

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์

รายงานผลการปฏิบัติตามมาตรการป้องกัน และแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม

โครงการโรงงานผลิตน้ำตาลทราย ระหว่างเดือนมกราคม-มิถุนายน พ.ศ. 2568

บริษัท รวมเกษตรอุตสาหกรรม จำกัด (มีตรึงหลวง)

รายการเครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์สำหรับตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Laboratory Instrument/Equipments (คุณภาพอากาศ)									
1	Analytical Balance (Readability 0.1 mg)	ฝุ่นละอองรวม, ฝุ่นละอองรวม (TSP), ฝุ่นละอองเล็กกว่า 10 ไมครอน (PM-10)	Mettler-Toledo	AB204-S / 1128312528	Mettler-Toledo (Thailand) Ltd.	23MM331	7 Apr 23	5 Apr 24	-
2	Analytical Balance (Readability 0.1 mg)	ฝุ่นละอองรวม, ฝุ่นละอองรวม (TSP), ฝุ่นละอองเล็กกว่า 10 ไมครอน (PM-10)	Mettler-Toledo	AB204-S/FACT / B108115858	Mettler-Toledo (Thailand) Ltd.	2502228-001-01	19 Mar 25	18 Mar 26	-
3	Analytical Balance (Readability 0.001 mg)	ฝุ่นละอองเล็กกว่า 2.5 ไมครอน (PM-2.5) ฝุ่นทุกขนาด (Total Dust), ฝุ่นขนาดที่เข้าถึง และสะสมในถุงลมของปอดได้ (Respirable dust)	Mettler-Toledo	XP6 / B322373893	Mettler-Toledo (Thailand) Ltd.	2402420-002-01	20 Mar 25	19 Mar 26	-
4	UV-VIS Spectrophotometer	แอมโมเนีย	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP24-018	7 May 24	6 May 25	-
5	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP24-008	16 Jan 24	14 Jan 25	-
6	Atomic Absorption Spectrophotometer (AAS)	ตะกั่ว	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research (TISTR).	MTCACL. No. 387/66	11 Mar 24	10 Mar 25	-
Laboratory Instrument/Equipments (คุณภาพน้ำและดิน)									
7	pH Meter	ความเป็นกรด-ด่าง อุณหภูมิ	Hanna Instrument	HI2020-02 C0051107	National Food Institute, Ministry of Industry, Thailand	2404042-001-01	21 Aug 24	20 Aug 25	-
8	pH Meter		Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2401718-001-01	24 Feb 25	23 Feb 26	-
9	BOD Incubator	บีโอดี	Arco	UC4-1320/13URC4S013201 (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	25TM205	8 Feb 25	7 Feb 26	-

รายการเครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์สำหรับตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Laboratory Instrument/Equipments.(คุณภาพน้ำและดิน)									
10	BOD Incubator	บีโอดี	Arco	UR-1320 / (UAE:WAO.018/2551)	Technology Promotion Association (Thailand-Japan)	25TM577	19 Mar 25	18 Mar 26	-
11	Analytical Balance (Repeatability 0.01 mg)	ของแข็งละลายน้ำทั้งหมด ของแข็งแขวนลอย	Mettler-Toledo	XSR205DU / C009071872	Technology Promotion Association (Thailand-Japan)	2502226-001-01	20 Mar 25	19 Mar 26	-
12	Hot Air Oven		Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	2500116-001-01	8 Oct 24	7 Oct 25	-
13	Digestor Unit	ทีเคเอ็น	FOSS TECATOR	2520auto / 91794469	National Food Institute, Ministry of Industry, Thailand	9809	8 Feb 24	6 Feb 25	-
14	Distillation Unit (Kjeldahl Method)	แอมโมเนีย ทีเคเอ็น	FOSS TECATOR	KT8100/ 91889052	FOSS South East Asia	9807	9 Feb 24	7 Feb 25	-
15	Analytical Balance (Repeatability 0.1 mg)	น้ำมันและไขมัน	Mettler-Toledo	XSR204 / C117635043	National Food Institute, Ministry of Industry, Thailand	24MM293	11 May 24	10 May 25	-
16	Atomic Absorption Spectrophotometer (AAS)	สารหนู, ตะกั่ว, นิกเกิล, ปรอท, ทองแดง	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research (TISTR).	MTCACL. No. 387/66	11 Mar 24	10 Mar 25	-
17	Inductively Coupled Plasma (ICP)		Agilent Technologies	System ID:G8015A G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	11 Jun 24	10 Jun 25	-
18	Incubator	โคลิฟอร์มแบคทีเรียทั้งหมด	Binder	KB400 / 202000000391	Technology Promotion Association (Thailand-Japan)	24TM884	7 Jun 24	6 Jun 25	-
19	Incubator	โคลิฟอร์มแบคทีเรียทั้งหมด	Memmert	IPP 260 /	Technology Promotion Association	24TM650	1 Apr 24	31 Mar 25	-
				V616.0066	(Thailand-Japan)				

รายการเครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์สำหรับตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Laboratory Instrument/Equipments.(คุณภาพน้ำและดิน)									
20	Water Bath	โคลิฟอร์มแบคทีเรียทั้งหมด	Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	2501624-001-01	10 Feb 25	9 Feb 26	-
21	Water Bath		Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	2501624-002-01	10 Feb 25	9 Feb 26	-
22	Analytical Balance		Mettler-Toledo	MS603S / 01 B007010311	Mettler-Toledo (Thailand) Ltd.	2402284-001-01	2 Apr 24	1 Apr 25	-
23	Auto Clave		ALP	CL-40L / 808763	Technology Promotion Association (Thailand-Japan)	2402281-001-01	2 Apr 24	1 Apr 25	-
24	UV-VIS Spectrophotometer	สี, ไนเตรท, ไนโตรเจน,แอมโมเนีย, ซีไอดี, ฟอสเฟต, ฟอสฟอรัส	Agilent Technologies	Cary60 / MY15410009	DQE Services Co.,Ltd.	SP25-019	26 May 25	25 May 26	-
25	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP24-008	16 Jan 24	14 Jan 25	-
26	COD Reactor		Hanna	HI839800-02 /1147807	Hanna Instruments (Thailand) Ltd.	HIT-2417-0568	23 Apr 24	22 Apr 25	-
Water									
27	pH Meter	pH	Horiba	LAQUA-PH210 HAOC0025	Technology Promotion Association (Thailand-Japan)	24CH319	28 Feb 25	27 Feb 26	-
28	DO Meter	DO	Horiba	LAQUA-DO210 HE9M0011	Technology Promotion Association (Thailand-Japan)	24TW129	19 Jun 24	18 Jun 25	-
29	Conductivity Meter	Conductivity	YSI	Pro30 18K100977	Technology Promotion Association (Thailand-Japan)	25CH618	29 Apr 25	28 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
Ambient									
30	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Andersen Instruments, Inc.	G25A 11MX	Tisch Environmental, Inc.	12062023	25 Jun 24	24 Jun 25	-
31	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	24P1250	10 Apr 24	9 Apr 25	-
32	Air Flow Meter	Particular Matter (PM _{2.5})	Mesa Labs	DeltaCal DC1 158850	Innovative Instrument Co., Ltd.	24-AFM-173	28 Aug 24	27 Aug 25	-
33	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24P1367	22 Apr 24	21 Apr 25	-
34	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24H758	10 Apr 24	9 Apr 25	-
35	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Electron	42C 0517512001	UAE Consultant Co., Ltd.	11102024	11 Oct 24	10 Oct 25	-
36	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 'CM08130002	UAE Consultant Co., Ltd.	17082024	17 Sep 24	16 Sep 25	-
37	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-67174-356	UAE Consultant Co., Ltd.	17112024	17 Sep 24	16 Sep 25	-
38	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-76412-383	UAE Consultant Co., Ltd.	17102024	17 Oct 24	16 Oct 25	-
39	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0159156/ 2015PSIG	Airgas an Air Liquide company	E04N99E15A01D3	6 Nov 23	6 Nov 26	-
40	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i /1201778111	UAE Consultant Co., Ltd.	9112023	6 Sep 24	6 Nov 26	-

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No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Ambient									
41	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i /1201778112	UAE Consultant Co.,Ltd.	4092024	4 Sep 24	6 Nov 26	-
42	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i /1201778113	UAE Consultant Co.,Ltd.	4092024	4 Sep 24	6 Nov 26	-
43	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i /1201778116	UAE Consultant Co.,Ltd.	4092024	19 Jun 24	6 Nov 26	-
44	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0162121 2015PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jul 23	6 Jul 31	-
45	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i /1180540074	UAE Consultant Co.,Ltd.	9112023	9 Sep 24	6 Nov 26	-
46	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i /1180540069	UAE Consultant Co.,Ltd.	14112024	14 Jun 24	6 Nov 26	-
47	Carbon Monoxide Analyzer	Carbon Monoxide	Horiba	APMA-370 YN43AG7T	UAE Consultant Co.,Ltd.	14062024	14 Jun 24	6 Nov 26	-
48	Carbon Monoxide Analyzer	Carbon Monoxide	Horiba	APMA-370/ YRLHTB7G	UAE Consultant Co.,Ltd.	08022023	9 Jun 25	6 Nov 26	-
49	Wind Speed/Wind Direction	WS/WD	LSI LASTEM	DA-650-3TV/110730029	Thai Meteorological Department	106/25	19 Feb 25	18 Feb 26	-
50	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35A 73249	Innovative Instrument Co.,Ltd.	24-ACT-070	17 May 24	16 May 25	-
51	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, L_{A90} , L_{Amax} , L_{Adn}	Larson Davis	LxT2 0006699	Innovative Instrument Co.,Ltd.	24-SLM-230	10 Jul 24	9 Jul 25	-
52	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, L_{A90} , L_{Amax} , L_{Adn}	Larson Davis	LxT2 0005293	Innovative Instrument Co.,Ltd.	24-SLM-231	10 Jul 24	10 Jul 25	-
53	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, L_{A90} , L_{Amax} , L_{Adn}	Larson Davis	LxT2 0005341	Innovative Instrument Co.,Ltd.	24-SLM-232	10 Jul 24	11 Jul 25	-
54	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, L_{A90} , L_{Amax} , L_{Adn}	Larson Davis	LxT2 0006698	Innovative Instrument Co.,Ltd.	24-SLM-233	10 Jul 24	12 Jul 25	-
55	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, L_{A90} , L_{Amax} , L_{Adn}	Larson Davis	LxT2 0005286	Innovative Instrument Co.,Ltd.	24-SLM-234	10 Jul 24	13 Jul 25	-
56	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, L_{A90} , L_{Amax} , L_{Adn}	Larson Davis	LxT2 0005346	Innovative Instrument Co.,Ltd.	24-SLM-235	10 Jul 24	14 Jul 25	-
57	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, L_{A90} , L_{Amax} , L_{Adn}	Larson Davis	LxT2 0006691	Innovative Instrument Co.,Ltd.	24-SLM-236	10 Jul 24	15 Jul 25	-

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No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Workplace									
58	Noise Dosimeter	Noise Dosimeter	Svantek	SV104/ 117693	Innovative Instrument Co.,Ltd.	24-NDM-107	26 Apr 24	25 Apr 25	-
59	Noise Dosimeter	Noise Dosimeter	Svantek	SV104/ 143224	Innovative Instrument Co.,Ltd.	24-NDM-172	15 Jul 24	14 Jul 25	
60	Noise Dosimeter	Noise Dosimeter	Svantek	SV104/ 143228	Innovative Instrument Co.,Ltd.	24-NDM-220	10 Sep 24	9 Sep 25	
61	Primary Flow Calibrator	Calibrate personal pump	TSI,Inc	4146/ 41461922008	Innovative Instrument Co.,Ltd.	24-AFM-010 R.1	23 Jan 24	23 Jan 25	-
62	Aneroid Barometer	Total Dust, Respirable Dust Ammonia, Lead	Testo, Germany	608-H1 34843154	Technology Promotion Association (Thailand-Japan)	24H700	5 Apr 24	4 Apr 25	-
63	Digital Thermo - Hygrometer	Total Dust, Respirable Dust Ammonia, Lead	Testo, Germany	608-H1 34835471	Technology Promotion Association (Thailand-Japan)	24H701	5 Apr 24	4 Apr 25	-
64	Thermal Environment Monitor	Heat Meter	TSI QUEST	QT-32/ TPT060014	Innovative Instrument Co.,Ltd.	24-TPM-248	3 Jun 24	2 Jun 25	-
65	Thermal Environment Monitor	Heat Meter	TSI QUEST	QT-32/ TPW020005	Innovative Instrument Co.,Ltd.	24-TPM-147	21 Mar 24	20 Mar 25	-
66	Digital Lux Meter	Lux	Extech Instrument, Taiwan	407026/ A037351	Innovative Instrument Co.,Ltd.	24-LXM-079	25 Mar 24	24 Mar 25	-
67	Digital Lux Meter	Lux	Extech Instrument, Taiwan	407026/ A056652	Innovative Instrument Co.,Ltd.	24-LXM-105	29 Apr 24	29 Apr 25	-



Cert.No.: 23MM331
Page: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : AB204-S
Serial No. : 1128312528
ID No. : UAE.AIR.019/2550
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Balance Room 2
Received order : 07 April 2023
Calibration Date : 07 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : Suwit Imjai
Approved by :
() Pornthippa Tarneyakul
() Malee Butkruea
Issue Date : 10 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0015OC-1
Procedure used :-

Cert.No.: 23MM331
Page: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

- | Instruments | Model | Serial No. | ID No. | Test report No. | Due date |
|-----------------------------|-------|------------|---------|-----------------|-------------|
| 1) Standard Weight Set (E2) | 15884 | 24053 | 70RC007 | MM-0010-22 | 20 Jan 2024 |
- This certificate is valid only to the item calibrated on date and place of calibration.
 - This result of calibration was made on requested at the point specified by customer.
 - This certificate is not certified for any commercial transaction.
 - This certification is traceable to the International System of Unit.

Result of calibration () Without Adjustment (*) After Adjustment by Internal Calibration

Range capacity : 0 g to 220 g **Resolution** 0.0001 g

Before Adjustment :

Applied Weight	Balance Reading	Correction	Measurement Uncertainty	Coverage Factor
(g)	(g)	(g)	(± mg)	(k)
100	99.9999	+0.0001	0.19	2.03
200	200.0001	-0.0001	0.29	2.00

After Adjustment :

1. Determination of the standard deviation of weighing machine (n = 10)

Applied Weight	Standard Deviation of Reading (g)
(g)	
100	0.00007
200	0.00007

เอกสารไม่ควบคุม

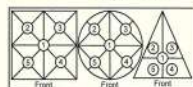


Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0015OC-1
Result of calibration

Cert.No.: 23MM331
Page: 3 of 3

2. Effect of off center loading

A mass of 100 g was placed to various position on the pan.
The weighing machine reading error obtained is given in the table



Maximum difference between off-center and central loading
(g)
0.0005

3. Departure from nominal value

Applied Weight	Balance Reading	Correction	Measurement Uncertainty	Coverage Factor
(g)	(g)	(g)	(± mg)	(k)
Unload	0.0000	0.0000	0.15	2.13
0.1	0.0999	+0.0001	0.15	2.13
1	0.9999	+0.0001	0.15	2.13
5	4.9999	+0.0001	0.15	2.13
10	9.9999	+0.0001	0.15	2.11
20	20.0000	0.0000	0.15	2.11
50	50.0000	0.0000	0.16	2.06
70	69.9999	+0.0001	0.18	2.04
100	99.9999	+0.0001	0.19	2.03
150	150.0003	-0.0003	0.29	2.00
200	200.0005	-0.0005	0.29	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 %.

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เอกสารไม่ควบคุม



มูลนิธิส่งเสริมพัฒนาอุตสาหกรรม
ศูนย์บริการวิจัยและพัฒนาอุตสาหกรรม
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Certificate

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

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

25003 บางเขน กรุงเทพฯ 35 หมู่ 10 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
25006 โซ 41 ถนนอุโมงค์ 41, สุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260 Thailand
Tel : 0-2601-2228 Fax : 0-2601-2228 Email : info@nfi.or.th

เอกสารไม่ควบคุม

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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 **Page 2 of 3**

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	8505567572	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:

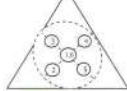
1. Repeatability of Reading:

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

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

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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 **Page 3 of 3**

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 k
Unloaded	0.00000	0.00000	0.00000	0.000096	2.00
0.1	0.10001	0.10000	0.00000	0.000096	2.00
1	1.00000	0.99999	0.00001	0.000097	2.00
3	3.00003	3.00000	0.00000	0.000098	2.00
5	5.00002	4.99999	0.00001	0.000098	2.00
10	10.00001	10.00000	0.00000	0.000099	2.00
20	20.00003	20.00000	0.00000	0.00011	2.00
50	50.00003	50.00001	-0.00001	0.00012	2.00
70	70.00006	70.00000	0.00001	0.00014	2.00
100	100.00006	100.00000	0.00001	0.00016	2.00
150	150.00009	150.00001	0.00000	0.00021	2.00
200	200.00013	200.00001	0.00000	0.00028	2.00

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

----- End -----

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

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Calibration Certificate

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

Page 1 of 3

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XP6

Serial No.: B322373893

ID No.: UAE.AIR.019/2556

Order No.: 2502228

Operation No.: 2502228-002

Date of Receipt: 19 March 2025

Date of Calibration: 20 March 2025

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

The uncertainties are for a confidence probability of approximately 95%

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

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

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Calibration Report

Certificate No.: 2502228-002-01
Equipment: Electronic Balance
Model: XP6
Serial No.: B322373893
Capacity: 6.1 g
Manufacturer: METTLER TOLEDO
Resolution: 0.000001 g
ID No.: UAE.AIR.019/2556

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	8505567572	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	QR25-0542	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:

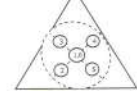
1. Repeatability of Reading:

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

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

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REPORT OF CALIBRATION

Certificate No. : SP24-008

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Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.046	0.0024	0.0029	2.00
	2.1876	2.186	0.0016	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.558	0.0015	0.0034	2.00
	1.0239	1.024	-0.0001	0.0035	2.00
	2.1230	2.121	0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.520	0.0030	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.516	0.0021	0.0031	2.00
	1.0002	0.999	0.0012	0.0033	2.00
	1.9973	1.994	0.0033	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.550	0.0017	0.0030	2.00
	1.0803	1.080	0.0003	0.0030	2.00
	2.0373	2.032	0.0053	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.558	0.0011	0.0031	2.00
	1.0518	1.051	0.0008	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

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FM-708-02 R01 1/11/2021



REPORT OF CALIBRATION

Certificate No. : SP24-008

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Photometric Accuracy :

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

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FM-708-02 R01 1/11/2021



REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 5 of 5

Wavelength Accuracy :

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

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- * Indicates non TISI accredited

- End of Certificate -

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FM-708-02 R01 1/11/2021



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-ME675610

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

3 Soi Udonsuk 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 Suld

(Miss Suladda Daawong)

Director of Analytical Chemistry Laboratory

Ref. 2015267020100454001

Issued Date : 11 March 2024

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FM.BLMTC.002 Rev.4

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Request No. 25-67 / 0275

1 / 5

MTC. ACL. No. 358 / 67

CALIBRATION DATA

1. Noise Level

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

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Request No. 25-67 / 0275

3 / 5

MTC. ACL. No. 358 / 67

3. Trueness

3.1 Reading on wavelength- Cadmium(Cd) at 228.8 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cd	0.020	0.020	0.000	1.10	± 0.005
	0.301	0.301	0.000	0.11	± 0.005
	0.707	0.693	-0.013	1.85	± 0.008

3.2 Reading on wavelength- Chromium (Cr) at 357.9 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cr	0.1007	0.104	0.004	3.49	± 0.009
	0.3035	0.297	-0.006	2.11	± 0.012
	0.7071	0.685	-0.023	3.19	± 0.023

3.3 Reading on wavelength- Copper (Cu) at 324.7 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cu	0.051	0.047	-0.004	7.58	± 0.003
	0.303	0.296	-0.007	2.19	± 0.009
	0.704	0.698	-0.005	0.74	± 0.020

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Request No. 25-67 / 0275

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MTC. ACL. No. 358 / 67

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	0.0951	0.0955	0.0956	0.095	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

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Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Sri 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
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Office
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Thailand
Tel. (66) 0 2577 9000
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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

Continue 5 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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.

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Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtg@tistr.or.th

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Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : sumalee@tistr.or.th

เอกสารไม่ควบคุม

MTC, ACL, No. 358 / 67

Calibration Report

Certificate No.: 240402-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: HI2020-02
Serial No.: C0051107 ID No.: UAE.WAQ.005/2557
Manufacturer: HANNA Instruments
Date of Calibration: 21 August 2024 Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature 23 °C ± 1 °C
Relative Humidity 55 % ± 3 %

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-24	NATIONAL FOOD INSTITUTE
Platinum Resistance Thermometer (PRT)	385	509201			

Support Equipment: - Low Temperature Bath (AMETEK RTC-187), Model: RTC-187C, S/N: 670030-00018

- 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:

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

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

Calibration Certificate

Certificate No.: 2501844-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.010/2553

Order No.: 2501844
Operation No.: 2501844-001
Date of Receipt: 24 February 2025
Date of Calibration: 24 February 2025

Calibrated by: Mr. Manas Somsak Specialist
Approved by: (Mr. Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 27 February 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 related to 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.: 240402-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: HI2020-02
Serial No.: C0051107 ID No.: UAE.WAQ.005/2557
Manufacturer: HANNA Instruments
Date of Calibration: 21 August 2024 Page 5 of 5

Calibration point: 15.0, 20.0 and 25.0 °C
Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 120 mm.
- Description of probe, model: HI1310 S/N: 539960
- Dimension of probe: Diameter 12 mm, Length 120 mm.
- Sheath material: Glass

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.0	14.996	0.0	0.099
20.0	19.999	0.0	0.099
25.0	24.999	0.0	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 -----

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

Calibration Report

Certificate No.: 2501844-001-01
Equipment: pH Meter
Resolution: 0.01 pH ± 1 mV
Manufacturer: METTLER TOLEDO Model: SevenEasy pH
Serial No.: 1231155210 Type: Bench top
ID No.: UAE.WAT.010/2553

Date of Calibration: 24 February 2025 Page 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (23.4 ± 1.5) °C Relative Humidity: (54 ± 3) %
Condition of Equipment: Good Condition

Condition of this Results of Calibration

- 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	Fuke	24E1752	30 May 2025	
2.2 Digital Thermometer	2709007	Fuke	2509376-002-01	29 October 2025	
2.3 Thermo-Hygro Meter	NFI.BTH.013/23	Isto	CC 67040-01	21 May 2025	
Certified Reference Material		Lot No.	Manufacturer	Ref No	Expire Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	1018435	CPAchem	PH-216.L5	25 July 2026	
2.5 pH buffer 6.865 (Primary pH buffer Solution)	949188	CPAchem	PH-217.L5	30 November 2025	
2.6 pH buffer 10.01 (Primary pH buffer Solution)	1016437	CPAchem	PH-220.L5	25 July 2025	
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 Units (SI Unit)

- Instruments Ng 2.1 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0008
- Instruments Ng 2.2 to 2.3 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061
- Certified Reference Material Ng 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
- Certified Reference Material Ng 2.7 traceable to PTB Certificate Nr. PTB-PHQA-563/3058/4/23 and Certificate Nr. PTB-PH08-055/30620/22 (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.

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

Calibration Report

Certificate No.: 2501844-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: METTLER TOLEDO Model: SevenEasy pH
Serial No.: 1231155210 Type: Bench top
ID No.: UAE.WAT.010/2553

Date of Calibration: 24 February 2025 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		
9	414.122	414	-0.01	0.58	2.00
2	295.815	296	1.99	0.58	2.00
4	177.463	178	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 TOLEDO Model: InLab Solids
Serial No.: 3065701 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	4.50	165	-	0.0071	2.00
7.001	7.00	-8	97.5	0.0086	2.00
10.010	10.01	-178	95.5	0.0083	2.00
6.876	6.88	0	-	0.0071	2.00

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

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Calibration Report

Certificate No.: 2501844-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenEasy pH
Serial No.: 1231155210 ID No.: UAE.WAT.010/2553
Manufacturer: METTLER TOLEDO

Date of Calibration: 24 February 2025 Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute

Environment Condition: Ambient Temperature 23.4 °C ± 1.0 °C
Relative Humidity 55.1 % ± 1.7 %

Condition of this results of Calibration:

- Calibration Method : - In house method: W-TE-025 by comparison with standard thermometer.
- The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
- The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).

2. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 0815/67	24-Jun-25	TISTR
Platinum Resistance Thermometer (PRT)	562TA	877332			

Support Equipment : -Low Temperature Bath (AMETEX RTC-187), Model: RTC-187C, S/N: 670030-00018

- 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
- Result of Calibration : ☒ Without adjustment ☐ After adjustment

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

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2501844-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenEasy pH
Serial No.: 1231155210 ID No.: UAE.WAT.010/2553
Manufacturer: METTLER TOLEDO

Date of Calibration: 24 February 2025 Page 5 of 5

Calibration point: 20.0, 25.0 and 30.0 °C

Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 120 mm.
- Description of probe, model : N/A S/N : N/A
- Dimension of probe : Diameter 4 mm, Length 120 mm.
- Sheath material : Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
20.1	20.001	0.1	0.099
25.1	25.002	0.1	0.099
30.1	30.003	0.1	0.099

Note:

- * UUC: Unit Under Calibration

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

----- End -----

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

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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 Udumuk 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
Kunchit
Approved by :
() 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
Procedure Used :-

Cert. No.: 25TM205
Page : 2 of 3

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

Condition of this result of calibration

1. Reference standard instrument:-

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

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

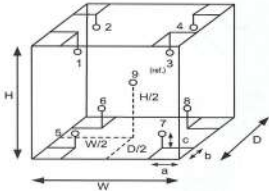
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



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

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



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 k
20.0	20.0	19.9	0.36	0.56	0.99	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	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 0-2717-3000-29 FAX 0-2719-9484



Certificate of Calibration

Cert. No.: 25TM577
Page : 1 of 3

Equipment : BOD Incubator

Manufacturer : ARCO

Model : UR-1320

Serial No. : -

ID No. : UAE.WAO.018/2551

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

Location : Lab Floor 2

Received Order : 19 March 2025

Calibration Date : 19 March 2025

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Man Pattanapongpaiboon

Approved by :

() Chakrit Waewwanjua
() Suwit Imjai
(✓) Kunchit Promprat

Issue Date : 27 March 2025

The Uncertainties are for a confidence probability of approximately 95%

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

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Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2503-0437OC-1
Procedure Used :-

Cert. No.: 25TM577
Page : 2 of 3

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

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	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.

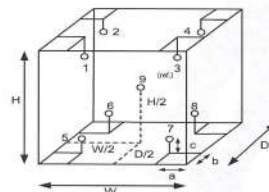
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	28
REL.Humid. (%)	56	55
AC Supply (Volt)	224	224



Probe Installation Details :

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

Dimension of Chamber :

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

Position :	Ref. Std. ID No.:
1	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

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Equipment : BOD Incubator
 Condition As-Received : Used Item
 Reference : 2503-04370C-1
 Result of Calibration : (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Close

Cert. No.: 25TM577
 Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	20.0	0.24	0.54	0.99	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.215	20.192	19.652	19.710	19.710	20.006	19.720	19.810	19.733	0.41

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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มูลนิธิสถาบันอาหาร
 สถาบันอาหาร
 Foundation for Industrial Development National Food Institute
 Food Industrial Laboratory Service Center



Calibration Certificate

Certificate No.: 2502226-001-01
 Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
 Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakanong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Serial No.: C009071872

ID No.: UAE.WAO.012/2563

Order No.: 2502226

Operation No.: 2502226-001

Date of Receipt: 19 March 2025

Date of Calibration: 20 March 2025

Calibrated by Mr.Yothin Charoensuk
 Scientist

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

Date of Issue: 25 March 2025

The uncertainties are for a confidence probability of approximately 95%

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

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

2503-04370C-1 35, Anin Anan Road, Bang Yai Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
 Tel: +66(0) 2422 8888 Fax: +66(0) 2422 8545

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มูลนิธิสถาบันอาหาร
 สถาบันอาหาร
 Foundation for Industrial Development National Food Institute
 Food Industrial Laboratory Service Center



Calibration Report

Certificate No.: 2502226-001-01
 Equipment: Electronic Balance
 Manufacturer: METTLER TOLEDO
 Model: XSR205DU
 Resolution: 0.00001 g / 0.0001 g
 Serial No.: C009071872
 ID No.: UAE.WAO.012/2563
 Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025 Page 2 of 4

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

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8505567572	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	QR25-0542	10 February 2026

3. This certificate is traceable to SI UNIT

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

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

Calibration Results:

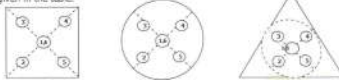
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
-40	0.000052
80	0.000042
100	0.000000
200	0.000000

2. Off-Center Error:

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

The balance reading obtained is given in the table.



1 (g)	2 (g)	3 (g)	4 (g)	5 (g)	6 (g)	(Maximum Difference) (g)
100.0001	100.0001	100.0001	100.0001	100.0001	100.0002	0.0001

Mr. N. Nijphat

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

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มูลนิธิสถาบันอาหาร
 สถาบันอาหาร
 Foundation for Industrial Development National Food Institute
 Food Industrial Laboratory Service Center



Calibration Report

Certificate No.: 2502226-001-01
 Equipment: Electronic Balance
 Manufacturer: METTLER TOLEDO
 Model: XSR205DU
 Resolution: 0.00001 g / 0.0001 g
 Serial No.: C009071872
 ID No.: UAE.WAO.012/2563
 Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025 Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0-80 g

Calibration Adjustment: Internal Calibration

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

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.000000	0.00000	0.00000	0.0000089	2.00
0.001	0.001003	0.00100	0.00000	0.0000092	2.00
0.005	0.005002	0.00500	0.00000	0.0000094	2.00
0.01	0.010003	0.01000	0.00000	0.0000091	2.00
0.05	0.049996	0.05000	0.00000	0.0000098	2.00
0.1	0.100011	0.10000	0.00001	0.000011	2.00
0.5	0.500016	0.50000	0.00002	0.000014	2.00
1	1.000003	1.00001	-0.00001	0.000016	2.00
2	2.000023	2.00005	-0.00003	0.000017	2.00
5	5.000015	5.00005	-0.00003	0.000021	2.00
10	10.000009	10.00005	-0.00004	0.000026	2.00
20	20.000030	20.00012	-0.00009	0.000037	2.00
30	30.000039	30.00012	-0.00008	0.000050	2.00
50	50.000028	50.00014	-0.00011	0.000068	2.00
80	80.000067	80.00020	-0.00013	0.00011	2.00

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

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2502226-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Resolution: 0.00001 g / 0.0001 g
Serial No.: C009071872
ID No.: UAE.WAO.012/2563
Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025 Page 4 of 4

Calibration Results: (Continued)

Calibration Range: >80-200 g

Calibration Adjustment: Internal Calibration

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

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
90	90.00010	90.0002	-0.0001	0.00015	2.00
100	100.00006	100.0001	0.0000	0.00016	2.00
110	110.00007	110.0001	0.0000	0.00017	2.00
120	120.00009	120.0002	-0.0001	0.00018	2.00
130	130.00010	130.0002	-0.0001	0.00019	2.00
140	140.00013	140.0002	-0.0001	0.00019	2.00
150	150.00009	150.0002	-0.0001	0.00021	2.00
160	160.00010	160.0002	-0.0001	0.00022	2.00
170	170.00012	170.0002	-0.0001	0.00023	2.00
200	200.00013	200.0002	-0.0001	0.00028	2.00

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

----- End -----

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

25009 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
25009 Soi 35, Aun Amart Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2432 8688 Fax: +66(0) 2432 8545

Calibration Report

Certificate No.: 2500116-001-01
Equipment: CHAMBER (Hot Air Oven)
Model: UF55
Resolution: 0.1 °C
Serial No.: B216.1666
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 RTD	MY57003188 CH#201-209/RTD#201-209	TE 670486-01	8 June 2025	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.
- 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 : X Without adjustment After adjustment

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

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25009 Soi 35, Aun Amart Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2432 8688 Fax: +66(0) 2432 8545

Calibration Certificate

Certificate No.: 2500116-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udumsook 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: CHAMBER (Hot Air Oven)

Manufacturer: MEMMERT

Model: UF55

Serial No.: B216.1666

ID No.: UAE.WAO.027/2559

Order No.: 2500116

Operation No.: 2500116-001

Date of Receipt: 8 October 2024

Date of Calibration: 8 October 2024

Calibrated by Mr.Yothin Charoensuk
Scientist

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

Date of Issue: 15 October 2024

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

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

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

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Tel: +66(0) 2432 8688 Fax: +66(0) 2432 8545

Calibration Report

Certificate No.: 2500116-001-01
Equipment: CHAMBER (Hot Air Oven)
Model: UF55
Resolution: 0.1 °C
Serial No.: B216.1666
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 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 -----

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

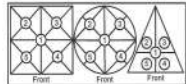
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25009 Soi 35, Aun Amart Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2432 8688 Fax: +66(0) 2432 8545

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Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2405-0166OC-2
Result of calibration

Cert.No.: 24MM293
Page: 3 of 3



Maximum difference between off-center and central loading

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)	(g)
+0.0002	-0.0001	0.0000	+0.0002	0.0000	0.0003

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.0000	0.0000	0.15	2.13
1	1.0000	0.0000	0.15	2.13
5	5.0000	0.0000	0.15	2.13
10	10.0000	0.0000	0.15	2.11
20	20.0000	0.0000	0.19	2.03
50	50.0001	-0.0001	0.19	2.06
60	60.0001	-0.0001	0.19	2.04
80	80.0001	-0.0001	0.27	2
100	100.0002	-0.0002	0.27	2.03
120	120.0001	-0.0001	0.29	2
200	200.0001	-0.0001	0.31	2

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

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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-ME8675610

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

3 Soi Udonsuk 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 (OP-513)

CALIBRATION RANGE: 0.02, 0.10, 0.30, 0.50, 0.70 mg/l at 228.8 nm.Cd, 0.10, 0.20, 0.30, 0.50, 0.70 mg/l at 357.9 nm.Cr,
0.05, 0.10, 0.30, 0.50, 0.70 mg/l at 324.7 nm.Cu, 0.10, 0.30, 0.50, 0.70, 1.00 mg/l at 248.3 nm.Fe,
0.20, 0.50, 0.70, 1.00, 1.50 mg/l at 217.0 nm.Pb, 0.05, 0.10, 0.30, 0.50, 0.70 mg/l at 279.5 nm.Mn,
0.10, 0.30, 0.50, 0.70, 1.00 mg/l at 232.0 nm.Ni, 0.05, 0.10, 0.30, 0.50, 0.70 mg/l at 213.9 nm.Zn

CALIBRATION DATE : 2 February 2024

REFERENCE MATERIAL : Traceable to NIST "Agilent Technologies", "CARLO ERBA"

Cadmium Lot No. 0006589926, Chromium Lot No. 0112384886, Copper Batch No. T117098A, Iron Batch No. T126087A,
Lead Lot No. 1227873, Manganese Batch No. T109228A, Nickel Batch No. T270178A, Zinc Batch No. T820140A

AMBIENT CONDITIONS : Temperature 25 ± 5 °C Relative humidity 50 ± 20 %

The Atomic Absorption Spectrophotometer has been calibrated against Reference Material traceable to National Institute of Standards and Technology (NIST) by The Analytical Chemistry Laboratory. The results are attached herewith.

Calibrated by Atipat
(Mr. Atipat Ratana)

Approved by
(Miss Suladda Daawong)
Director of Analytical Chemistry Laboratory
Ref. 2015267020100454001
Issued Date : 11 March 2024

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Request No. 25-67 / 0275

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MTC. ACL. No. 358 / 67

CALIBRATION DATA

1. Noise Level

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

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Head Office

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Request No. 25-67 / 0275

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MTC. ACL. No. 358 / 67

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	0.4024	0.4025	0.3993	0.3997	0.402	0.0019	0.48

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MTC. ACL. No. 358 / 67

3. Trueness

3.1 Reading on wavelength- Cadmium(Cd) at 228.8 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cd	0.020	0.020	0.000	1.10	± 0.005
	0.301	0.301	0.000	0.11	± 0.005
	0.707	0.693	-0.013	1.85	± 0.008

3.2 Reading on wavelength- Chromium (Cr) at 357.9 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cr	0.1007	0.104	0.004	3.49	± 0.009
	0.3035	0.297	-0.006	2.11	± 0.012
	0.7071	0.685	-0.023	3.19	± 0.023

3.3 Reading on wavelength- Copper (Cu) at 324.7 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cu	0.051	0.047	-0.004	7.58	± 0.003
	0.303	0.296	-0.007	2.19	± 0.009
	0.704	0.698	-0.005	0.74	± 0.020

Subst.

Continue 4 / 5

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Request No. 25-67 / 0275

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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 Sul Dr
(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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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

Subst.

Continue 5 / 5

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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.



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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 6059A	77 19030001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

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

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components and implementation of Service Notes
- ☒ Check for required firmware/software updates and verify with customers if they would like them installed.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. *ถ้ามี*
- ☒ 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. *ถ้ามี*
- ☒ Remove and clean instrument water inlet filter.

Agilent Water Recirculator

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

SPS 3 Auto Sampler

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

SPS 4 Auto sampler

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

AVS 4, 6, 7 Advanced Valve System

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

ICP-OES adjustment

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

Record Post-PM instrument performance

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

Restore Instrument

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

Service Review

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

Test Results

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	1500.9	2219.4	4124.9	6965.9
Mn 257.610 nm SRBR	3915.0	7492.2	13017.6	31121.6
Al 396.152 nm SBR	9.9	10.3	9.9	21.1
K 766.491 nm SBR	5.9	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	231.41 VAC	226.93 VAC
Mains Current	0.051 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	53.9 °C
Water Flow Oscillator	No measurement	1.34 L/min
Water Flow Detector	0.86 L/min	0.81 L/min
Water Inlet Temperature	19.3 °C	19.3 °C
Polychromator Temperature	35.0 °C	35.0 °C
CCD Temperature	-40.1 °C	-39.6 °C
Thermal Stabilizer	35.0 °C	35.0 °C
Argon Supply Pressure	646.92 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	0.30 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	1204.3 W
RF Supply Current	No measurement	3.856 A
RF Supply Voltage	No measurement	204.41 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	5799-9037	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:

6003197100

Date Service Completed:

04 Nov 2024

Service Engineer Name:

Kanyakorn S.

Customer Name:

Aphorn Onkong

Service Engineer Signature:

Kanyakorn S.

Customer Signature:

Aphorn Onkong

Total number of pages in this document:

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Report Summary

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

Result Summary

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

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Resolution Test

Pass

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

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Sensitivity Test

Fail

Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	104.1	793.0	50.8
Se (196.026 nm)	≥ 41.0	SRBR	87.6	862.0	79.7
Zn (213.857 nm)	≥ 1421.0	SRBR	1500.8	41823.3	749.0
Pb (220.353 nm)	≥ 46.0	SRBR	170.7	2432.0	174.9
Mn (257.610 nm)	≥ 3518.0	SRBR	3915.0	264700.2	4420.0
Al (396.152 nm)	≥ 3.4	SBR	7.7	48454.6	5563.2
Ba (493.408 nm)	≥ 34.0	SBR	45.9	1966719.7	41903.8
K (766.491 nm)	≥ 1.8	SBR	5.7	99038.2	14687.7
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	126.5	1498.8	119.0
Se (196.026 nm)	≥ 159.0	SRBR	112.0	1773.6	197.8
Zn (206.200 nm)	≥ 234.0	SRBR	466.0	6784.2	199.7
Zn (213.857 nm)	≥ 1743.0	SRBR	2217.4	95597.6	1789.7
Cd (214.439 nm)	≥ 4227.0	SRBR	1919.3	68724.6	1236.4
Pb (220.353 nm)	≥ 320.0	SRBR	332.6	7929.5	499.0
Mn (257.610 nm)	≥ 10625.0	SRBR	7492.2	991238.3	16911.7
Cr (267.716 nm)	≥ 1048.0	SRBR	2254.6	129706.6	3150.9
Cu (324.754 nm)	≥ 19.0	SBR	26.9	290746.3	10407.5
Al (396.152 nm)	≥ 6.0	SBR	10.7	211329.2	18005.0
Ba (493.408 nm)	≥ 60.0	SBR	49.3	6956460.4	138336.9
K (766.491 nm)	≥ 24.0	SBR	28.1	1395190.2	47996.2

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

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Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Hardware 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	
Intensity	Radial 3184054 Axial 3177175
Wavelength	Radial 737.212 Axial 737.212

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เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	6.97	
As (188.980 nm)	≤ 8.20	6.14	
C (193.027 nm)	≤ 11.50	8.33	
Mo (202.032 nm)	≤ 8.20	6.33	
Cr (206.133 nm)	≤ 13.40	9.06	
Zn (213.637 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	

Page 2 of 4

เอกสารไม่ควบคุม

Sensitivity Test			Fail		
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	130.6	977.1	50.4
Se (196.026 nm)	≥ 41.0	SRBR	106.0	958.7	70.2
Zn (213.857 nm)	≥ 1421.0	SRBR	4124.8	44037.7	113.4
Pb (220.353 nm)	≥ 46.0	SRBR	207.2	2554.7	136.2
Mn (257.610 nm)	≥ 3518.0	SRBR	13017.8	271846.6	434.7
Al (396.152 nm)	≥ 3.4	SBR	9.7	50615.5	4717.0
Ba (493.408 nm)	≥ 34.0	SBR	133.7	2069203.0	15359.3
K (766.491 nm)	≥ 1.8	SBR	4.8	100199.5	17235.5
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	174.9	1566.7	73.0
Se (196.026 nm)	≥ 159.0	SRBR	167.0	1863.4	110.2
Zn (206.200 nm)	≥ 234.0	SRBR	740.9	6836.0	83.1
Zn (213.857 nm)	≥ 1743.0	SRBR	6965.9	101568.1	211.7
Cd (214.439 nm)	≥ 4227.0	SRBR	5781.0	72852.9	158.1
Pb (220.353 nm)	≥ 320.0	SRBR	501.0	8464.3	267.7
Mn (257.610 nm)	≥ 10625.0	SRBR	31121.6	1006637.8	1044.0
Cr (267.716 nm)	≥ 1048.0	SRBR	4424.8	132202.9	880.8
Cu (324.754 nm)	≥ 19.0	SBR	68.7	302907.8	4345.6
Al (396.152 nm)	≥ 6.0	SBR	21.1	218771.0	9892.3
Ba (493.408 nm)	≥ 60.0	SBR	250.6	7137380.9	28367.3
K (766.491 nm)	≥ 24.0	SBR	45.3	1435050.6	31025.0

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เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	0.81	
Se (196.026 nm)	≤ 2.60	0.98	
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 (213.857 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	

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เอกสารไม่ควบคุม

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

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เอกสารไม่ควบคุม

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

Page 2 of 2

เอกสารไม่ควบคุม

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

Page 1 of 4

เอกสารไม่ควบคุม

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

Page 2 of 4

เอกสารไม่ควบคุม

Sensitivity Test						Pass
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	110.5	868.9	54.3	
Se (196.026 nm)	≥ 41.0	SRBR	88.3	934.7	91.3	
Zn (213.857 nm)	≥ 1421.0	SRBR	3535.4	44017.7	153.9	
Pb (220.353 nm)	≥ 46.0	SRBR	184.5	2492.3	159.8	
Mn (257.610 nm)	≥ 3518.0	SRBR	11099.6	249595.3	503.6	
Al (396.152 nm)	≥ 3.4	SBR	8.7	50274.4	5172.0	
Ba (493.408 nm)	≥ 34.0	SBR	124.5	1903164.1	15166.0	
K (766.491 nm)	≥ 1.8	SBR	6.9	110041.4	13991.2	
Axial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 208.0	SRBR	253.3	3744.3	196.3	
Se (196.026 nm)	≥ 159.0	SRBR	206.7	4199.7	347.2	
Zn (206.200 nm)	≥ 234.0	SRBR	923.0	12282.3	172.1	
Zn (213.857 nm)	≥ 1743.0	SRBR	6398.3	157551.5	601.7	
Cd (214.439 nm)	≥ 4227.0	SRBR	5069.2	99873.7	385.2	
Pb (220.353 nm)	≥ 320.0	SRBR	389.0	10641.1	658.6	
Mn (257.610 nm)	≥ 10625.0	SRBR	21190.4	985528.7	2153.6	
Cr (267.716 nm)	≥ 1048.0	SRBR	3054.1	131797.6	1811.5	
Cu (324.754 nm)	≥ 19.0	SBR	36.3	301401.4	8082.9	
Al (396.152 nm)	≥ 6.0	SBR	10.8	228359.5	19280.5	
Ba (493.408 nm)	≥ 60.0	SBR	106.5	6460421.5	60122.8	
K (766.491 nm)	≥ 24.0	SBR	30.2	1639840.6	52562.1	

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เอกสารไม่ควบคุม

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

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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.: 24TM884
Page : 1 of 3

Equipment :	Incubator
Manufacturer :	Binder
Model :	KB 400
Serial No. :	20220000000391
ID No. :	UAE.MIC.029/2565
Submitted by :	United Analyst and Engineering Consultant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Location :	Microbiology Laboratory
Received Order :	07 June 2024
Calibration Date :	07 June 2024
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %
Calibrated by :	Tawatchai Pama 
Approved by :	 Approved Signatory
	() Ponpan Paipim () Suwit Imjai (✓) Kunchit Promprat
Issue Date :	11 June 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2404-0003OC-2
Procedure Used :-

Cert. No.: 24TM650
Page : 2 of 3

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

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY49023932	23LM122	TPA	26 Jul 2024

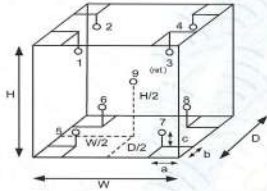
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm

Dimension of Chamber :

D = 0.50 m
W = 0.64 m
H = 0.80 m
Capacity = 0.26 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	25
REL.Humid. (%)	57	54
AC Supply (Volt)	221	222

Position :	Ref. Std. ID No.:
1	19-16RTD-01
2	19-16RTD-02
3	19-16RTD-03
4	19-16RTD-04
5	19-16RTD-05
6	19-16RTD-06
7	21-16RTD-07
8	19-16RTD-08
9 (ref.)	19-16RTD-09



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2404-0003OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM650
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
25.0	25.0	25.0	0.053	0.78	1.3	2
36.0	36.0	36.0	0.14	0.57	0.93	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
25.0	25.596	25.310	25.439	25.412	24.347	24.332	24.313	24.414	24.875	0.30
36.0	35.843	35.965	35.618	35.701	36.239	36.260	36.343	36.357	36.063	0.31

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

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

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

-000-

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2501624-001-01
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: 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)
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

Uncontrolled Documents



nfi.co.th

Calibration Report

Certificate No.: 2501624-001-01
Equipment: Water Bath
Model: WNE14
Resolution: 0.1 °C
Manufacturer: MEMMERT
Serial No.: L416.0606
ID No.: UAE.MIC.002/2560

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

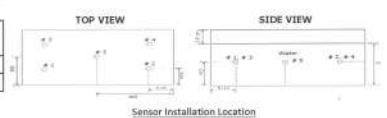


Table1 : Reporting of Temperature

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.

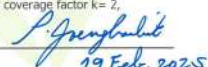
Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

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


19 Feb. 2025

Uncontrolled Documents



nfi.co.th

Calibration Certificate

Certificate No.: 2402284-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: MS6035/01
Serial No.: B007010311
ID No.: UAE.TOX.008/2553
Order No.: 2402284
Operation No.: 2402284-001
Date of Receipt: 2 April 2024
Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong
Scientist
Approved by (Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 9 April 2024

The uncertainties are for a confidence probability of approximately 95%

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

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

2008 ๒๕๔๘ กรมส่งเสริมการค้าระหว่างประเทศ กระทรวงพาณิชย์
2008 Soi 36, Aun Amai Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66(0) 2-422 8668 Fax : +66(0) 2-422 8545



Calibration Report

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

Page 2 of 3

Date of Calibration: 2 April 2024
Environment Condition: Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 48 ± 2.5 %
Place of Calibration: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	B505567572	TCS	M23040535	8 April 2024
Standard Weight Class E2	500g	B505567696	TCS	M23040545	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFLBTH 017/23	Quality Reborn	QR24-0344	9 February 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

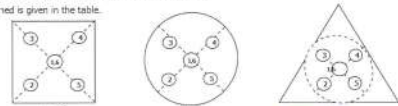
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
300	0.00000
600	0.00048

2. Off-Center Error:

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

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
200.000	199.997	199.999	199.999	199.998	200.000	0.003

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

2008 ๒๕๔๘ กรมส่งเสริมการค้าระหว่างประเทศ กระทรวงพาณิชย์
2008 Soi 36, Aun Amai Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66(0) 2-422 8668 Fax : +66(0) 2-422 8545



Calibration Report

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

Date of Calibration: 2 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
Unload	0.0000	0.000	0.000	0.00082	2.00
0.1	0.1000	0.100	0.000	0.00082	2.00
0.5	0.5000	0.500	0.000	0.00082	2.00
1	1.0000	1.000	0.000	0.00082	2.00
2	2.0000	2.000	0.000	0.00082	2.00
5	5.0000	5.000	0.000	0.00082	2.00
10	10.0000	10.000	0.000	0.00082	2.00
20	20.0000	20.000	0.000	0.00082	2.00
50	50.0000	50.000	0.000	0.00082	2.00
100	100.0001	100.000	0.000	0.00083	2.00
150	150.0001	150.000	0.000	0.00084	2.00
200	200.0002	200.000	0.000	0.00086	2.00
300	300.0002	299.999	0.001	0.00090	2.00
400	400.0003	399.998	0.002	0.00100	2.00
500	500.0003	499.997	0.003	0.00111	2.00
600	600.0004	599.996	0.004	0.0012	2.00

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

***** End *****

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

2008 ๒๕๔๘ กรมส่งเสริมการค้าระหว่างประเทศ กระทรวงพาณิชย์
2008 Soi 36, Aun Amai Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66(0) 2-422 8668 Fax : +66(0) 2-422 8545



Unit Value		Standard Value		Average Reading		Correction		Uncertainty (U)		Total Error		Judgement		Total Error < Judgement	
g		g		g		g		g		g		g		g	
30	0.0000	0.000	0.000	0.000	0.000	0.000	0.000	0.00082	0.001	0.001	0.001	Pass	Pass	Pass	Pass
60	0.1000	0.100	0.100	0.100	0.100	0.000	0.000	0.00082	0.001	0.001	0.001	Pass	Pass	Pass	Pass
90	0.5000	0.500	0.500	0.500	0.500	0.000	0.000	0.00082	0.001	0.001	0.001	Pass	Pass	Pass	Pass
120	1.0000	1.000	1.000	1.000	1.000	0.000	0.000	0.00082	0.001	0.001	0.001	Pass	Pass	Pass	Pass
150	2.0000	2.000	2.000	2.000	2.000	0.000	0.000	0.00082	0.001	0.001	0.001	Pass	Pass	Pass	Pass
180	5.0000	5.000	5.000	5.000	5.000	0.000	0.000	0.00082	0.001	0.001	0.001	Pass	Pass	Pass	Pass
210	10.0000	10.000	10.000	10.000	10.000	0.000	0.000	0.00082	0.001	0.001	0.001	Pass	Pass	Pass	Pass
240	20.0000	20.000	20.000	20.000	20.000	0.000	0.000	0.00082	0.001	0.001	0.001	Pass	Pass	Pass	Pass
270	50.0000	50.000	50.000	50.000	50.000	0.000	0.000	0.00082	0.001	0.001	0.001	Pass	Pass	Pass	Pass
300	100.0001	100.000	100.000	100.000	100.000	0.000	0.000	0.00083	0.001	0.001	0.001	Pass	Pass	Pass	Pass
330	150.0001	150.000	150.000	150.000	150.000	0.000	0.000	0.00084	0.001	0.001	0.001	Pass	Pass	Pass	Pass
360	200.0002	200.000	200.000	200.000	200.000	0.000	0.000	0.00086	0.001	0.001	0.001	Pass	Pass	Pass	Pass
390	300.0002	299.999	299.999	299.999	299.999	0.001	0.001	0.00090	0.001	0.001	0.001	Pass	Pass	Pass	Pass
420	400.0003	399.998	399.998	399.998	399.998	0.002	0.002	0.00100	0.001	0.001	0.001	Pass	Pass	Pass	Pass
450	500.0003	499.997	499.997	499.997	499.997	0.003	0.003	0.00111	0.001	0.001	0.001	Pass	Pass	Pass	Pass
480	600.0004	599.996	599.996	599.996	599.996	0.004	0.004	0.0012	0.001	0.001	0.001	Pass	Pass	Pass	Pass

Unit Under Calibration

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2402281-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Autoclave
Manufacturer: ALP
Model: CL-40L
Serial No.: 808763
ID No.: UAE.MIC.026/2563
Order No.: 2402281
Operation No.: 2402281-001
Date of Receipt: 2 April 2024
Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong
Scientist
Approved by (Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 9 April 2024

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

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

Calibration Report

Certificate No.: 2402281-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 808763
Resolution: 0.1 °C ID No.: UAE.MIC.026/2563
Manufacturer: ALP
Date of Calibration: 2 April 2024

Page 2 of 3

Location: LABORATORY, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Environment Condition: Ambient Temperature (25 ± 1) °C
Relative Humidity (55 ± 7) %
Line Voltage (225 ± 5) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert 3 standard temperature recorder with RTD into its autoclave and calibration according to W-TE-018 based on BS 2646-1(2021) : Autoclaves for sterilization in laboratories Design, construction, safety and performance Specification.
- The temperature scale used was based on ITS - 90 .
- All data show below were final values and the initial data may be obtained upon request.
- Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with RTD (Data Logger)	HiTemp140-2	R54918	TE 660383-01	8 April 2024	NATIONAL FOOD INSTITUTE
	HiTemp140-2	S25601	TE 670033-01	9 November 2024	MADGETECH INC.
	HiTemp140-2	S25602	TE 670034-01	9 November 2024	MADGETECH INC.

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- This standard does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical.
- Condition of Calibrated item : Good
UUC Description : Setting program function sterilization : STERILIZE/NORMAL
Time of sterilization 15 Minute At 115.0 and 121.0 °C
- Result of Calibration : ☒ Without adjustment
☐ After adjustment

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

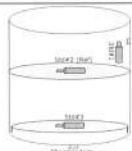
Calibration Report

Certificate No.: 2402281-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 808763
Resolution: 0.1 °C ID No.: UAE.MIC.026/2563
Manufacturer: ALP
Date of Calibration: 2 April 2024

Page 3 of 3

Calibration point: 115.0 and 121.0 °C

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	24.4	48.6	220
Max	25.5	62.1	230



Standard ALP Model
S1 (1st) - 1st probe
S2 (2nd) - 2nd probe
S3 (3rd) - 3rd probe

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	115.28	115.35	115.38	0.64
121.0	121.28	121.36	121.37	0.64

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	Min (°C)	Max (°C)	Average (°C)			
115.0	115.0	115.1	115.0	0.08	0.13	0.48
121.0	121.0	121.1	121.0	0.12	0.10	0.38


Note

The quoted uncertainty include " Stability " and " Loading effect (20% of Uniformity) "
UUC* = Unit Under Calibration
Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.
Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.
Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.
The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k = 2, providing a level of confidence of approximately 95 %.

***** End *****

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

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



REPORT OF CALIBRATION

Certificate No. : SP25-019

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

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

Certified Reference Materials :

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

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

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 60 nm/min

Scan Interval of UUC : 0.15 nm.


Resolution of UUC : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

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



REPORT OF CALIBRATION

Certificate No. : SP25-019

Page 3 of 5

Calibration Results : Without adjustment


Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.0000	0.0000	0.0028	2.00
	0.5780	0.5739	0.0041	0.0031	2.00
	1.0484	1.0430	0.0054	0.0029	2.00
	2.1876	2.1876	0.0000	0.0084	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5595	0.5581	0.0014	0.0034	2.00
	1.0239	1.0219	0.0020	0.0035	2.00
	2.1230	2.1207	0.0023	0.0085	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5230	0.5190	0.0040	0.0029	2.00
	0.9633	0.9609	0.0024	0.0029	2.00
	1.9753	1.9719	0.0034	0.0079	2.00
546.1	0.0000	0.0000	0.0000	0.0028	2.00
	0.5181	0.5161	0.0020	0.0031	2.00
	1.0002	0.9979	0.0023	0.0033	2.00
	1.9973	2.0021	-0.0048	0.0102	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5517	0.5503	0.0014	0.0030	2.00
	1.0803	1.0808	-0.0005	0.0031	2.00
	2.0373	2.0324	0.0049	0.0105	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5591	0.5583	0.0008	0.0031	2.00
	1.0518	1.0513	0.0005	0.0030	2.00
	1.9274	1.9281	-0.0007	0.0102	2.00

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.
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REPORT OF CALIBRATION

Certificate No. : SP25-019

Page 4 of 5


Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.0000	0.0000	0.0050	2.00
	0.7469	0.7488	-0.0019	0.0063	2.00
257	0.0000	0.0000	0.0000	0.0050	2.00
	0.8674	0.8663	0.0011	0.0067	2.00
313	0.0000	0.0000	0.0000	0.0050	2.00
	0.2919	0.2902	0.0017	0.0052	2.00
350	0.0000	0.0000	0.0000	0.0050	2.00
	0.6430	0.6428	0.0002	0.0063	2.00

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FM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. : SP25-019

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	242.0	-0.28	0.18	2.00
279.45	279.5	-0.05	0.18	2.00
287.81	287.6	0.21	0.18	2.00
334.06	333.8	0.26	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	417.9	0.69	0.18	2.00
445.94	445.4	0.54	0.18	2.00
453.66	453.2	0.46	0.18	2.00
460.02	459.6	0.42	0.18	2.00
536.59	536.5	0.09	0.18	2.00
637.98	638.5	-0.52	0.18	2.00
431.38	430.7	0.68	0.18	2.00
472.50	472.3	0.20	0.18	2.00
513.47	513.5	-0.03	0.18	2.00
528.88	528.9	-0.02	0.18	2.00
573.17	573.8	-0.63	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	685.1	-0.70	0.18	2.00
740.72	741.1	-0.38	0.20	2.00
748.55	748.9	-0.35	0.18	2.00
807.03	807.1	-0.07	0.18	2.00
879.28	879.1	0.18	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- End of Certificate -

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

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

ISO 17025 TIS 17025

LABORATORY 5494

CERTIFICATE OF CALIBRATION

Certificate No. : SP24-008Page 1 of 5

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

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

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064

ID No. : UAE.WAS.006/2552

Received Date : 16 January 2024

Calibration Date : 16 January 2024

Issue Date : 19 January 2024

Condition Instrument : Good

Calibrated by : (Mr.Tanawat Rittidach)Approved by : (Ms.Chonthicha Sangngern)

Technical ManagerQuality 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 recognised national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

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

ISO 17025 TIS 17025

LABORATORY 5494

REPORT OF CALIBRATION

Certificate No. : SP24-008Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

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

Certified Reference Materials :

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

Traceability : This certification is traceable to the International System of Unit maintained at National - Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 4.0 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

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ISO 17025 TIS 17025

LABORATORY 5494

REPORT OF CALIBRATION

Certificate No. : SP24-008Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.046	0.0024	0.0029	2.00
	2.1876	2.186	0.0016	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.558	0.0015	0.0034	2.00
	1.0239	1.024	-0.0001	0.0035	2.00
	2.1230	2.121	0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.520	0.0030	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.516	0.0021	0.0031	2.00
	1.0002	0.999	0.0012	0.0033	2.00
	1.9973	1.994	0.0033	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.550	0.0017	0.0030	2.00
	1.0803	1.080	0.0003	0.0030	2.00
	2.0373	2.032	0.0053	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.558	0.0011	0.0031	2.00
	1.0518	1.051	0.0008	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

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ISO 17025 TIS 17025

LABORATORY 5494

REPORT OF CALIBRATION

Certificate No. : SP24-008Page 4 of 5

Photometric Accuracy :

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

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 5 of 5

Wavelength Accuracy :

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

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- * Indicates non TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

Certificate No. : HIT-2417-0568

Page : 1 of 2

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater
 Meter Model : HI839800-02 Serial No. : 1147807
 Tube Heater : 25 Vial Capacity Resolution : 0.1°C
 Temperature Range : (-10 to 160)°C Temperature of Reaction : 150°C
 Manufacturer : Hanna Instruments Made in : Romania
 Condition As-Received : Used Product Reference : RE240681
 Ambient Temperature : (25 ± 2)°C Relative Humidity : (50 ± 15)%RH
 Customer name : United Analyst and Engineering Consultant Co., Ltd.
 3 Soi Udomsuk 41, Sukhumvit Rd., Bangehak,
 Phrakhanong, Bangkok 10260

Received date : 22 April 2024


Calibrate date : 23 April 2024

Issue date : 25 April 2024

Calibrated Location : Hanna Instruments (Thailand) Ltd.

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

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

Approved by : 
 Mr. Anan Suwanchaisakul
 Authorized Signatory



This certificate was certified only for the instrument we calibrated.

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

** This certificate may not be reproduced other than in full, except with the prior written **

approval of the head of Hanna Instrument (Thailand).

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Certificate No. : HIT-2417-0568

Page : 2 of 2

Condition of this calibration result:

Reference Standard Instruments : This certification is traceable to the international unit of unit maintained through:

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MY44065265	WK2307-164-I	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HT-771SD	AL07155	24H41	Technology Promotion Association (Thailand-Japan).

Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor.

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	Uncertainty of Measurement (±°C)
25 Vial	150.0	149.8	0.49

Unit : °C

(1A)	(2A)	(3A)	(4A)	(5A)
148.901	149.249	149.950	150.042	149.186
(1B)	(2B)	(3B)	(4B)	(5B)
149.724	149.578	149.852	150.100	150.117
(1C)	(2C)	(3C)	(4C)	(5C)
149.863	149.799	150.233	149.847	149.977
(1D)	(2D)	(3D)	(4D)	(5D)
149.550	149.666	149.958	149.744	149.819
(1E)	(2E)	(3E)	(4E)	(5E)
150.044	149.869	149.361	149.973	149.654

Figure : Shows the location of the temperature source.

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

** End of certificate **

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Certificate of Calibration

Cert.No.: 25CH261
 Page.: 1 of 3

Equipment : pH Meter
 Manufacturer : Horiba
 Model : LAQUA-PH210
 Serial No. : HAOC0025
 ID No. : UAE.EFM.117/2563(EFM.pH.07/63)
 Condition As-Received : Used Item
 Received Date : 25 February 2025
 Calibration Date : 26 to 28 February 2025
 Reference : 2502-0783WSC-1
 Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangehak, 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 Lengagatrakul

Approved by : 
 Approved Signatory

() Chakrit Waewwanjua
 () Ponpan Paipim
 (✓) Saithip Meangmai

Issue Date : 28 February 2025

The Uncertainties are for a confidence probability of approximately 95%

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 Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

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Cert.No.: 25CH261
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.007	CPA chem	1066665	18 Jan 2027
pH 6.999	Hach Lenge GmbH	C03220	29 Oct 2026
pH 10.010	CPA chem	1066669	18 Jan 2026

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (\pm mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: HA0C0025	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.: 25CH261
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (\pm)	Coverage factor k
pH Electrode S/N.: Q9AG0214	4.007	4.01	178.4	0.0071	2.00
	6.999	7.00	4.1	0.0092	2.00
	6.999	7.00	3.0	0.0095	2.00
	10.010	10.01	-169.8	0.0092	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652-10D
- Serial No. : Q9AG0214

Dimension of probe

- Length : 110 mm.
- Diameter : 16 mm.
- Immersion Depth : 80 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (\pm °C)	Coverage factor k
15.0	15.002	15.0	-0.002	0.13	2.00
30.0	30.003	30.0	-0.003	0.13	2.00
45.0	45.002	44.9	-0.102	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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

Cert.No.: 24TW129
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE9M0011
ID No. : UAE.EFM.017/2563 (EFM.DO.06/63)
Received Date : 18 June 2024
Test Date : 19 June 2024
Reference : 2406-0571WSC-3
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 :

Saithip
Approved Signatory

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

Issue Date : 20 June 2024



Cert.No.: 24TW129
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	23MM405	16 July 2024

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 9KDH0035

Titration Method (Azide Modification Method)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.10	8.10	0.0045

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.: 24LM98
Page.: 1 of 2

Equipment : DO Meter with Sensor
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE9M0011
ID No. : UAE.EFM.017/2563(EFM.DO.06/63)
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 : 18 June 2024
Calibrated Date : 20 June 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Warakorn Lernagatrakul
Approved by : Kunchit
() Ponpan Paipim
() Suwit Imjai
(✓) Kunchit Promprat
Issue Date : 24 June 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 : 2406-0571WSC-4
Procedure Used :-

Cert. No.: 24LM98
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:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188090	231216	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.: 9K0H0035

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	80	25.001	25.0	-0.001	0.16	2.00
30.0	80	30.003	30.0	-0.003	0.16	2.00
35.0	80	35.002	35.0	-0.002	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.: 25CH496
Page.: 1 of 3

Equipment : Conductivity Meter
Manufacturer : YSI Environmental
Model : Pro 30
Serial No. : 18K100977
ID No. : UAE.EFM.069/2562 (ENV.SCT.05/61)
Condition As-Received: Used Item
Received Date : 28 April 2025
Calibration Date : 29 April 2025
Reference : 2504-0717WSC-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-CH6 by direct measurement
with certified reference material (CRM)
- CP-CH8 by comparison with temperature standard
Calibrated by : Warakorn Lernagatrakul
Approved by :
() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Sathip Meangmai
Issue Date : 30 April 2025

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

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Cert.No.: 25CH496
Page.: 2 of 3

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	24I995	09 Sep 2025
2) Ref. Std. Thermometer	4982054	110RC044	24I757	14 July 2025

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

2. Certified Reference Materials :-

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

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1412.9 µS/cm	CPA Chem	1005307	15 June 2025
12.881 mS/cm	CPA Chem	1005308	15 June 2025

- Control Conductivity calibration solution temperature by Water bath (25 ± 0.1) °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 µS/cm

Conductivity Electrode Serial No.: 22E100218

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
1412.9 µS/cm	1406 µS/cm	1413 µS/cm	9.2 µS/cm	2.00
12.881 mS/cm	12.84 mS/cm	12.88 mS/cm	0.086 mS/cm	2.00

Remark : - UUC* = Unit Under Calibration

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Cert.No.: 25CH496
Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

This equipment was connected with Temperature Probe;

- Model :	PRO 30 COND-T
- Serial No. :	22E100218
Dimension of probe;	
- Length :	8 mm
- Diameter :	2 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 k
15.0	15.003	15.0	-0.003	0.13	2.00
30.0	30.004	30.0	-0.004	0.13	2.00
45.0	45.002	45.0	-0.003	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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Jiranatee Associates Co., Ltd.
63/14-15, 63/15-36
Petchburi Road, Bangkok
Bangkok 10200 (Thailand)
Tel: +66(0)2959555
Mobile: +66(0)2959555
E-mail: jna-calibration@jiranatee.com
Web site: www.jiranatee.com

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

Flow measurement laboratory
Calibration services department



NSC-TIS-TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No.: CDF-026-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Office
MANUFACTURER : Andersen Instruments
MODEL/TYPER : G25A
SERIAL NUMBER : 113M2
ID NUMBER : UAE.ANV.008/2543
CONDITION AS-RECEIVED : Used Item
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260

RECEIVED DATE : 25 Jun 2024
MEASUREMENT DATE : 28 Jun 2024
ISSUE DATE : 28 Jun 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 23.6 °C and 52.1 %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 Office gas flow device was calibrated against Standard Rotary Displacement (Rotary Roots Meter) Model 665/CMC/WG-ds. The MFC-004 was used as a calibration guideline.

Traceability:
This certificate provides a traceability of the measurement to recognized the national standards used in realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: 096063-23.

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".

Calibrating by:
Mr. Sangwit Thachetad
50 Mita Intrigorn Lerthongkol



Approved signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

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

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Continuation of Certificate of Calibration Number CDF-026-67

Page 2 of 2 Pages

MEASUREMENT RESULTS:

The Office 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 m³/min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Ap_meter mmHg	Ap_Office mmHg	Y	Standard Flow [Qs] m³/min
1	0.702	755.185	23.64	22.77	51.420	1.742	1.319	0.655
2	1.006	755.232	23.62	22.95	57.188	3.542	1.882	0.932
3	1.118	755.264	23.59	22.94	57.648	4.630	1.949	1.065
4	1.168	755.227	23.56	22.92	58.056	5.178	1.974	1.127
5	1.414	755.224	23.64	22.91	58.079	7.610	2.756	1.364

Slope (m): 2.05189
Intercept (b): -0.01129
Correlation coefficient (r): 0.99981
Uncertainty (k=2): 0.015 m³/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m³/min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Ap_meter mmHg	Ap_Office mmHg	Y	Standard Flow [Qs] m³/min
1	0.702	755.185	23.64	22.77	51.420	1.742	0.827	0.656
2	1.006	755.232	23.62	22.95	57.188	3.542	1.180	0.932
3	1.118	755.264	23.59	22.94	57.648	4.630	1.349	1.065
4	1.168	755.227	23.56	22.92	58.056	5.178	1.426	1.127
5	1.414	755.224	23.64	22.91	58.079	7.610	1.729	1.364

Slope (m): 1.27253
Intercept (b): -0.00708
Correlation coefficient (r): 0.99981
Uncertainty (k=2): 0.015 m³/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.: 24P1250
Page: 1 of 2

Equipment : U Tube Manometer
Manufacturer: Dwyer
Model : 1221-36-W/M
Serial No.: -
ID No.: UAE.EFM.076/2566

Condition As-Received: Used Item
Received Date: 03 April 2024
Calibration Date: 10 April 2024

Reference: 2404-0118WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1007 mbar

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

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-0176-23	12 Sep 2024

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

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

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

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

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

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

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

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

Calibrated by : Suksan Khankaew
Issue Date : 17 April 2024

Approved Signatory :
[] Phalinee Prabpaipal
[] Sura Suwannasri
[✓] Attapol Panurach

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Cert.No.: 24P1250
Page: 2 of 2

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

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

Applied Pressure		UUC Indication		ΔP	Error
High-port side	Low-port side	High-port side	Low-port side		
0.00	0.00	0.00	0.00	0.00	0.00
2.00	1.00	-1.00	2.00	0.00	0.00
4.00	2.00	-2.00	4.00	0.00	0.00
6.00	3.00	-3.00	6.00	0.00	0.00
8.00	4.00	-4.00	8.00	0.00	0.00
10.00	5.05	-4.95	10.00	0.00	0.00
12.00	6.05	-5.95	12.00	0.00	0.00
14.00	7.05	-6.95	14.00	0.00	0.00
16.00	8.10	-7.95	16.05	0.05	0.05
18.00	9.10	-8.95	18.05	0.05	0.05
20.00	10.10	-9.95	20.05	0.05	0.05
22.00	11.10	-10.95	22.05	0.05	0.05
24.00	12.10	-11.95	24.05	0.05	0.05
26.00	13.15	-12.95	26.10	0.10	0.10
28.00	14.15	-13.95	28.10	0.10	0.10
30.00	15.20	-14.95	30.15	0.15	0.15
32.00	16.20	-15.95	32.15	0.15	0.15
34.00	17.20	-16.95	34.15	0.15	0.15
35.50	18.00	-17.70	35.70	0.20	0.20

The uncertainty of measurement was ± 0.11 inH₂O

* ΔP = High-port side - Low-port side

* UUC = Unit Under Calibration

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

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Page 2/3

Certificate No : 24-AFM-173
Request No : Req-2024-1833

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
25.60	99.80	14.50	14.46	-0.04	0.20	0.109	N/A
25.60	99.80	15.00	14.95	-0.05	0.21	0.113	N/A
25.50	99.70	15.80	15.73	-0.07	0.22	0.119	N/A
25.40	99.60	16.67	16.59	-0.08	0.23	0.125	N/A
25.50	99.50	18.30	18.20	-0.10	0.26	0.137	N/A

Note: STD : Standard UUC : Unit Under Calibration
- UUC Reference Condition : 25 °C, 101.3 kPa, Air
- Flow Rate was corrected for non-standard operating condition by using equation :

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

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

* Indicates non accredited

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

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

เอกสารไม่ควบคุม



Page 1/3

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sakhumvit Road, Bangchak, Prakanong, Bangkok
10269

Certificate No : 24-AFM-173

Request No : Req-2024-1833

Unit Under Calibration Details

Measurement Item : Air Flow Meter

Manufacturer : BGI

Model : Delta Cal DC1

Serial Number : 158850

ID : UAE.EFM.038/2561

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C \pm 3 °C

Humidity : 55 %RH \pm 20 %RH

Barometric Pressure : 1013 hPa \pm 10 hPa

Received Date : 15 August 2024

Calibration Date : 28 August 2024

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 High flow	18501012012	Sensidyne	1 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 :
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :
Mr. Pait Mahavorn
Calibration Engineer Supervisor

Issue Date : 28 August 2024

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Page 3/3

Certificate No : 24-AFM-173
Request No : Req-2024-1833

Decision Rule for Statements of Conformity

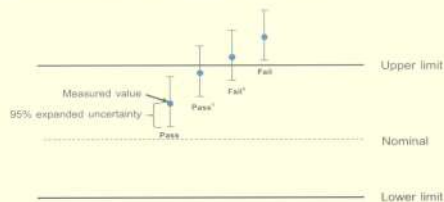
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G09:2019. Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



End of Certificate

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Certificate of Calibration

Certificate No : 24-TPM-390
Request No : Req-2024-1833
Page : 1/2

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

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Air Flow meter
Manufacturer : BGI
Model : Delta Cal DC1
Serial Number : 158850
Resolution : 0.1 °C
ID Number : UAE.EFM.038/2561
Range Calibration : 20 °C to 50 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 3
Calibration Position (mm) : 45
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 15 August 2024
Calibrated Date : 29 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 : 29 August 2024

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

Calibration Note :
UUC Adjustment : Not Adjust
Certificate No : 24-TPM-391
Request No : Req-2024-1832
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
Ta	20.031	20.0	0.0	0.13
	25.034	25.1	-0.1	0.13
	30.035	30.1	-0.1	0.13
	35.029	35.1	-0.1	0.13
	40.011	39.9	+0.1	0.13
	45.008	44.8	+0.2	0.13
Tt	50.007	49.8	+0.2	0.13
	20.031	19.9	+0.1	0.13
	25.034	24.9	+0.1	0.13
	30.035	30.0	0.0	0.13
	35.029	35.1	-0.1	0.13
	40.011	40.1	-0.1	0.13
	45.008	45.2	-0.2	0.13
	50.007	50.2	-0.2	0.13

End of Certificate

Calibrated By :
Mr. Sittichok Jarakdeesakul

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



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



Certificate of Calibration

Certificate No.: 24P1367
Page : 1 of 2

Equipment : Aneroid Barometer
Manufacturer: Barigo
Model : -
Serial No.: -
ID No.: UAE-ANV.152/2550

Condition As-Received: Used Item
Received Date: 06 April 2024
Calibration Date: 22 April 2024

Reference: 2404-0243WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1007 mbar
Submitted by: United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsak 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

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

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	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.This result of calibration instrument was in absolute pressure.

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew
Issue Date : 23 April 2024

Approved Signatory :
[] Phalinee Prabpaipal
[] Sura Suwanmasri
[✓] Attapol Panurach

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

Range : 960 hPa to 1030 hPa
Scale Interval : 1 hPa (The Fifth Estimate)

Applied Pressure (hPa)	957.13	968.77	980.13	990.56	1001.26	1011.35	1022.10	1032.61
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	2.87	1.23	-0.13	-0.56	-1.26	-1.35	-2.10	-2.61

Applied Pressure (hPa)	1032.61	1021.84	1010.88	1000.82	990.20	979.52	968.48	957.17
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-2.61	-1.84	-0.88	-0.82	-0.20	0.48	1.52	2.83

The uncertainty of measurement was ± 0.25 hPa
* UUC = Unit Under Calibration

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

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Cert.No.: 24P1367
Page: 2 of 2

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Certificate of Calibration

Certificate No.: 24H758
Page: 1 of 2

Cert. No.: 24H758
Page: 2 of 2

Equipment : Dial Thermo-Hygrometer
Manufacturer: Barigo
Model : -
Serial No.: -
ID No.: UAE.EMA2,013/2555

Condition As-Received: Used Item

Received Date: 05 April 2024

Calibration Date: 10 April 2024

Reference: 2404-0247WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

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

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

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

Condition of this result of calibration

1. Reference standards instruments :

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

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

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

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

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

Calibrated by : Chakrit Waewwanjua
Issue Date : 18 April 2024

Approved Signatory :
[] Chakrit Waewwanjua
[x] Vipom Tantiyawutti
[] Unnopphol Harachai

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Result of Calibration:-

Without Adjustment

Function: Humidity Measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	46	5.9	1.6
25.0	60.0	61	1.0	1.7
25.0	80.0	70	-10.0	1.8

Result of Calibration:-

Without Adjustment

Function: Temperature Measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.007	21.0	0.993	0.72
25.032	25.5	0.468	0.72
29.997	30.0	0.003	0.72
35.010	34.5	-0.510	0.72
40.019	39.0	-1.019	0.72

UUC* : Unit Under Calibration

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

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United Analyst and Engineering Consultant Co., Ltd.

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

Tel. 0 2763 2828 Fax 0 2763 2800 www.uaiconsultant.com E-mail: uae@uaiconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date : Oct 11, 2024

Equipment : Gas Analyzer (NO₂)
Manufacturer : Thermo Electron Corporation
Model : 42C
Serial Number : 0517512001

Standard Gas Concentration

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

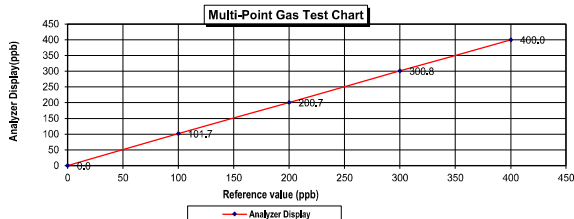
Dilutor Detail

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	0.00	0.00	0.00
Level 2	20.00%	100.0	101.7	1.70	1.67
Level 3	40.00%	200.0	200.7	0.70	0.35
Level 4	60.00%	300.0	300.8	0.80	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range	500.0 ppb		Average Difference (%)	0.46	

:Acceptable Limit ± 5%



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Approve by

11 / Oct / 2024

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United Analyst and Engineering Consultant Co., Ltd.

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

Tel. 0 2763 2828 Fax 0 2763 2800 www.uaiconsultant.com E-mail: uae@uaiconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date : Sep 17, 2024

Equipment : Gas Analyzer (NO₂)
Manufacturer : Thermo Scientific
Model : 42i
Serial Number : CM08130002

Standard Gas Concentration

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

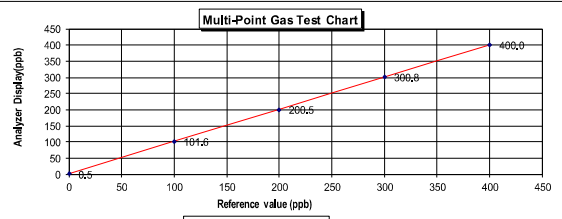
Dilutor Detail

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
Level 2	20.00%	100.0	101.6	1.60	1.57
Level 3	40.00%	200.0	200.5	0.50	0.25
Level 4	60.00%	300.0	300.8	0.80	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range	500.0 ppb		Average Difference (%)	0.52	

:Acceptable Limit ± 5%



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17 / 9 / 2567

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17 / Sep / 2024

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MULTI-POINT GAS TEST REPORT

Test Date : Sep 17, 2024

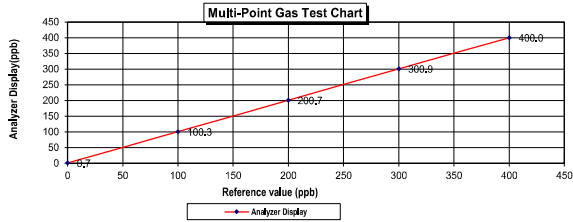
Equipment : Gas Analyzer (NO₂) Model : 42C
Manufacturer : Thermo Environmental Instruments Serial Number : 42C- 67174-356

Standard Gas Concentration			Dilutor Detail	
Sulphur Dioxide (SO ₂)	42.89	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	46.77	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9			
Cylinder No. :	EB0159156			
Expiration Date :	Nov 06, 2026			

Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.7	0.70	0.70	0.70
Level 2	20.00%	100.3	0.30	0.30	0.30
Level 3	40.00%	200.7	0.70	0.35	0.35
Level 4	60.00%	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range	500.0 ppb		Average Difference (%)		0.33

:Acceptable Limit \pm 5%



Calculate by

17/9/2567

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17 Sep 2024

MULTI-POINT GAS TEST REPORT

Test Date : Oct 17, 2024

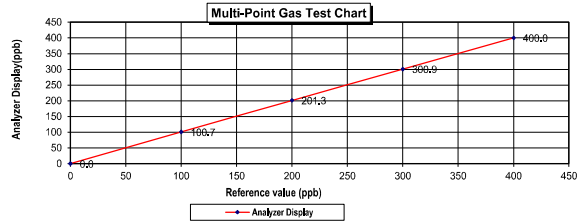
Equipment : Gas Analyzer (NO₂) Model : 42C
Manufacturer : Thermo Environmental Instruments Serial Number : 42C-76412-383

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

Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.7	0.70	0.70	0.70
Level 3	40.00%	201.3	1.30	0.65	0.65
Level 4	60.00%	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range	500.0 ppb		Average Difference (%)		0.33

:Acceptable Limit \pm 5%



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17/10/2567

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17 Oct 2024

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE
(THAILAND) LTD
Part Number: E04NI99E15A01D3
Cylinder Number: EB0159156
Laboratory: 124 - Durham (SAP) - NC
PGVP Number: B22023
Gas Code: CO, NO, NO₂, SO₂, BALN
Reference Number: 122-402880224-1
Cylinder Volume: 144.0 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 660
Certification Date: Nov 06, 2023
Expiration Date: Nov 06, 2026

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2017)" document EPA 800/R-12/51, 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 gases 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	45.00 PPM	45.78 PPM	G1	\pm 1.3% NIST Traceable	10/30/2023, 11/06/2023
NITRIC OXIDE	45.00 PPM	45.77 PPM	G1	\pm 1.3% NIST Traceable	10/30/2023, 11/06/2023
SULFUR DIOXIDE	45.00 PPM	42.89 PPM	G1	\pm 1.0% NIST Traceable	10/30/2023, 11/06/2023
CARBON MONOXIDE	1000 PPM	965.9 PPM	G1	\pm 0.7% NIST Traceable	10/30/2023
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	21060703	CC707954	48.41 PPM NITRIC OXIDE/NITROGEN	\pm 1.2%	Sep 21, 2025
PRM		D913660	15.01 PPM NITROGEN DIOXIDE/AIR	\pm 1.5%	Feb 18, 2023
GMIS	124206889	CC322689	4.573 PPM NITROGEN DIOXIDE/NITROGEN	\pm 1.6%	Feb 17, 2026
NTRM	16061005	CC473180	49.02 PPM SULFUR DIOXIDE/NITROGEN	\pm 0.8%	Mar 22, 2028
NTRM	14060154	CC436951	960.9 PPM CARBON MONOXIDE/NITROGEN	\pm 0.6%	Nov 15, 2025

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

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 AUP2010249 CO	FTIR	Oct 11, 2023
Nicolet iS50 AUP2010249 H ₂ O	FTIR	Oct 11, 2023
Nicolet iS50 AUP2010249 NO ₂	FTIR	Oct 11, 2023
Nicolet iS50 AUP2010249 SO ₂	FTIR	Oct 11, 2023

Triad Data Available Upon Request

NOTES: GROSS WEIGHT: 28.4 kg

NET WEIGHT: 4.7 kg



Signature on file

Approved for Release

MULTI-POINT GAS TEST REPORT

Test Date : Sep 6, 2024

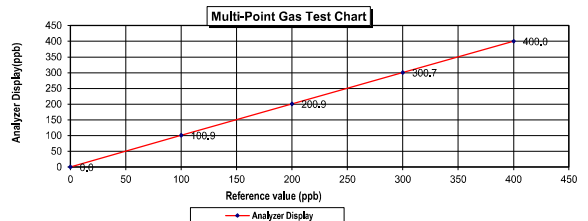
Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778111

Standard Gas Concentration			Dilutor Detail	
Sulphur Dioxide (SO ₂)	42.89	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	46.77	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9			
Cylinder No. :	EB0159156			
Expiration Date :	Nov 06, 2026			

Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.9	0.90	0.89	0.89
Level 3	40.00%	200.9	0.90	0.45	0.45
Level 4	60.00%	300.7	0.70	0.23	0.23
Level 5	80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range	500.0 ppb		Average Difference (%)		0.31

:Acceptable Limit \pm 5%



Calculate by

6/9/2567

Approve by

6 Sep 2024

MULTI-POINT GAS TEST REPORT

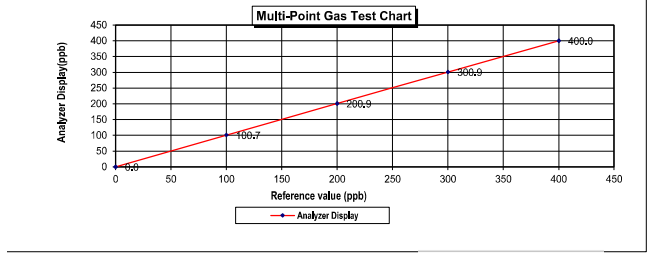
Test Date : Sep 4, 2024

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778112

Standard Gas Concentration			Dilutor Detail	
Sulphur Dioxide (SO ₂)	42.89	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	46.77	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9			
Cylinder No. :	EB0159156			
Expiration Date :	Nov 06, 2026			

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.7	0.70	0.70	0.70
Level 3	40.00%	200.0	200.9	0.90	0.45	0.45
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 (%)		0.29



Calculate by
4 / 9 / 2567

Approve by
4 / Sep / 2024

MULTI-POINT GAS TEST REPORT

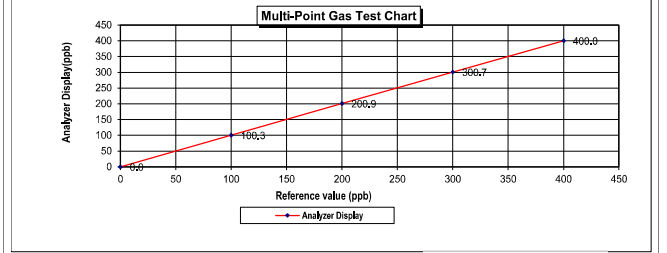
Test Date : Sep 4, 2024

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778113

Standard Gas Concentration			Dilutor Detail	
Sulphur Dioxide (SO ₂)	42.89	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	46.77	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9			
Cylinder No. :	EB0159156			
Expiration Date :	Nov 06, 2026			

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]	
Level 1	Zero	0.0	0.0	0.00	0.00	0.00	
Level 2	20.00%	100.0	100.3	0.30	0.30	0.30	
Level 3	40.00%	200.0	200.9	0.90	0.45	0.45	
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 (%)			0.20



Calculate by
4 / 9 / 2567

Approve by
4 / Sep / 2024

MULTI-POINT GAS TEST REPORT

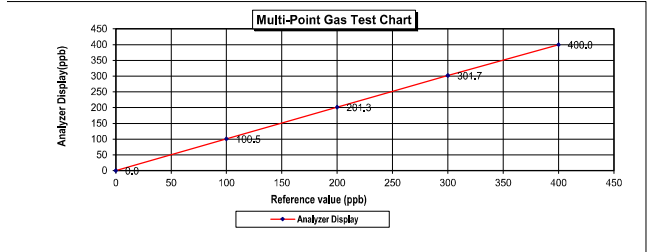
Test Date : June 19, 2024

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778116

Standard Gas Concentration			Dilutor Detail	
Sulphur Dioxide (SO ₂)	42.89	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	46.77	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9			
Cylinder No. :	EB0159156			
Expiration Date :	Nov 06, 2026			

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.5	0.50	0.50	0.50
Level 3	40.00%	200.0	201.3	1.30	0.65	0.65
Level 4	60.00%	300.0	301.7	1.70	0.56	0.56
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.34



Calculate by
19 / 06 / 2567

Approve by
19 / June / 2024

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)
LTD.: E05N191E15A0014
Part Number: E05N191E15A0014
Cylinder Number: E05N191E15A0014
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12023
Gas Code: CO, CO₂, NO, NO₂, SO₂, BALN
Reference Number: 160-402772205-1
Cylinder Volume: 144.0 CF
Cylinder Pressure: 2016 PSIG
Valve Outlet: 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 800/R-12/031, 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	+/- 0.5% NIST Traceable	06/27/2023, 07/05/2023
NITRIC OXIDE	100.0 PPM	100.2 PPM	G1	+/- 0.5% NIST Traceable	06/27/2023, 07/05/2023
SULFUR DIOXIDE	100.0 PPM	100.0 PPM	G1	+/- 1.4% NIST Traceable	06/27/2023, 07/05/2023
CARBON MONOXIDE	200.0 PPM	199.2 PPM	G1	+/- 0.3% NIST Traceable	06/25/2023
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	96.36 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	96.52 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Apr 25, 2031
PRM	12409	D913660	15.01 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Feb 17, 2023
GMIS	15340202002	EB0130037	9.993 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.0%	Sep 29, 2025
NTRM	180162-22	KAL003620	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	CC411738	13.358 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 14, 2025
The GRM, NTRM, PRM, or RDM 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 CO ₂	FTIR		Jun 15, 2023		
SIEMENS ULTRAMATE6 N1-D8-180	NDIR		Jun 14, 2023		
Nicolet iS50 FTIR AUP2010245 NO	FTIR		Jun 29, 2023		
Nicolet iS50 FTIR AUP2010245 NO ₂	FTIR		Jun 15, 2023		
Nicolet iS50 FTIR AUP2010245 SO ₂	FTIR		Jun 08, 2023		

Approved for Release

MULTI-POINT GAS TEST REPORT

Test Date : Sep 9, 2024

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo Scientific Serial Number : 1180540074

Standard Gas Concentration

Sulphur Dioxide (SO₂) 42.89 PPM
Nitric Oxide (NO) 46.77 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 965.9 PPM
Cylinder No. : EB0159156
Expiration Date : Nov 06, 2026

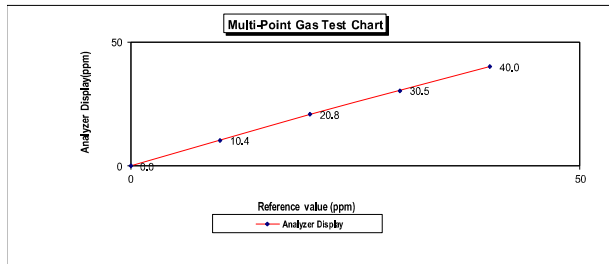
Dilutor Detail

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

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.4	0.4	3.8
Level 3	40.00%	20.0	20.8	0.8	3.8
Level 4	60.00%	30.0	30.5	0.5	1.6
Level 5	80.00%	40.0	40.0	0.0	0.0

Remark : Measuring Range 50.0 ppm
:Acceptable Limit \pm 5%



Calculate by
Girichai C.
9/9/2567

Approve by
Rakham V.
9 Sep 2024

MULTI-POINT GAS TEST REPORT

Test Date : June 14, 2024

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo Scientific Serial Number : 1180540069

Standard Gas Concentration

Sulphur Dioxide (SO₂) 42.89 PPM
Nitric Oxide (NO) 46.77 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 965.9 PPM
Cylinder No. : EB0159156
Expiration Date : Nov 06, 2026

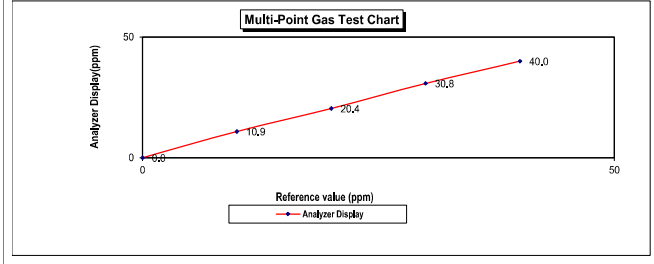
Dilutor Detail

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

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.9	0.9	8.3
Level 3	40.00%	20.0	20.4	0.4	2.0
Level 4	60.00%	30.0	30.8	0.8	2.6
Level 5	80.00%	40.0	40.0	0.0	0.0

Remark : Measuring Range 50.0 ppm
:Acceptable Limit \pm 5%



Calculate by
Girichai C.
14/06/2567

Approve by
Rakham V.
14 June 2024

MULTI-POINT GAS TEST REPORT

Test Date : June 14, 2024

Equipment : Gas Analyzer (CO) Model : APMA-370
Manufacturer : HORIBA Serial Number : YN43AG7T

Standard Gas Concentration

Sulphur Dioxide (SO₂) 42.89 PPM
Nitric Oxide (NO) 46.77 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 965.9 PPM
Cylinder No. : EB0159156
Expiration Date : Nov 06, 2026

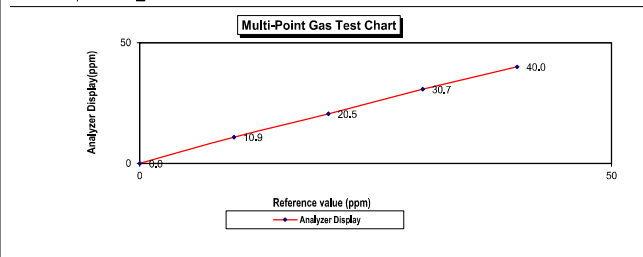
Dilutor Detail

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

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.9	0.9	8.3
Level 3	40.00%	20.0	20.5	0.5	2.4
Level 4	60.00%	30.0	30.7	0.7	2.3
Level 5	80.00%	40.0	40.0	0.0	0.0

Remark : Measuring Range 50.0 ppm
:Acceptable Limit \pm 5%



Calculate by
Girichai C.
14/06/2567

Approve by
Rakham V.
14 June 2024

MULTI-POINT GAS TEST REPORT

Test Date : Jan 9, 2025

Equipment : Gas Analyzer (CO) Model : APMA-370
Manufacturer : HORIBA Serial Number : YRLHTB7G

Standard Gas Concentration

Sulphur Dioxide (SO₂) 42.89 PPM
Nitric Oxide (NO) 46.77 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 965.9 PPM
Cylinder No. : EB0159156
Expiration Date : Nov 06, 2026

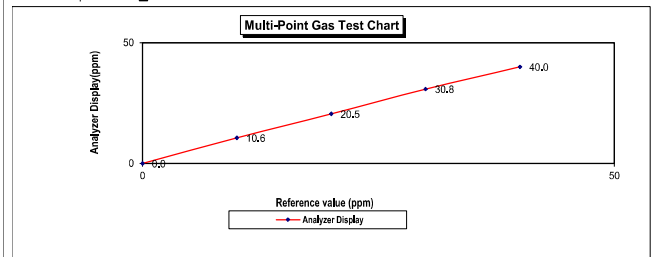
Dilutor Detail

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

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.6	0.6	5.7
Level 3	40.00%	20.0	20.5	0.5	2.4
Level 4	60.00%	30.0	30.8	0.8	2.6
Level 5	80.00%	40.0	40.0	0.0	0.0

Remark : Measuring Range 50.0 ppm
:Acceptable Limit \pm 5%



Calculate by
Girichai C.
9/1/68

Approve by
Rakham V.
9 Jan 2025



THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 19 February, 2025

Certification No. 106/25

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2205DR0114

Wind Sensor 2205DT0114

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 1011.3 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Axiot 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

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

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. 44320001

Calibrated by : Mr. Watcharapol Subwat

Signed : Mr. Pisod Promsat

(Authorized Signature)

for the Chief

Sub-Standard Instrument

Mechanical Engineer

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

19 February, 2025

Certification No. 106/25

Page : 2 of 5

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

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

Calibrated by :

Mr. Watcharapol Subwat

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

19 February, 2025

Certification No. 106/25

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
1010.57	1011	-0.33
1011.01	1011	0.01

Average

0.08

Calibrated by :

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

19 February, 2025

Certification No. 106/25

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	758	0.60
758.35	758	0.35
758.10	758	0.10
757.79	758	-0.21
757.42	757	0.42
756.76	757	-0.24
757.07	757	0.07
757.48	757	0.48
757.99	758	-0.01
758.62	759	-0.38
759.29	759	0.29
757.37	757	0.37
758.06	758	0.06
758.32	758	0.32

Average

0.04

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. 106/25

19 February, 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:

Handwritten signature

Mr. Watcharapol Subwat
Mechanical Engineer



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Certificate of Calibration

Customer

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

Certificate No : 24-ACT-070
Request No : Req-2024-1027

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 1
Manufacturer : SVANTEK Range : 94 ~ 114 dB / 1000 Hz
Model : SV 35A Instrument Status : Used
Serial Number : 73249
ID : UAE.EFM.105/2561

Calibration Environment and Details

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

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

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

Note

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

Calibrated By :

Handwritten signature
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :

Handwritten signature
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 17 May 2024

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

FM-708-ACT-02 Rev.01 Issue date: 8/23

Certificate No : 24-ACT-070

Request No : Req-2024-1027

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Deviated value	Measured	Deviated value		
94 dB / 1000 Hz	93.79	-0.21	-	-	0.13	0.25
114 dB / 1000 Hz	113.84	-0.16	-	-	0.13	0.25

Frequency of Sound pressure level

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

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

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)	Measured (%)		
94 dB / 1000 Hz	0.19	-	0.40	2.5
114 dB / 1000 Hz	0.04	-	0.40	2.5

Note :

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

- Acceptance limit was IEC60942:2017 Class 1

- The calibration results exclude the calibrator pressure correction

- The calibration results exclude the microphone volume correction

End of Calibration

Certificate of Calibration

Customer

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

Certificate No : 24-SLM-230
Request No : Req-2024-1449

Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2
Manufacturer : Larson Davis Microphone Model : 375A04
Model : LXT2 Microphone SN : 11792
Serial Number : 0006699 Pre-amplifier Model : PRMLx12C
ID : UAE.EFM.139/2565 Pre-amplifier S/N : 071569
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 : 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	108273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	Swantek	Swantek	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 :

Handwritten signature
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :

Handwritten signature
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 10 July 2024

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust			After Adjust		UNCERTAINTY	Acceptance Limit	Result
	Level	UUC	ERR	UUC	ERR	UUC			
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(± dB)	(± dB)	
1000 Hz 114 dB	113.76	112.9	-0.86	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 / A / 37-139	(dB)	(± dB)
A	31.2	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
A	31.0	0.10
C	30.5	0.10
Z	34.9	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance Limit	Result
	A	C	Z	(± dB)	(± dB)	
FAST / 37-139	(dB)	(dB)	(dB)			
STD Setting	A	C	Z	(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	0.2	0.2	0.2	0.60	3.0	Pass
8000 Hz	-0.1	0.0	0.0	0.70	5.0	Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the calibration laboratory.
FM-700-SLM-01 Rev.04 Issue date 5/6/24

เอกสารไม่ควบคุม

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

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

6. Frequency and time weightings at 1kHz

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

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

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

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7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC	(± dB)	(± dB)	
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
	REF	UUC	ERR	(± dB)	(± dB)	
FAST / A / 37-139	(dB)	(dB)	(dB)			
STD dB	A	C	Z	(dB)	(dB)	
136.00	139	139.0	0.0	0.30	1.1	Pass
134.00	134	134.0	0.0	0.30	1.1	Pass
129.00	129	129.0	0.0	0.30	1.1	Pass
124.00	124	124.0	0.0	0.30	1.1	Pass
119.00	119	119.0	0.0	0.30	1.1	Pass
114.00	114	114.0	0.0	0.30	1.1	Pass
109.00	109	109.0	0.0	0.30	1.1	Pass
104.00	104	104.0	0.0	0.30	1.1	Pass
99.00	99	99.0	0.0	0.30	1.1	Pass
94.00	94	94.0	0.0	0.30	1.1	Pass
89.00	89	89.0	0.0	0.30	1.1	Pass
84.00	84	84.0	0.0	0.30	1.1	Pass
79.00	79	79.0	0.0	0.30	1.1	Pass
74.00	74	74.0	0.0	0.30	1.1	Pass
69.00	69	69.0	0.0	0.30	1.1	Pass
64.00	64	64.0	0.0	0.30	1.1	Pass
59.00	59	59.0	0.0	0.30	1.1	Pass
54.00	54	54.0	0.0	0.30	1.1	Pass
49.00	49	49.0	0.0	0.30	1.1	Pass
44.00	44	44.2	0.2	0.30	1.1	Pass
43.00	43	43.2	0.2	0.30	1.1	Pass
42.00	42	42.3	0.3	0.30	1.1	Pass
41.00	41	41.4	0.4	0.30	1.1	Pass

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

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9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance Limit	Result
	REF	UUC	ERR	(± dB)	(± dB)	
FAST / A	(dB)	(dB)	(dB)			
UUC Range	A	C	Z	(dB)	(dB)	
37-139	46.20	46.3	0.1	0.30	1.1	Pass
	114	114.0	0.0	0.30	1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance Limit	Result
	Toneburst	Ref	UUC	ERR	(± dB)	(± dB)	
A / 37-139	(ms)	(dB)	(dB)	(dB)			
UUC Time Response	A	C	Z	(dB)	(dB)		
Fast	200	135.0	134.9	-0.1	0.20	1.0	Pass
	2	118.0	117.9	-0.1	0.20	+1.0, -2.5	Pass
	0.25	109.0	108.6	-0.4	0.20	+1.5, -5.0	Pass
Slow	200	128.6	128.4	-0.2	0.20	1.0	Pass
	2	109.0	108.8	-0.2	0.20	+1.0, -5.0	Pass
	200	129.0	129.0	0.0	0.20	1.0	Pass
SEL	2	109.0	109.1	+0.1	0.20	+1.0, -2.5	Pass
	0.25	100.0	99.8	-0.2	0.20	+1.5, -5.0	Pass

11. Peak C Sound level

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

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the calibration laboratory.
FM-700-SLM-01 Rev.04 Issue date 5/6/24

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12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC	(± dB)	(± dB)	
STD Setting	(dB)			
Positive one-half cycle	145.0			
Negative one-half cycle	144.9	0.20	1.5	Pass
Deviated	0.1			

13. High Level Stability

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

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 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

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ISM-709-0LM-01 Rev.04 Issue date 5/6/24

Decision Rule for Statements of Conformity

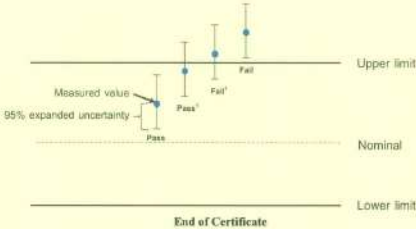
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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.



The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
ISM-709-0LM-01 Rev.04 Issue date 5/6/24

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 24-SLM-231
Address : 81 Set Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260 Request No : Req-2024-1450

Unit Under Calibration Details

Measurement Item : Microphone Class : 2
Manufacturer : Larson Davis Microphone Model : 375B92
Model : LX72 Microphone S/N : 11792
Serial Number : 0005293 Pre-amplifier Model : PRM1.x12B
ID : UAE.FPM.108.2562 Pre-amplifier S/N : 056073
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 : 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	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	388273	20 August 2024	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	Svante	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 :  Approved By : 
Mr. Noppadol Luangart Mr. Pait Muthavorn
Service Calibration Engineer Calibration Engineer Supervisor
Issue Date : 10 July 2024

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ISM-709-0LM-01 Rev.04 Issue date 5/6/24

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR	(± dB)	(± dB)	
Calibrator Setting	(dB)	(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	(dB)	(± dB)
UUC Weighting		
A	29.8	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting		
A	29.4	0.10
C	28.8	0.10
Z	32.9	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance Limit	Result
FAST / 37-139	A	C	Z	(± dB)	(± dB)	
STD Setting	(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	0.7	0.7	0.7	0.60	3.0	Pass
8000 Hz	1.4	1.4	1.5	0.70	3.0	Pass1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
ISM-709-0LM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-231
Request No : Req-2024-1450

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	-0.1	-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 (± dB)	Acceptance Limit (± dB)	Result
		REF	ERR			
FAST / 37-139						
UUC Weighting						
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		REF	ERR			
37-139 / A						
UUC Time Responce						
Fast	114.00	114.0	0.0	0.20	0.10	Pass
Slow	114.00	114.0	0.0		0.10	Pass
1sq	114.00	114.0	0.0		0.10	Pass

Certificate No : 24-SLM-231
Request No : Req-2024-1450

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		REF	UUC	ERR		
FAST / A / 37-139						
STD dB	(dB)	(dB)	(dB)	(dB)		
130.00	130	130.0	0.0	0.30	1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
120.00	120	120.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
110.00	110	110.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
100.00	100	100.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
90.00	90	90.0	-0.1		1.1	Pass
94.00	94	93.9	-0.1		1.1	Pass
80.00	80	80.0	-0.1		1.1	Pass
84.00	84	83.9	-0.1		1.1	Pass
70.00	70	70.0	-0.1		1.1	Pass
74.00	74	73.9	-0.1		1.1	Pass
60.00	60	60.0	-0.1		1.1	Pass
64.00	64	63.9	-0.1		1.1	Pass
50.00	50	50.0	-0.1		1.1	Pass
54.00	54	53.9	-0.1		1.1	Pass
40.00	40	40.0	0.0		1.1	Pass
44.00	44	44.1	0.1		1.1	Pass
30.00	30	30.0	0.0		1.1	Pass

Certificate No : 24-SLM-231
Request No : Req-2024-1450

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		REF	ERR			
FAST / A						
UUC Range	(dB)	(dB)	(dB)			
37-139	44.80	44.9	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 Limit (± dB)	Result
			Ref	UUC	ERR		
A / 37-139							
UUC Time Responce	(ms)	(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	100.0	100.0	-0.4		+1.5, -5.0	Pass
Slow	200	128.0	128.0	-0.1		1.0	Pass
	2	109.0	108.9	-0.1		+1.0, -5.0	Pass
	200	129.0	129.0	0.0		1.0	Pass
SEL	2	109.0	109.1	+0.1		+1.0, -2.5	Pass
	0.25	100.0	99.8	-0.2		+1.5, -5.0	Pass

11. Peak C Sound level

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

Certificate No : 24-SLM-231
Request No : Req-2024-1450

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC	(± dB)	Limit (± dB)	
STD Setting	(dB)	(± dB)	(± dB)	
Positive one-half cycle	143.7			
Negative one-half cycle	143.8			
Deviated	-0.1			

13. High Level Stability

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

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 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 Second level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

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

Certificate No : 24-SLM-231
Request No : Req-2024-1450

Decision Rule for Statements of Conformity

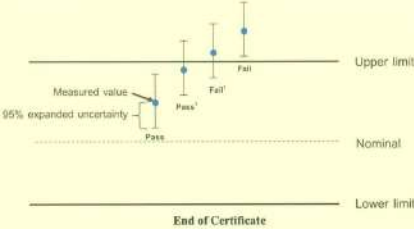
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-Q8:09:2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements:

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.



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

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 24-SLM-232
Address : 81 Soi Udomrak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260 Request No : Req-2024-1451

Unit Under Calibration Details

Measurement Item : Sound Level Meter Microphone Class : 2
Manufacturer : Larson Davis Microphone Model : 375802
Model : LX72 Microphone S/N : 11793
Serial Number : 0005341 Preamplifier Model : PRMLx72B
ID : UAEFFM.038/2563 Preamplifier S/N : 056133
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 : 1 July 2024
Calibrated Date : 10 July 2024

Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-1 : 2013 Electroacoustics - Sound level meters - Part 1: Periodic tests

Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	198273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Questcal	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 Luangrit
Service Calibration Engineer

Approved By : 
Mr. Paet Muthavorn
Calibration Engineer/Supervisor
Issue Date : 10 July 2024

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

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
	Level (dB)	UUC (dB)	ERR (dB)	ERR (dB)	UUC (dB)	ERR (dB)			
Calibrator Setting									
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 Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A	C	Z			
FAST / 37-139						
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

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Engineer. **เอกสารไม่ควบคุม**
FSI-708-SLM-01 Rev.04 Issue date 5/6/24

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

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

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

Certificate No : 24-SLM-232
Request No : Req-2024-1451

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC	(± dB)	(± dB)	
STD Setting	(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	0.50
STD dB	(dB)	(dB)	(dB)	(± dB)	
139.00	139	139.0	0.0	1.1	
134.00	134	134.0	0.0	1.1	
129.00	129	129.0	0.0	1.1	
124.00	124	124.0	0.0	1.1	
119.00	119	119.0	0.0	1.1	
114.00	114	114.0	0.0	1.1	
109.00	109	109.0	0.0	1.1	
104.00	104	104.0	0.0	1.1	
99.00	99	99.0	0.0	1.1	
94.00	94	94.0	0.0	1.1	
89.00	89	89.0	0.0	1.1	
84.00	84	84.0	0.0	1.1	
79.00	79	79.0	0.0	1.1	
74.00	74	74.0	0.0	1.1	
69.00	69	69.0	0.0	1.1	
64.00	64	64.0	0.0	1.1	
59.00	59	59.0	0.0	1.1	
54.00	54	54.0	0.0	1.1	
49.00	49	49.1	0.1	1.1	
44.00	44	44.2	0.2	1.1	
39.00	39	39.5	0.5	1.1	

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

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	
	114	114.0	0.0	1.1	Pass

10. Tone burst response

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

11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance	Result
FAST / C / 95-142	REF	UUC	ERR	Limit	0.20
STD Setting	(dB)	(dB)	(dB)	(± dB)	
Complete cycle	137.4	136.8	-0.60	3.0	
Positive half cycle	138.4	136.2	-0.20	2.0	
Negative half cycle	138.4	136.2	-0.20	2.0	

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
FSM-708-SLM-01 Rev.04 Issue date: 5/6/24

Certificate No : 24-SLM-232
Request No : Req-2024-1451

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC	(± dB)	(± dB)	
STD Setting	(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	(± dB)	(± 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

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

Certificate No : 24-SLM-232
Request No : Req-2024-1451

Decision Rule for Statements of Conformity

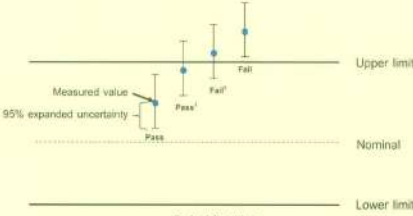
The standard decision rule employed for the statements of conformity to each calibration result will be applied using IAC-GR 09:2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
FSM-708-SLM-01 Rev.04 Issue date: 5/6/24

Certificate of Calibration

Customer

Name

: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Certificate No : 24-SLM-233

Address

: 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260.

Request No : Req-2024-1452

Unit Under Calibration Details

Measurement Item

: Sound Level Meter

Microphone Class : 2

Manufacturer

: Larson Davis

Microphone Model : 375A04

Model

: LxT2

Microphone S/N : 33789

Serial Number

: 0006698

Preamplifier Model : PRMLxT2C

ID

: UAE.EFM.138.2555

Preamplifier S/N : 071568

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

: 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	ETFA000234	26 July 2024	TSI
Audio Generator	Svante	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. Noppadol Luangar

Service Calibration Engineer

Approved By : 

Mr. Pacht Mathavorn

Calibration Engineer Supervisor

Issue Date :

10 July 2024

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FSM-700-SLM-01 Rev.04 Issue date: 5/6/24

Certificate No : 24-SLM-233

Request No : Req-2024-1452

1. Indication at the calibration check frequency

UUC Setting	Nominal Level	Before Adjust	After Adjust	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	(dB)	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)	
Calibrator Setting						
1000 Hz 114 dB	113.76	114.6	0.84	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: 38079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting		
A	29.3	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting		
A	29.0	0.10
C	28.7	0.10
Z	33.1	0.10

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




UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY	Acceptance Limit	Result
FAST / 37-139	A (dB) C (dB) Z (dB)	(± dB)	(± dB)	
STD Setting				
125 Hz	-0.1 0.1 0.0	0.60	1.5	Pass
1000 Hz	0.0 0.0 0.0	0.60	1.0	Pass
4000 Hz	0.7 0.7 0.7	0.60	3.0	Pass
8000 Hz	0.9 0.9 1.0	0.70	5.0	Pass

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FSM-700-SLM-01 Rev.04 Issue date: 5/6/24

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/19 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KAEU,
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL : 0660-2116-5900 / FAX: 0660-2116-7140



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Certificate No : 24-SLM-233

Request No : Req-2024-1452

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

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

6. Frequency and time weightings at 1kHz

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

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FSM-700-SLM-01 Rev.04 Issue date: 5/6/24

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Page : 4/7

Certificate No : 24-SLM-233

Request No : Req-2024-1452

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	REF (dB)	UUC (dB) ERR (dB)	(± dB)	(± dB)	
STD dB					
139.00	139	139.0 0.0	0.30	1.1	Pass
134.00	134	134.0 0.0	0.30	1.1	Pass
129.00	129	129.0 0.0	0.30	1.1	Pass
124.00	124	124.0 0.0	0.30	1.1	Pass
119.00	119	119.0 0.0	0.30	1.1	Pass
114.00	114	114.0 0.0	0.30	1.1	Pass
109.00	109	109.0 0.0	0.30	1.1	Pass
104.00	104	104.0 0.0	0.30	1.1	Pass
99.00	99	98.9 -0.1	0.30	1.1	Pass
94.00	94	93.9 -0.1	0.30	1.1	Pass
89.00	89	88.9 -0.1	0.30	1.1	Pass
84.00	84	83.9 -0.1	0.30	1.1	Pass
79.00	79	78.9 -0.1	0.30	1.1	Pass
74.00	74	73.9 -0.1	0.30	1.1	Pass
69.00	69	68.9 -0.1	0.30	1.1	Pass
64.00	64	63.9 -0.1	0.30	1.1	Pass
59.00	59	58.9 -0.1	0.30	1.1	Pass
54.00	54	53.9 -0.1	0.30	1.1	Pass
49.00	49	49.0 0.0	0.30	1.1	Pass
44.00	44	44.0 0.0	0.30	1.1	Pass
39.00	39	39.3 0.3	0.30	1.1	Pass

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FSM-700-SLM-01 Rev.04 Issue date: 5/6/24

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance Limit	Result
		UUC	ERR			
FAST / A	REF	(dB)	(dB)	(± dB)	(± dB)	
UUC Range	(dB)	(dB)	(dB)			
	44.10	44.2	0.1		1.1	Pass
37-139	114	114.0	0.0	0.30	1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance Limit	Result
			UUC	ERR			
A / 37-139	Toneburst	Ref	(dB)	(dB)	(± dB)	(± dB)	
UUC Time Response	(ms)		(dB)	(dB)			
	200	135.0	134.9	-0.1		1.0	Pass
	2	118.0	117.7	-0.3		+1.0, -2.5	Pass
Fast	0.25	109.0	108.6	-0.4		+1.5, -5.0	Pass
	200	128.6	128.5	-0.1		1.0	Pass
	2	109.0	108.8	-0.2		+1.0, -5.0	Pass
Slow	200	129.0	129.0	0.0		1.0	Pass
	2	109.0	108.9	-0.1		+1.0, -2.5	Pass
	0.25	100.0	99.8	-0.2		+1.5, -5.0	Pass
SEL							

11. Peak C Sound level

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

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

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC			
STD Setting	(dB)	(± dB)	(± dB)	
Positive one-half cycle	143.1			
Negative one-half cycle	143.0			
Deviated	0.1	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC			
STD Setting	(dB)	(± 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 30 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at 30 Hz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

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

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

Decision Rule for Statements of Conformity

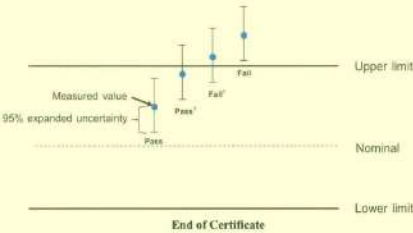
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



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

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10269

Certificate No : 24-SLM-234
Request No : Req-2024-1453

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : Larson Davis
Model : LXT2
Serial Number : 0005286
ID : UAE.FFM.1022562
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375B02
Microphone S/N : 011740
Preamplifier Model : P8MLX7B
Preamplifier S/N : 056087
Instrument Status : Used

Calibration Environment and Details


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

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	Svante	Scans401	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. Noppadol Luangrot
Service Calibration Engineer

Approved By : 
Mr. Pacht Mahavorn
Calibration Engineer Supervisor
Issue Date : 10 July 2024

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

Certificate No : 24-SLM-234
Request No : Req-2024-1453

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)			
FAST / A / 37-139	Level							
Calibrator Setting (dB)		(dB)	(dB)	(dB)	(dB)			
1000 Hz 114 dB	113.76	114.4	0.64	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)	(± dB)
A	31.3	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)	(± dB)
A	31.1	0.10
C	30.6	0.10
Z	34.9	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A (dB)	C (dB)	Z (dB)			
FAST / 37-139						
STD Setting (dB)	(dB)	(dB)	(dB)			
125 Hz	0.0	0.1	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	1.2	1.2	1.2	0.60	3.0	Pass
8000 Hz	2.7	2.8	2.9	0.70	5.0	Pass

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F36-708-0LM-01 Rev.04 Issue date: 5/9/24

Certificate No : 24-SLM-234
Request No : Req-2024-1453

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

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

6. Frequency and time weightings at 1kHz

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

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

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F36-708-0LM-01 Rev.04 Issue date: 5/9/24

Certificate No : 24-SLM-234
Request No : Req-2024-1453

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting	Anticipated REF (dB)	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		UUC (dB)	ERR (dB)			
FAST / A / 37-139						
STD dB	(dB)	(dB)	(dB)			
136.00	139	136.0	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
43.00	43	43.3	0.3		1.1	Pass
42.00	42	42.3	0.3		1.1	Pass
41.00	41	41.4	0.4		1.1	Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
F36-708-0LM-01 Rev.04 Issue date: 5/9/24

Certificate No : 24-SLM-234
Request No : Req-2024-1453

9. Level linearity including the level range control

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		UUC (dB)	ERR (dB)			
FAST / A						
UUC Range (dB)	(dB)	(dB)	(dB)			
37-139	46.30	46.4	0.1	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting	STD Toneburst (ms)	Anticipated Ref (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
			UUC (dB)	ERR (dB)			
A / 37-139							
UUC Time Response	(ms)	(dB)	(dB)	(dB)			
Fast	200	135.0	134.9	-0.1	0.20	1.0	Pass
	2	118.0	117.6	-0.4		+1.0, -2.5	Pass
	0.25	109.0	108.6	-0.4		+1.5, -5.0	Pass
	200	128.6	128.5	-0.1		1.0	Pass
Slow	2	109.0	108.9	-0.1		+1.0, -5.0	Pass
	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	99.8	-0.2		+1.5, -5.0	Pass

11. Peak C Sound level

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

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
F36-708-0LM-01 Rev.04 Issue date: 5/9/24

Certificate No : 24-SLM-234
Request No : Req-2024-1453

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC	(± dB)	(± dB)	
STD Setting	(dB)			
Positive one-half cycle	145.5			
Negative one-half cycle	145.4			
Deviated	0.1	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC	(± dB)	(± dB)	
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 1 kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

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

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
FSM-708-SLM-01 Rev.04 Issue date: 5/6/24

Certificate No : 24-SLM-234
Request No : Req-2024-1453

Decision Rule for Statements of Conformity

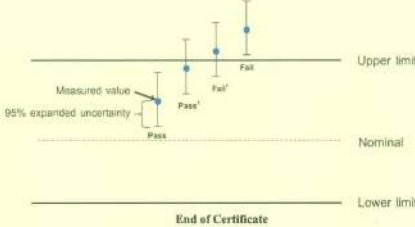
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2009, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
FSM-708-SLM-01 Rev.04 Issue date: 5/6/24

Certificate of Calibration

Customer

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

Unit Under Calibration Details

Measurement Item : Sound Level Meter Microphone Class : 2
Manufacturer : Larson Davis Microphone Model : 375902
Model : LX72 Microphone S/N : 11798
Serial Number : 0065346 Preamplifier Model : PRMLX72B
ID : UAEFM.0432563 Preamplifier S/N : 036138
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 : 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	29 August 2024	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	Svante	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 :  Approved By : 
Mr. Noppadon Luangrat Mr. Pachi Mathavom
Service Calibration Engineer Calibration Engineer Supervisor
Issue Date : 10 July 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
FSM-708-SLM-01 Rev.04 Issue date: 5/6/24

Certificate No : 24-SLM-235
Request No : Req-2024-1454

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR	(± dB)	(± dB)	
Calibrator Setting	(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 SVANTER, Model SV 35A, SN. 38079

2. Self-generated noise, Microphone installed

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

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting	(dB)	(± dB)
A	31.1	0.10
C	30.5	0.10
Z	35.6	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance Limit	Result
FAST / 37-139	A	C	Z	(± 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	1.1	1.1	1.1	0.60	3.0	Pass
8000 Hz	2.6	2.5	2.6	0.70	5.0	Pass

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

Certificate No : 24-SLM-235
Request No : Req-2024-1454

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

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

6. Frequency and time weightings at 1kHz

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

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

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เอกสารไม่ควบคุม

FM-700-SLM-01 Rev.04 Issue date: 5/6/24

Certificate No : 24-SLM-235
Request No : Req-2024-1454

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		REF	UUC	ERR		
FAST / A / 37-139	REF	UUC	ERR	0.30	1.1	Pass
STD dB	(dB)	(dB)	(dB)			
139.00	139	139.0	0.0			
134.00	134	134.0	0.0			
129.00	129	129.0	0.0			
124.00	124	124.0	0.0			
119.00	119	119.0	0.0			
114.00	114	114.0	0.0			
109.00	109	109.0	0.0			
104.00	104	104.0	0.0			
99.00	99	99.0	0.0			
94.00	94	94.0	0.0			
89.00	89	89.0	0.0			
84.00	84	84.0	0.0			
79.00	79	79.0	0.0			
74.00	74	74.0	0.0			
69.00	69	69.0	0.0			
64.00	64	64.0	0.0			
59.00	59	59.0	0.0			
54.00	54	54.0	0.0			
49.00	49	49.1	0.1			
44.00	44	44.2	0.2			
41.00	41	41.3	0.3			
42.00	42	42.3	0.3			
41.00	41	41.4	0.4			

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เอกสารไม่ควบคุม

FM-700-SLM-01 Rev.04 Issue date: 5/6/24

Certificate No : 24-SLM-235
Request No : Req-2024-1454

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		REF	ERR			
FAST / A	REF	UUC	ERR	0.30	1.1	Pass
UUC Range	(dB)	(dB)	(dB)			
37-139	46.40	46.5	0.1			
	114	114.0	0.0			

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	134.9	-0.1	0.20	1.0	Pass
	2	118.0	117.6	-0.4		+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
	200	129.0	129.0	0.0		1.0	Pass
SEL	2	109.0	108.8	-0.2		+1.0, -2.5	Pass
	0.25	100.0	99.7	-0.3		+1.5, -5.0	Pass

11. Peak C Sound level

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

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เอกสารไม่ควบคุม

FM-700-SLM-01 Rev.04 Issue date: 5/6/24

Certificate No : 24-SLM-235
Request No : Req-2024-1454

12. Overload indication

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

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / A / 37-139	UUC			
STD Setting	(dB)	0.10	0.30	Pass
Initial	128.0			
Final	128.0			
Deviated	0.0			

Note :

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

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

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

เอกสารไม่ควบคุม

FM-700-SLM-01 Rev.04 Issue date: 5/6/24

Certificate No : 24-SLM-235
Request No : Req-2024-1454

Decision Rule for Statements of Conformity

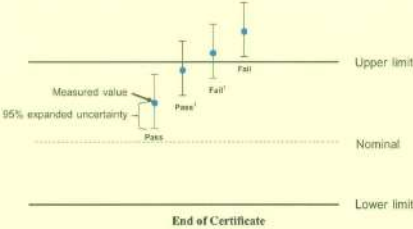
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



End of Certificate

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

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

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

Unit Under Calibration Details

Measurement Item : Sound Level Meter
Microphone Class : 2
Manufacturer : Larson Davis
Microphone Model : 375A04
Model : LX72
Microphone S/N : 335980
Serial Number : 0006691
Preamplifier Model : PBMLX72C
ID : UAE.FFM.131.2565
Preamplifier S/N : 071565
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 : 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	EFA0002.34	26 July 2024	TSI
Audio Generator	Svanek	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 Luangut
Service Calibration Engineer

Approved By : 
Mr. Paci Mathavorn
Calibration Engineer/Supervisor
Issue Date : 10 July 2024

เอกสารไม่ควบคุม

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

1. Indication at the calibration check frequency

UUC Setting FAST / A / 37-139	Nominal	Before Adjust		After Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	Level (dB)	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)			
Calibrator Setting								
1000 Hz 114 dB	113.76	114.2	0.44	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 FAST / 37-139	Measured (dB)	UNCERTAINTY (± dB)
UUC Weighting		
A	30.9	0.10

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

UUC Setting FAST / 37-139	Measured (dB)	UNCERTAINTY (± dB)
UUC Weighting		
A	30.8	0.10
C	30.5	0.10
Z	35.0	0.10

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

UUC Setting FAST / 37-139	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A	C	Z			
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.1	0.1	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	2.0	1.9	1.9	0.60	3.0	Pass
8000 Hz	1.7	1.6	1.7	0.70	5.0	Pass

เอกสารไม่ควบคุม

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

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

UUC Setting FAST / 37-139	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
STD Setting	A (dB)	C (dB)	Z (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	0.1	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	-0.1	-0.1	+5, -INF	Pass	

6. Frequency and time weightings at 1kHz

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

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

เอกสารไม่ควบคุม

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

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC	(± dB)	(± dB)	
STD Setting	(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	0.30
STD dB	(dB)	(dB)	(dB)	(± dB)	
139.00	139	139.0	0.0	1.1	
134.00	134	134.0	0.0	1.1	
129.00	129	129.0	0.0	1.1	
124.00	124	124.0	0.0	1.1	
119.00	119	119.0	0.0	1.1	
114.00	114	114.0	0.0	1.1	
109.00	109	109.0	0.0	1.1	
104.00	104	104.0	0.0	1.1	
99.00	99	99.0	0.0	1.1	
94.00	94	94.0	0.0	1.1	
89.00	89	89.0	0.0	1.1	
84.00	84	84.0	0.0	1.1	
79.00	79	79.0	0.0	1.1	
74.00	74	74.0	0.0	1.1	
69.00	69	69.0	0.0	1.1	
64.00	64	64.0	0.0	1.1	
59.00	59	59.0	0.0	1.1	
54.00	54	54.0	0.0	1.1	
49.00	49	49.3	0.1	1.1	
44.00	44	44.2	0.2	1.1	
43.00	43	43.3	0.3	1.1	
42.00	42	42.3	0.3	1.1	
41.00	41	41.4	0.4	1.1	
40.00	40	40.5	0.5	1.1	

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

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

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	46.00	46.1	0.1	1.1	
	134	134.0	0.0	1.1	

10. Tone burst response

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

11. Peak C Sound level

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

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

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

12. Overload indication

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

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC	(± dB)	(± 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

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

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

Decision Rule for Statements of Conformity

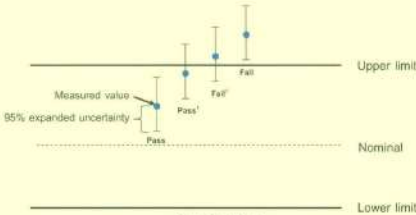
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:2019. Guidelines on the Reporting of Compliance with Specification as following Fig. and statements:

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

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

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

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



The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.
เอกสารไม่ควบคุม
FM-709-SLM-01 Rev.04 Issue date: 5/6/24

Certificate of Calibration

Customer

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

Certificate No : 24-NDM-107
Request No : Req-2024-0832

Unit Under Calibration Details

Measurement Item : Noise Dosimeter
Manufacturer : SVANTER
Model : SV 104
Serial Number : 117693
ID : UAE.EFM.115.2565
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV27
Microphone S/N : 112806
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 10 April 2024
Calibrated Date : 26 April 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Date calibration	Traceability
Multi-frequency Calibrator	Quest	Questcal	EFA000234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Sine Generator	SvanteK	Sva491	131	9 October 2024	WK Electric
Timer	EXTech	-	05-ACT	14 March 2025	TPA

Note

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

Calibrated By : 
Mr. Noppadon Luangrat
Service Calibration Engineer

Approved By : 
Mr. Pacht Mahavorn
Calibration Engineer Supervisor
Issue Date : 26 April 2024

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

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ISM-708-NDM-01 Rev.02 Issue date: 07/11/23

Certificate No : 24-NDM-107
Request No : Req-2024-0832

1. Absolute acoustical sensitivity

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

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances
FAST / 55-140	A	C	(± dB)	(± dB)
STD Setting	(dB)	(dB)		
63 Hz	0.2	0.2	0.40	2.0
125 Hz	-0.2	0.0	0.40	1.5
250 Hz	0.0	0.2	0.40	1.5
500 Hz	0.1	0.2	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.1	0.2	0.40	2.0
4000 Hz	2.3	2.4	0.40	3.0
8000 Hz	0.7	0.7	0.40	5.0

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

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ISM-708-NDM-01 Rev.02 Issue date: 07/11/23

Certificate No : 24-NDM-107
Request No : Req-2024-0832

3. Linearity of response to steady signals

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

UUC Setting	FAST / A / High									
Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
1000 Hz	Level A	(dB)	54.6	80.1	90.1	100.0	110.0	114.0	120.0	130.0
	Error	(dB)	-0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9
	Level A	(dB)			88.9	98.9	108.9	112.9	118.9	128.9
	Error	(dB)			0.0	0.0	0.0	0.0	0.0	-0.1
63 Hz	Ref	(dB)					87.8	93.8	103.8	113.8
	Level A	(dB)					87.8	93.8	103.8	113.8
	Error	(dB)					0.0	0.0	0.0	0.0
Tolerances Limit		(±dB)	1.0							
UNCERTAINTY		(±dB)	0.3							

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
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
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	0.99	-1.00		
1000 Hz 110 dB	180	180	2.00	1.98	-1.00		
1000 Hz 120 dB	36	36	4.00	3.94	-1.50		
1000 Hz 120 dB	72	72	8.00	7.87	-1.63	5.6	-21, +26
1000 Hz 120 dB	90	90	10.00	9.90	-1.00		
1000 Hz 120 dB	180	180	20.00	19.76	-1.20		
1000 Hz 120 dB	360	360	40.00	39.42	-1.45		
1000 Hz 120 dB	720	720	80.00	78.66	-1.68		

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ISM-708-NDM-01 Rev.02 Issue date: 07/11/23

Certificate No : 24-NDM-107
Request No : Req-2024-0832

4. Response to short duration

a. Response for sinusoidal signals – reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
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)	(Pa ² h)
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.052	-0.29, +0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
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	1.00	0.00	5.6	-21, +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00		-29, +41
Burst 1 ms, 108 dB	143	143	1.00	1.01	+1.00		-29, +41

5. Response to unipolar pulse

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

* Indicates non accredited

End of Certificate

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

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ISM-708-NDM-01 Rev.02 Issue date: 07/11/23

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

Unit Under Calibration Details

Measurement Item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 143224
ID : UAE.EFM.142/2566
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV27
Microphone S/N : I32054
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Calibration Environment and Details


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

Reference Standard

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

Note

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

Calibrated By : 
Mr. Noppadon Luangrat
Service Calibration Engineer

Approved By : 
Mr. Puch Mathavom
Calibration Engineer Supervisor
Issue Date : 15 July 2024

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P56-706-NDM-01 Rev.04 Issue date 3/6/24

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

1. Absolute acoustical sensitivity

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

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

2. Frequency weightings

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

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P56-706-NDM-01 Rev.04 Issue date 3/6/24

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

3. Linearity of response to steady signals

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

UUC Setting	Ref	(dB)	55.0	60.0	65.0	70.0	75.0	80.0	85.0	90.0	95.0	100.0	105.0	110.0	115.0	120.0	125.0	130.0	140.0
1000 Hz	Level A	(dB)	54.9	60.2	65.2	70.2	75.2	80.2	85.2	90.2	95.2	100.2	105.2	110.2	115.2	120.2	125.2	130.2	140.2
	Error	(dB)	0.1	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8000 Hz	Level A	(dB)	88.9	98.9	108.9	118.9	128.9	138.9	148.9	158.9	168.9	178.9	188.9	198.9	208.9	218.9	228.9	238.9	248.9
	Error	(dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
63 Hz	Level A	(dB)	87.8	93.8	103.8	113.8	123.8	133.8	143.8	153.8	163.8	173.8	183.8	193.8	203.8	213.8	223.8	233.8	243.8
	Error	(dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tolerances Limit		(±dB)	1.0																
UNCERTAINTY		(±dB)	0.3																
Result			Pass																

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	(%)	Limit	Result
Calibrator Setting	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)		(%)	
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.0	-21, +26	Pass
1000 Hz 110 dB	45	45	0.50	0.50	0.00			Pass
1000 Hz 110 dB	90	90	1.00	1.01	+1.00			Pass
1000 Hz 110 dB	180	180	2.00	2.02	+1.00			Pass
1000 Hz 120 dB	36	36	4.00	4.03	+0.75			Pass
1000 Hz 120 dB	72	72	8.00	8.05	+0.63			Pass
1000 Hz 120 dB	90	90	10.00	9.90	-1.00			Pass
1000 Hz 120 dB	180	180	20.00	19.76	-1.20	5.6		Pass
1000 Hz 120 dB	360	360	40.00	40.34	+0.85			Pass
1000 Hz 120 dB	720	720	80.00	80.49	+0.61			Pass

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P56-706-NDM-01 Rev.04 Issue date 3/6/24

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

4. Response to short duration

a. Response for sinusoidal signals - reference level

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

b. Sound exposure meter response for series of toneburst impulses

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

5. Response to unipolar pulse

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

* Indicates non accredited

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P56-706-NDM-01 Rev.04 Issue date 3/6/24

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

Decision Rule for Statements of Conformity

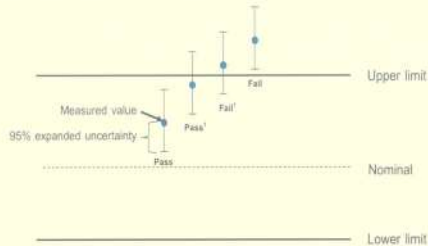
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements.

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.

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

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



End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-NDM-01 Rev.05 Issue date 2/6/24

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

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

Certificate No : 24-NDM-220
Request No : Req-2024-1258

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 143228
ID : UAE-EFM-146/2566
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV27
Microphone S/N : 136866
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 6 June 2024
Calibrated Date : 10 September 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

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

Note

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

Calibrated By : 
Mr. Noppadon Luangari
Service Calibration Engineer

Approved By : 
Mr. Pachi Mathayorn
Calibration Engineer Supervisor
Issue Date : 10 September 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-NDM-01 Rev.05 Issue date 2/6/24

เอกสารไม่ควบคุม

Certificate No : 24-NDM-220
Request No : Req-2024-1258

1. Absolute acoustical sensitivity

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

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances	Result
FAST / 55-140	A	C	(± dB)	(± dB)	
STD Setting	(dB)	(dB)			
63 Hz	0.1	0.1	0.40	2.0	Pass
125 Hz	0.0	0.2	0.40	1.5	Pass
250 Hz	-0.2	-0.1	0.40	1.5	Pass
500 Hz	-0.1	0.0	0.40	1.5	Pass
1000 Hz	0.0	0.0	0.40	-	-
2000 Hz	-0.1	-0.1	0.40	2.0	Pass
4000 Hz	1.2	1.1	0.40	3.0	Pass
8000 Hz	2.0	1.9	0.40	5.0	Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-NDM-01 Rev.05 Issue date 2/6/24

เอกสารไม่ควบคุม

Certificate No : 24-NDM-220
Request No : Req-2024-1258

3. Linearity of response to steady signals

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

UUC Setting	Ref	FAST / A / High											
		(dB)	35.0	80.0	80.0	100.0	110.0	114.0	120.0	130.0	140.0		
1000 Hz	Level A	(dB)	54.6	80.5	90.2	100.1	110.0	114.0	120.0	130.0	140.0		
	Error	(dB)	-0.4	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0		
		(dB)											
8000 Hz	Ref	(dB)		88.9	98.9	108.9	112.9	116.9	128.9	138.9			
	Level A	(dB)		88.9	98.9	108.9	112.9	116.9	128.9	138.9			
	Error	(dB)		0.0	0.0	0.0	0.0	0.0	-0.1	-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	1.01	+1.00			Pass
1000 Hz 110 dB	180	180	2.00	2.02	+1.00			Pass
1000 Hz 120 dB	36	36	4.00	4.03	+0.75			Pass
1000 Hz 120 dB	72	72	8.00	8.05	+0.63	5.6		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

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-NDM-01 Rev.05 Issue date 2/6/24

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Certificate No : 24-NDM-220
Request No : Req-2024-1258

4. Response to short duration
a. Response for sinusoidal signals - reference level

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

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time	Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 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	1.00	0.00	-21 ~ +26	Pass
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00	-29 ~ +41	Pass
Burst 1 ms, 108 dB	143	143	1.00	1.01	+1.00	-28 ~ +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	10.17	0.00	3.7	-21 ~ +26	Pass	Pass
Continuous Rectangle -		10.17					Pass

* Indicates non accredited

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

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FM-708-NDM-01 Rev.03 Issue date 2/9/24

Certificate No : 24-NDM-220
Request No : Req-2024-1258

Decision Rule for Statements of Conformity

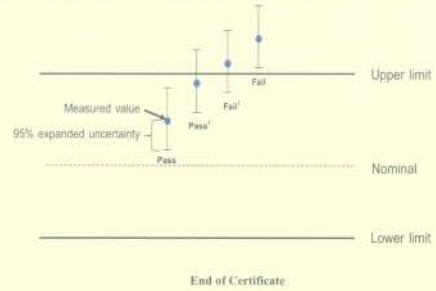
The standard decision rule employed for the statements of conformity to such calibration result will be applied using ILAC-G8:2019. Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



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

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FM-708-NDM-01 Rev.03 Issue date 2/9/24

Certificate of Calibration

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

Certificate No : 24-AFM-010 Rev.1
Request No : Req-2023-2235

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : TSI
Model : 4146
Serial Number : 41461922008
ID : UAE EFM.224-2562
Location of Calibration : LAB 4 AIR VELOCITY METER

Senior Model : -
Sensor Serial Number : -

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 18 October 2023
Calibration Date : 23 January 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	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	08000057	Qreborn	27 February 2024
Pressure meter	CPG2400	41000KDU/651882	TPA	9 November 2024


Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 2943.01.

Note :

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %
This Certificate was issued to replace to Calibration Certificate No. 24-AFM-010

Calibration By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 24 April 2024

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

FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate No : 24-AFM-010 Rev.1
Request No : Req-2023-2235

Result of Calibration :

Temperature	Pressure	STD	UUC	Error	Uncertainty
(°C)	(kPa)	(l/min)	(l/min)	(l/min)	(l/min)
24.40	101.19	0.020	0.020	0.000	0.0013
24.30	101.15	0.050	0.050	0.000	0.0033
24.40	101.12	0.099	0.100	0.001	0.0028
24.50	100.95	0.200	0.202	0.002	0.0056
24.60	100.91	0.501	0.500	-0.001	0.0074
26.60	100.96	0.994	1.000	0.006	0.015
24.50	100.90	1.691	1.701	0.010	0.025
24.60	100.92	1.997	2.011	0.014	0.029
26.60	101.20	2.903	3.020	0.027	0.042
24.50	101.20	4.019	4.000	-0.019	0.056
24.60	101.20	5.024	5.006	-0.018	0.070

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

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

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

* Indicates non accredited

End of Certificate

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

FM-708-AFM-01 Rev.00 Issue date 01/07/19



Certificate of Calibration

Certificate No.: 24H700
Page: 1 of 2

Equipment: Digital Thermo-Hygrometer

Manufacturer: Testo

Model: 608-H1

Serial No.: 34643154

ID No.: UAE.ANV.133/2550

Condition As-Received: Used Item

Received Date: 03 April 2024

Calibration Date: 05 April 2024

Reference: 2404-0121WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

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

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

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

Condition of this result of calibration

1.Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Chilled Mirror Hygrometer	Dew Master	44730	21656	02 Aug 2024
2) Handheld Thermometer With Sensor	1521	ASA339	2311236	16 Oct 2024

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

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

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

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

Calibrated by: Vipom Tantiyawutti
Issue Date: 12 April 2024

Approved Signatory:

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

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B 0338421



Result of Calibration:-

Without Adjustment

Function: Humidity Measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	44.1	4.0	1.3
25.0	50.1	54.1	4.0	1.6
25.0	60.0	63.1	3.1	1.6
25.0	70.2	72.7	2.5	1.6

Result of Calibration:-

Without Adjustment

Function: Temperature Measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
15.004	15.0	-0.004	0.42
19.983	20.0	0.017	0.42
25.012	25.0	-0.012	0.42
30.000	29.8	-0.200	0.42
39.996	39.5	-0.496	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%.

-000-

Cert. No.: 24H700
Page.: 2 of 2

เอกสารไม่ควบคุม

a 1210312



Certificate of Calibration

Certificate No.: 24H701
Page: 1 of 2

Equipment: Digital Thermo-Hygrometer

Manufacturer: Testo

Model: 608-H1

Serial No.: 34635471

ID No.: UAE.ANV.136/2550

Condition As-Received: Used Item

Received Date: 03 April 2024

Calibration Date: 05 April 2024

Reference: 2404-0121WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

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

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

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

Condition of this result of calibration

1.Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Chilled Mirror Hygrometer	Dew Master	44730	21656	02 Aug 2024
2) Handheld Thermometer With Sensor	1521	ASA339	2311236	16 Oct 2024

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

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

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

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

Calibrated by: Vipom Tantiyawutti
Issue Date: 12 April 2024

Approved Signatory:

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

เอกสารไม่ควบคุม

B 0338422



Result of Calibration:-

Without Adjustment

Function: Humidity Measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	46.1	6.0	1.3
25.0	50.1	56.0	7.9	1.6
25.0	60.0	68.7	8.7	1.6

Result of Calibration:-

Without Adjustment

Function: Temperature Measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.983	20.3	0.317	0.42
30.000	30.0	0.000	0.42
39.996	39.7	-0.296	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%.

-000-

Cert. No.: 24H701
Page.: 2 of 2

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a 1210311



Certificate of Calibration

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

Certificate No : 24-TPM-248
Request No : Req-2023-2361

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-32
Serial Number : TPT060014
Resolution : 0.1 °C
ID Number : UAE.EFM.221/2562

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

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 8 November 2023
Calibrated Date : 3 June 2024
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

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

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

Note

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

Approved By :

Mr. Noppadon Luangari

Technical Manager

Issue Date : 3 June 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority.
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FSM-709-TPM-01 Rev.01 Issue Date 13/02/20

Certificate No : 24-TPM-248

Request No : Req-2023-2361

Page : 2/2

Calibration Note

UUC Adjustment : Not Adjust

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
WET	20.031	19.9	+0.1	0.13
	25.034	24.9	+0.1	0.13
	30.034	29.8	+0.1	0.13
	35.035	34.9	+0.1	0.13
	40.038	39.9	+0.1	0.13
	45.041	44.9	+0.1	0.13
DRY	50.043	49.8	+0.1	0.13
	60.046	59.9	+0.1	0.13
	20.032	19.9	+0.1	0.13
	25.034	24.9	+0.1	0.13
	30.036	29.9	+0.1	0.13
	35.037	34.9	+0.1	0.13
GLOBE	40.040	39.9	+0.1	0.13
	45.040	45.0	0.0	0.13
	50.042	50.0	0.0	0.13
	60.046	60.0	0.0	0.13
	20.032	20.0	0.0	0.13
	25.033	25.0	0.0	0.13

End of Certificate

Calibrated By :

Mr. Sittichok Jirapulsuksakul

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority.
เอกสารไม่ควบคุม
FSM-709-TPM-01 Rev.01 Issue Date 13/02/20



Certificate of Calibration

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

Certificate No : 24-TPM-147
Request No : Req-2024-0546

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-32
Serial Number : TPW020005
Resolution : 0.1 °C
ID Number : UAE.EFM.122/2565

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

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 5 March 2024
Calibrated Date : 21 March 2024
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/INGGO, Model: GT11/RTD100, SN: 12000077, ID: AR-TPM Which was calibrated on 27 October 2023, Calibration Certificate No.: QR23-2374

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

Note

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

Approved By :

Mr. Noppadon Luangari

Technical Manager

Issue Date : 21 March 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority.
เอกสารไม่ควบคุม
FSM-709-TPM-01 Rev.01 Issue Date 13/02/20

Certificate No : 24-TPM-147

Request No : Req-2024-0546

Page : 2/2

Calibration Note

UUC Adjustment : Not Adjust

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
WET	20.030	20.1	-0.1	0.13
	25.033	25.1	-0.1	0.13
	30.035	30.1	-0.1	0.13
	35.036	35.0	0.0	0.13
	40.038	40.0	0.0	0.13
	45.041	44.9	+0.1	0.13
DRY	50.044	49.9	+0.1	0.13
	60.047	59.9	+0.1	0.13
	20.031	20.2	-0.2	0.13
	25.033	25.2	-0.2	0.13
	30.034	30.2	-0.2	0.13
	35.036	35.2	-0.2	0.13
GLOBE	40.038	40.2	-0.2	0.13
	45.039	45.2	-0.2	0.13
	50.043	50.2	-0.2	0.13
	60.047	60.2	-0.2	0.13
	20.032	20.2	-0.2	0.13
	25.033	25.2	-0.2	0.13

End of Certificate

Calibrated By :

Mr. Sittichok Jirapulsuksakul

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority.
เอกสารไม่ควบคุม
FSM-709-TPM-01 Rev.01 Issue Date 13/02/20

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-079
Request No : Req-2024-0537
Page : 1/2

Unit Under Calibration Details

Instrument Name : Light Meter
Manufacturer : EXTECH
Model : 407026
Serial Number : A037351
Resolution : 1 lx
ID Number : UAE.EFM.086/25561
Range Calibration : 2000 , 20000 lx
Instrument Status : Used


Calibration Environment and Details

Temperature : 25 °C ± 2 °C
Humidity : 60 %RH ± 20 %RH
Received Date : 5 March 2024
Calibrated Date : 25 March 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 : 15 March 2024

เอกสารไม่ควบคุม

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-LXM-01 Rev.00 Issue date 01/07/19

Calibration Note
UUC Adjustment : Zero adjustment before use


Certificate No : 24-LXM-079
Request No : Req-2024-0537
Page : 2/2

Result of Calibration :

UUC Range (lx)	Standard (lx)	UUC Reading (lx)	Correction (lx)	Uncertainty (= lx)
2000	0	0	0	0.0058
	50	50	0	2.2 % of Reading
	100	101	-1	2.2 % of Reading
	200	204	-1	2.2 % of Reading
	300	302	-2	2.2 % of Reading
	400	405	-5	2.2 % of Reading
	600	605	-5	2.2 % of Reading
	800	807	-7	2.2 % of Reading
	1000	1011	-11	2.2 % of Reading
	1200	1209	-9	2.2 % of Reading
	1400	1410	-10	2.2 % of Reading
	1600	1608	-8	2.2 % of Reading
	1800	1809	-9	2.2 % of Reading
	2000	1993	7	2.2 % of Reading
20000	3000	2990	10	2.2 % of Reading
	4000	3970	30	2.2 % of Reading
	5000	4960	40	2.2 % of Reading

* Indicates non accredited

End of Certificate

Calibrated By : 
Mr. Noppadon Luangrat

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-LXM-01 Rev.00 Issue date 01/07/19

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-LXM-103
Request No : Req-2024-0838
Page : 1/2

Unit Under Calibration Details

Instrument Name : Light Meter
Manufacturer : EXTECH
Model : 407026
Serial Number : A056652
Resolution : 1 lx
ID Number : UAE.EFM.126/2565
Range Calibration : 2000 , 20000 lx
Instrument Status : Used


Calibration Environment and Details

Temperature : 25 °C ± 2 °C
Humidity : 60 %RH ± 20 %RH
Received Date : 10 April 2024
Calibrated Date : 29 April 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 : 29 April 2024

เอกสารไม่ควบคุม

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-LXM-01 Rev.00 Issue date 01/07/19

Calibration Note
UUC Adjustment : Zero adjustment before use


Certificate No : 24-LXM-103
Request No : Req-2024-0838
Page : 2/2

Result of Calibration :

UUC Range (lx)	Standard (lx)	UUC Reading (lx)	Correction (lx)	Uncertainty (= lx)
2000	0	0	0	0.0058
	50	50	0	2.2 % of Reading
	100	101	-1	2.2 % of Reading
	200	202	-2	2.2 % of Reading
	300	303	-3	2.2 % of Reading
	400	402	-2	2.2 % of Reading
	600	604	-4	2.2 % of Reading
	800	804	-4	2.2 % of Reading
	1000	1005	-5	2.2 % of Reading
	1200	1209	-9	2.2 % of Reading
	1400	1400	-9	2.2 % of Reading
	1600	1614	-14	2.2 % of Reading
	1800	1809	-9	2.2 % of Reading
	2000	1989	11	2.2 % of Reading
20000	3000	2970	30	2.2 % of Reading
	4000	3970	30	2.2 % of Reading
	5000	4960	40	2.2 % of Reading

* Indicates non accredited

End of Certificate

Calibrated By : 
Mr. Noppadon Luangrat

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-LXM-01 Rev.00 Issue date 01/07/19

เอกสารไม่ควบคุม