

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

Calibrated By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 16 July 2024



Certificate No : 24-NDM-177
Request No : Req-2024-1551

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 h)	(Pa ² h)	(%)			
1000 Hz 114 dB	120	120	3.17	3.20	+0.9	3.1	-21, +26	Pass

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit	Result
FAST / 55-140	A	C	(± dB)	(± dB)	
STD Setting	(dB)	(dB)			
*63 Hz	0.5	0.3	0.40	2.0	Pass
125 Hz	0.4	0.5	0.40	1.5	Pass
250 Hz	0.3	0.4	0.40	1.5	Pass
500 Hz	0.3	0.4	0.40	1.5	Pass
1000 Hz	0.0	0.0	0.40	-	-
2000 Hz	-0.7	-0.6	0.40	2.0	Pass
4000 Hz	2.4	2.4	0.40	3.0	Pass
8000 Hz	1.9	1.9	0.40	5.0	Pass

Certificate No : 24-NDM-177

Request No : Req-2024-1551

3. Linearity of response to steady signals

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

UUC Setting		FAST / A / High									
1000 Hz	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
	Level A	(dB)	54.8	80.1	90.1	100.0	110.0	114.0	119.9	129.9	139.9
	Error	(dB)	-0.2	0.1	0.1	0.0	0.0	0.0	-0.1	-0.1	-0.1
8000 Hz	Ref	(dB)				88.9	98.9	108.9	112.9	118.9	128.9
	Level A	(dB)				89.0	98.9	108.9	112.9	118.9	128.9
	Error	(dB)				0.1	0.0	0.0	0.0	0.0	-0.1
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8
	Level A	(dB)						87.8	93.8	103.8	113.8
	Error	(dB)						0.0	0.0	0.0	0.0
Tolerances Limit		(±dB)	1.0								
UNCERTAINTY		(±dB)	0.3								
Result			Pass								

b. Sound exposure meter linearity of error

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

Certificate No : 24-NDM-177

Request No : Req-2024-1551

4. Response to short duration

a. Response for sinusoidal signals - reference level

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

b. Sound exposure meter response for series of toneburst impulses

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

5. Response to unipolar pulse

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

* Indicates non accredited

Certificate No : 24-NDM-177

Request No : Req-2024-1551

Decision Rule for Statements of Conformity

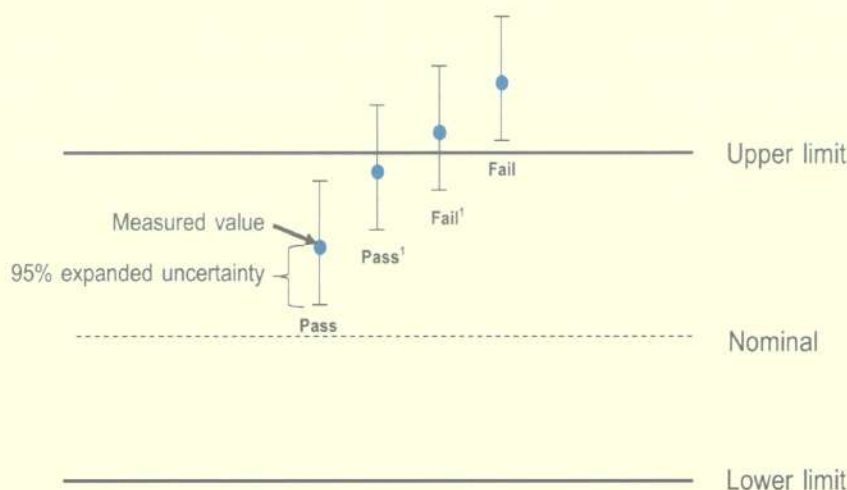
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



End of Certificate

Certificate of Calibration

Customer

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

Certificate No : 24-AFM-156

Request No : Req-2024-1575

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : TSI Accuracy : 2% of Reading
Model : 4146 Sensor Model : -
Serial Number : 41462327002 Sensor Serial Number : -
ID : UAE.EFM.125/2566 Instrument Status : Used
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 15 July 2024
Calibration Date : 19 August 2024
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceble	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	2 August 2025
Temperature meter	GT 11	08000057	Qreborn	1 March 2025
Pressure meter	CPG2400	41000KDU/651882	TPA	9 November 2024

Traceability :

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

Note :

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

Calibration By : me
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : ป. 57
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 27 August 2024

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Certificate No : 24-AFM-156

Request No : Req-2024-1575

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Uncertainty (l/min)	MPE (l/min)	Result
21.50	100.55	0.020	0.021	0.001	0.0013	0.005	N/A
21.30	100.53	0.050	0.052	0.002	0.0033	0.005	N/A
21.40	100.56	0.099	0.101	0.002	0.0028	0.005	N/A
21.30	100.58	0.200	0.204	0.004	0.0056	0.005	N/A
21.50	100.54	0.500	0.505	0.005	0.007	0.010	N/A
21.60	100.52	1.000	1.019	0.019	0.014	0.020	N/A
21.40	100.58	1.698	1.731	0.033	0.024	0.034	N/A
21.70	100.63	1.999	2.037	0.038	0.029	0.040	N/A
21.60	100.64	2.998	3.057	0.059	0.043	0.060	N/A
22.00	100.80	4.002	4.079	0.077	0.056	0.080	N/A
22.30	100.96	5.001	5.094	0.093	0.072	0.100	N/A

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

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

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

* Indicates non accredited

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

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

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

Certificate No : 24-AFM-156

Request No : Req-2024-1575

Decision Rule for Statements of Conformity

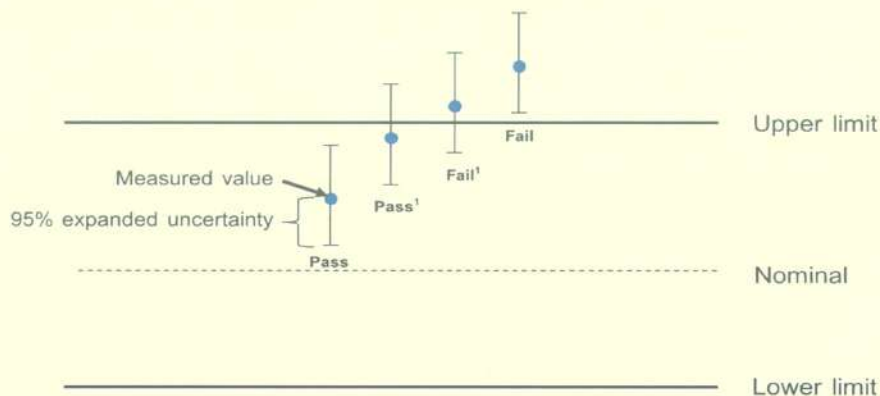
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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



End of Certificate

เอกสารไม่ควบคุม



Certificate of Calibration

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

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, Bangchak,
Phrakhanong, Bangkok 10260

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

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
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 Khankaew
Issue Date : 23 April 2024

Approved Signatory : _____
[] Phalinee Prabpaipal
[] Sura Suwannasri
[✓] Attapol Panurach

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Cert.No.: 24P1370

Page: 2 of 2

Result of calibration:- Without adjustment

Range : 720 mmHg to 770 mmHg

Function:- Absolute Pressure Measurement

Scale Interval : 1 mmHg (The Fifth Estimate)

Increasing Pressure

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

Decreasing Pressure

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

The uncertainty of measurement was ± 0.24 mmHg

* UUC = Unit Under Calibration

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

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



Certificate of Calibration

Certificate No. : 25P1359

Page : 1 of 2

Equipment : Aneroid Barometer
Manufacturer: Barigo
Model : 111MS
Serial No.: -
ID No.: UAE.EMA2.067/2552

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

Condition As-Received: Used Item

Received Date: 10 April 2025

Calibration Date: 17 April 2025

Reference: 2504-0315WSC

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

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

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

Atmospheric Pressure: 1009 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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Standard Barometer	DPI142	1422505046	MP-0133-24	15 May 2025

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

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

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Kaerkpon Saivichai
Issue Date : 21 April 2025

Approved Signatory : Attapol P.

[] Phalinee Prabpaipal

[] Sura Suwannasri

[✓] Attapol Panurach

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Result of calibration:- Without adjustment

Range : 720 mmHg to 780 mmHg

Function:- Absolute Pressure Measurement

Scale Interval : 1 mmHg (The Fifth Estimate)

Increasing Pressure

Applied Pressure (mmHg)	717.92	728.95	739.74	750.28	761.55	773.52	784.47
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0	780.0
Error (mmHg)	2.08	1.05	0.26	-0.28	-1.55	-3.52	-4.47

Decreasing Pressure

Applied Pressure (mmHg)	784.47	773.53	761.51	750.35	739.81	729.05	718.10
UUC* Indication (mmHg)	780.0	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-4.47	-3.53	-1.51	-0.35	0.19	0.95	1.90

The uncertainty of measurement was ± 0.24 mmHg

* UUC = Unit Under Calibration

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

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



Certificate of Calibration

Certificate No. : 24H1487

Page : 1 of 2

Equipment : Digital Thermo-Hygrometer
Manufacturer: Digicon
Model : TH-02A
Serial No.: 435031148
ID No.: UAE.EFM.006/2567

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

Condition As-Received: New Item

Received Date: 10 July 2024

Calibration Date: 15 July 2024
to 17 July 2024

Reference: 2407-0393WSC

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

Ambient Temperature: (25 \pm 3) °C

Relative Humidity: (50 \pm 20) %

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

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

Condition of this result of calibration

1.Reference standards instruments :

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

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

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

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

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

Calibrated by : Surasit Phansudnoi
Issue Date : 17 July 2024

Approved Signatory :

Viporn

[] Chakrit Waewwanjua

[✓] Viporn Tantiyawutti

[] Unnopphol Harachai

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Cert. No.: 24H1487

Page.: 2 of 2

Result of Calibration:- Without Adjustment

Function: Humidity Measurement.

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

Result of Calibration:- Without Adjustment

Function: Temperature Measurement.

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

UUC* : Unit Under Calibration

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

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Certificate of Calibration

Customer

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

Certificate No : 24-LXM-199

Request No : Req-2024-1492

Page : 1/3

Unit Under Calibration Details

Instrument Name	: Light Meter	Range Calibration	: 2000 , 20000 lx
Manufacturer	: EXTECH	Accuracy	: 4 % of Reading + 2 digits
Model	: 407026	Instrument Status	: Used
Serial Number	: A062335		
Resolution	: 1 , 10 lx		
ID Number	: UAE.EFM.108/2566		

Calibration Environment and Details

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

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

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

Note

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

Approved By :



Mr. Pacit Mathavorn

Calibration Engineer Supervisor

Issue Date :

1 August 2024

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Calibration Note

UUC Adjustment : Zero adjustment before use

Certificate No : 24-LXM-199

Request No : Req-2024-1492

Page : 2/3

Result of Calibration :

UUC Range (Ix)	Standard (Ix)	UUC Reading (Ix)	Correction (Ix)	Uncertainty (\pm Ix)	MPE (Ix)	Reslt
2000	* 0	0	0	0.58	2	N/A
	50	50	0	2.5 % of Reading	4	N/A
	100	99	1	2.3 % of Reading	6	N/A
	200	199	1	2.2 % of Reading	10	N/A
	300	302	-2	2.2 % of Reading	14	N/A
	400	403	-3	2.2 % of Reading	18	N/A
	600	604	-4	2.2 % of Reading	26	N/A
	800	803	-3	2.2 % of Reading	34	N/A
	1000	1005	-5	2.2 % of Reading	42	N/A
	1200	1206	-6	2.2 % of Reading	50	N/A
	1400	1409	-9	2.2 % of Reading	58	N/A
	1600	1611	-11	2.2 % of Reading	66	N/A
	1800	1808	-8	2.2 % of Reading	74	N/A
	2000	1990	10	2.2 % of Reading	82	N/A
20000	3000	2970	30	2.2 % of Reading	121	N/A
	4000	3960	40	2.2 % of Reading	160	N/A
	5000	4950	50	2.2 % of Reading	200	N/A

* Indicates non accredited

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

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

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Certificate No : 24-LXM-199

Request No : Req-2024-1492

Page : 3/3

Decision Rule for Statements of Conformity

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

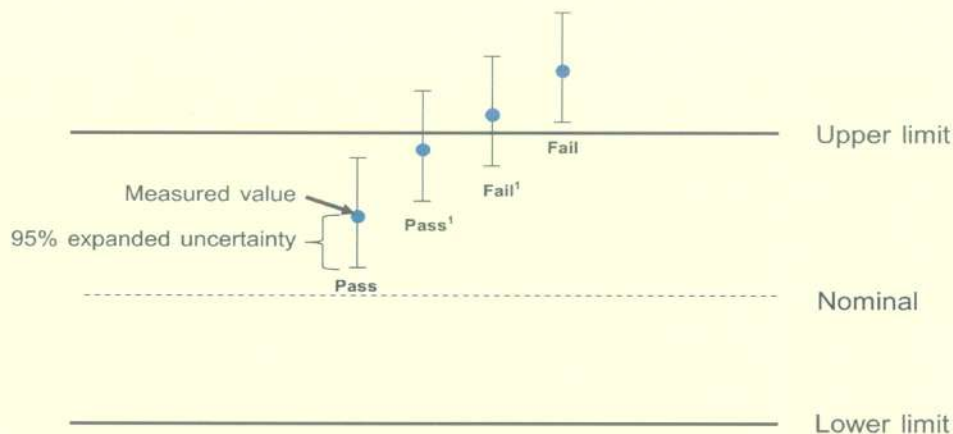
Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



End of Certificate

Calibrated By :

me

Mr. Noppadon Luangart

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

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

Certificate No : 24-TPM-371

Request No : Req-2024-1693

Page : 1/2

Unit Under Calibration Details

Calibration Parameter	: Temperature	Range Calibration	: 20 °C to 60 °C
Instrument Name	: Thermal Environment Monitor	Type of Sensor	: RTD
Manufacturer	: TSI QUEST	Sensor Diameter (mm)	: 4.5
Model	: QT-34	Calibration Position (mm)	: 67.5
Serial Number	: TEK120020	Instrument Status	: Used
Resolution	: 0.1 °C		
ID Number	: UAE.EMA2.023/2555		

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 2 August 2024
Calibrated Date : 15 August 2024
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

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

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

Note

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

Approved By :



Mr. Noppadon Luangart

Technical Manager

Issue Date :

19 August 2024

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Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 24-TPM-371

Request No : Req-2024-1693

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	20.031	20.0	0.0	0.13
	25.031	25.1	- 0.1	0.13
	30.034	30.0	0.0	0.13
	35.036	35.0	0.0	0.13
	40.035	40.0	0.0	0.13
	45.038	45.2	- 0.2	0.13
	50.041	50.0	0.0	0.13
	60.046	60.0	0.0	0.13
DRY	20.032	19.9	+ 0.1	0.13
	25.031	25.1	- 0.1	0.13
	30.034	29.9	+ 0.1	0.13
	35.036	35.1	- 0.1	0.13
	40.037	39.9	+ 0.1	0.13
	45.038	45.1	- 0.1	0.13
	50.041	48.9	+ 1.1	0.13
	60.046	59.9	+ 0.1	0.13
GLOBE	20.032	19.9	+ 0.1	0.13
	25.030	25.2	- 0.2	0.13
	30.035	29.9	+ 0.1	0.13
	35.035	35.1	- 0.1	0.13
	40.037	39.9	+ 0.1	0.13
	45.040	45.1	- 0.1	0.13
	50.040	50.0	0.0	0.13
	60.045	60.0	0.0	0.13

End of Certificate

Calibrated By :



Mr. Sittichok Jirapukdeesakul

เอกสารไม่ควบคุม



Certificate of Calibration

Customer

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

Certificate No : 24-TPM-369

Request No : Req-2024-1692

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : 3M
Model : QT-32
Serial Number : TPQ020022
Resolution : 0.1 °C
ID Number : UAE.EFM.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: GINGO/GINGO, Model: GT11/RTD100, SN: 08000057, ID: 02-TPM
Which was calibrated on 1 March 2024, Calibration Certificate No. : QR24-0478

Traceability

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

Note

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

Approved By :

me

Mr. Noppadon Luangart

Technical Manager

Issue Date :

19 August 2024

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Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 24-TPM-369

Request No : Req-2024-1692

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	20.031	20.0	0.0	0.13
	25.031	25.1	- 0.1	0.13
	30.031	30.0	0.0	0.13
	35.037	35.1	- 0.1	0.13
	40.037	40.0	0.0	0.13
	45.038	45.1	- 0.1	0.13
	50.041	50.1	- 0.1	0.13
	60.044	60.1	- 0.1	0.13
DRY	20.032	20.0	0.0	0.13
	25.030	25.1	- 0.1	0.13
	30.033	30.0	0.0	0.13
	35.035	35.2	- 0.2	0.13
	40.037	40.0	0.0	0.13
	45.038	45.1	- 0.1	0.13
	50.041	50.1	- 0.1	0.13
	60.045	60.1	- 0.1	0.13
GLOBE	20.032	20.0	0.0	0.13
	25.030	25.0	0.0	0.13
	30.034	30.0	0.0	0.13
	35.035	35.2	- 0.2	0.13
	40.038	40.0	0.0	0.13
	45.039	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. Sittichok Jirapukdeesakul

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