

ภาคผนวก ง

เอกสารสอบเทียบเครื่องมือ

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Tisch Environmental, Inc.	TE-5025A 3393	Jiranatee Associates Co., Ltd.	CL-004-65	26 Jul 22	25 Jul 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	22P801	12 Mar 22	11 Mar 23	-
3	Mass Flow Meter	Benzene	Alicat Scientific, Inc.	MB-5SCCM-D/5M 57730	Miracle International Technology Co., Ltd.	AD2110-274-0001	1 Nov 21	31 Oct 22	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Benzene	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22P2722	22 Jul 22	21 Jul 23	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Benzene	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22H1587	27 Jul 22	26 Jul 23	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo	42C 42C-0508011076	UAE Consultant Co., Ltd.	19042022	19 Apr 22	18 Apr 23	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Fisher Scientific	42C 0517512000	UAE Consultant Co., Ltd.	07042022	7 Apr 22	6 Apr 23	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Electron	42C 0517512001	UAE Consultant Co., Ltd.	07042022	7 Apr 22	6 Apr 23	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM08130002	UAE Consultant Co., Ltd.	07042022	7 Apr 22	6 Apr 23	-
10	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-67174-356	UAE Consultant Co., Ltd.	19042022	19 Apr 22	18 Apr 23	-
11	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-

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No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1200906874	UAE Consultant Co.,Ltd.	08042022	8 Apr 22	7 Apr 23	-
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1200906876	UAE Consultant Co.,Ltd.	07122021	7 Dec 21	6 Dec 22	-
14	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1200906876	UAE Consultant Co.,Ltd.	03042022	3 May 22	2 May 23	-
15	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778111	UAE Consultant Co.,Ltd.	03042022	3 May 22	2 May 23	-
16	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778113	UAE Consultant Co.,Ltd.	03042022	3 May 22	2 May 23	-
17	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778116	UAE Consultant Co.,Ltd.	22042022	22 Apr 22	21 Apr 23	-
18	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
19	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1180540068	UAE Consultant Co.,Ltd.	29042022	29 Apr 22	28 Apr 23	-
20	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1180540069	UAE Consultant Co.,Ltd.	29042022	29 Apr 22	28 Apr 23	-
21	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1180540074	UAE Consultant Co.,Ltd.	26042022	26 Apr 22	25 Apr 23	-
22	Carbon Monoxide Analyzer	Carbon Monoxide	Horiba	APMA-370 YN43AG7T	UAE Consultant Co.,Ltd.	26042022	26 Apr 22	25 Apr 23	-
23	Carbon Monoxide Analyzer	Carbon Monoxide	Horiba	APMA-370 YRLHTB7G	UAE Consultant Co.,Ltd.	26042022	26 Apr 22	25 Apr 23	-

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No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
24	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
25	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DT0004	Scarlet Tech Ltd.	22022022	22 Feb 22	21 Feb 23	-
26	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DT0041	Scarlet Tech Ltd.	25032022	25 Mar 22	24 Mar 23	-
27	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DT0052	Scarlet Tech Ltd.	25032022	25 Mar 22	24 Mar 23	-
28	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DT0058	Scarlet Tech Ltd.	25032022	25 Mar 22	24 Mar 23	-
29	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DT0065	Scarlet Tech Ltd.	25032022	25 Mar 22	24 Mar 23	-
30	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35A 73249	Innovative Instrument Co.,Ltd.	22-ACT-406	1 Jul 22	30 Jun 23	-
31	Sound Level Meter	L _{Aeq} 24 hours	Larson Davis	LxT2 0005286	Sithiporn Associates Co., Ltd.	ACL22081	25 Jan 22	24 Jan 23	-
32	Sound Level Meter	L _{Aeq} 24 hours	Larson Davis	LxT2 0005289	Sithiporn Associates Co., Ltd.	ACL22082	25 May 22	24 May 23	-
33	Sound Level Meter	L _{Aeq} 24 hours	Larson Davis	LxT2 0005304	Innovative Instrument Co.,Ltd.	22-ACT-249	1 Apr 22	31 Mar 23	-
34	Sound Level Meter	L _{Aeq} 24 hours	Larson Davis	LxT2 0005344	Innovative Instrument Co.,Ltd.	22-ACT-248	1 Apr 22	31 Mar 23	-
35	Sound Level Meter	L _{Aeq} 24 hours	Larson Davis	LxT2 0005394	Innovative Instrument Co.,Ltd.	22-ACT-034	21 Jan 22	20 Jan 23	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
36	Sound Level Meter	L _{Aeq} 24 hours	Larson Davis	LxT2 0005395	Innovative Instrument Co.,Ltd.	22-ACT-247	1 Apr 22	31 Mar 23	-
37	Sound Level Meter	L _{Aeq} 24 hours	Larson Davis	LxT2 0005396	Innovative Instrument Co.,Ltd.	22-ACT-105	11 Feb 22	10 Feb 23	-
38	Sound Level Meter	L _{Aeq} 24 hours	Larson Davis	LxT2 0005398	Innovative Instrument Co.,Ltd.	22-ACT-035	21 Jan 22	20 Jan 23	-
39	Sound Level Meter	L _{Aeq} 24 hours	Larson Davis	LxT2 0005400	Innovative Instrument Co.,Ltd.	22-ACT-036	21 Jan 22	20 Jan 23	-
40	Sound Level Meter	L _{Aeq} 24 hours	Larson Davis	LxT2 0005402	Innovative Instrument Co.,Ltd.	22-ACT-103	11 Feb 22	10 Feb 23	-
41	Sound Level Meter	L _{Aeq} 24 hours	Larson Davis	LxT2 0005405	Innovative Instrument Co.,Ltd.	22-ACT-101	11 Feb 22	10 Feb 23	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Stack									
1	Pre-Test Console	Total Suspended Particulate Hydrogen Sulphide Mercury	Apex Instruments, USA.	XC-572-V 1701018	Envi Equipment Service Co., Ltd.	E22-08034	17 Aug 22	16 Aug 23	-
2	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide Carbon Monoxide	Testo	Testo 350 60899698	Entech Industrial Solution Co., Ltd.	G 650090	11 Feb 22	10 Feb 23	-
3	Gas Detector	TVOCs	RAE Systems, Inc.	Mini-RAE 3000 592-925267	Executive Trading Limited	RA 111/22	21 Jul 22	20 Jul 23	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Workplace									
1	Primary Flow Calibrator	Calibrate personal pump	TSI, Inc	5300 53002052003	Innovative Instrument Co., Ltd.	22-AFM-039	22 Mar 22	21 Mar 23	-
2	Aneroid Barometer	Respirable Dust Hydrogen Sulphide Benzene Methanol Toluene Xylene Hexane	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22P2724	22 Jul 22	21 Jul 23	-
3	Dial Thermo-Hygrometer	Respirable Dust Hydrogen Sulphide Benzene Methanol Toluene Xylene Hexane	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22H1586	27 Jul 22	26 Jul 23	-
4	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6307	Innovative Instrument Co., Ltd.	22-ACT-373	8 Jun 22	7 Jun 23	-
5	Sound Level Meter	$L_{Aeq\ 8\ hours}$, L_{Amax}	Rion, Japan	NL-42 00709670	Innovative Instrument Co., Ltd.	22-ACT-060	2 Feb 22	1 Feb 23	-
6	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35A 73249	Innovative Instrument Co., Ltd.	22-ACT-406	1 Jul 22	30 Jun 23	-
7	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 67627	Innovative Instrument Co., Ltd.	22-ACT-610	22 Sep 22	21 Sep 23	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Workplace									
8	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 91925	Innovative Instrument Co.,Ltd.	22-ACT-033	21 Jan 22	20 Jan 23	-
9	Digital Light Meter	Light	Extech Instrument, Taiwan	407026 A 016905	Innovative Instrument Co.,Ltd.	21-LXM-154	12 Nov 21	11 Nov 22	-

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	YSI	pH100A JC03335	Technology Promotion Association (Thailand-Japan)	22CH541	19 Apr 22	18 Apr 23	-
2	DO Meter	DO	Horiba	LAQUA-DO210 HE0H0008	Technology Promotion Association (Thailand-Japan)	22TW45	18 Feb 22	17 Feb 23	-
3	Conductivity Meter	Conductivity	YSI	Pro30 18C103131	Technology Promotion Association (Thailand-Japan)	21CH1155	31 Aug 22	30 Aug 23	-

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพอากาศ									
1	Analytical Balance (Readability 0.1 mg)	ฝุ่นละอองรวม (TSP) ฝุ่นละอองขนาดเล็กไม่เกิน 10	Mettler-Toledo	AB204-S / 1128312528	National Food Institute, Ministry of Industry, Thailand	TH2058-097-040722- ACC-TH	7 Apr 22	6 Apr 23	
2	Analytical Balance (Readability 0.1 mg)	(PM-10)	Mettler-Toledo	AB204-S/FACT / B108115858	National Food Institute, Ministry of Industry, Thailand	TH2058-098-040722- ACC-TH	7 Apr 22	6 Apr 23	-
3	Gas Chromatography - Mass Spectrometer (GC-MS)	เบนซีน สารอินทรีย์ระเหยง่าย (VOCs)	Bruker Scion	451-GC / BR1201M099 Scion-SQ / GQS1203F021 CP8400 / BR1203M331	World Tech Enterprise Co.,Ltd.	SV2205/20385	19 May 22	18 May 23	-
4	UV-VIS Spectrophotometer	NOX as NO2 H2S	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP21-016	31 May 22	30 May 23	-
5	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP22-007	20 Jan 22	19 Jan 23	-
6	Atomic Absorption Spectrometer (AAS)	Hg	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research (TISTR).	MTC.ACL. No. 486/65	7 Mar 22	6 Mar 23	-
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพอากาศ และน้ำ									
7	pH Meter	พีเอช, อุณหภูมิ	Hanna Instrument	HI2020-02 / C0051107	National Food Institute, Ministry of Industry, Thailand	2203135-001-01	8 Jun 22	7 Jun 23	-
8	pH Meter		Mettler-Toledo	Seven Easy S20 / 123052512	National Food Institute, Ministry of Industry, Thailand	2202093-001-01	16 Mar 22	15 Mar 23	-
9	Conductivity Meter	ค่าการนำไฟฟ้า	SI Analytics	Lab955 / 16300356	SPC Calibration Center Co.,Ltd.	C24220084	22 Mar 22	21 Mar 23	-
10	Analytical Balance (Repeatability 0.01 mg)	สารแขวนลอย ,ทีดีเอส	Mettler-Toledo	XSR205DU / C009071872	Technology Promotion Association (Thailand-Japan)	22MM210	26 Apr 22	25 Apr 23	
11	Hot Air Oven		Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	22TM1490	19 Oct 22	18 Oct 23	
12	Analytical Balance (Repeatability 0.1 mg)	น้ำมันและไขมัน, ปิโตรเลียมไฮโดรคาร์บอน	Mettler-Toledo	XSR204 / C117635043	National Food Institute, Ministry of Industry, Thailand	2202934-001-01	13 May 22	12 May 23	

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
13	COD Reactor (Heating Block)	ซีโอดี	Hanna	HI839800-02 / 4500052101	Hanna Instruments (Thailand) Ltd.	HIT-2219-0480	9 May 22	8 May 23	

เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพอากาศ และน้ำ									
14	BOD Incubator	บีโอดี	Arco	UC4-1320 / (UAE.LAB.015/2561)	Technology Promotion Association (Thailand-Japan)	22TM90	17 Feb 22	16 Feb 23	-
15	BOD Incubator		Arco	UR-1320 / (UAE.LAB.018/2551)	Technology Promotion Association (Thailand-Japan)	22TM305	7 Apr 22	6 Apr 23	-
16	Incubator (Cooled Incubator)	โคลิฟอร์มแบคทีเรีย	Memmert	IPP 260 / V616.0066	Technology Promotion Association (Thailand-Japan)	22TM672	5 May 22	4 May 23	-
17	Incubator (Cooled Incubator)		Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	22TM563	7 Apr 22	6 Apr 23	-
18	Water Bath		Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	22TM334	17 Feb 22	16 Feb 23	-
19	Water Bath		Memmert	WNE 14 / L414.1407	Technology Promotion Association (Thailand-Japan)	22TM565	7 Apr 22	6 Apr 23	-
20	Analytical Balance		Mettler-Toledo	MS603S / B0070110311	National Food Institute, Ministry of Industry, Thailand	2058-096-040722-ACC-T	7 Apr 22	6 Apr 23	
21	Auto Clave		ALP	CL-40L / 802664	Technology Promotion Association (Thailand-Japan)	22TM89	17 Feb 22	16 Feb 23	-
22	Atomic Absorption Spectrometer (AAS)	ปรอท	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research (TISTR).	MTC.ACL. No. 486/65	7 Mar 22	6 Mar 23	-
23	Atomic Fluorescence Spectrometer (AFS)	ปรอทรวม (น้ำทะเล)	Analytik Jena	mercur DUO plus / K170A0153	Analytik Jena FarEast Thailand Ltd.	Maintenance Protocol C04-006	4 Apr 22	3 Apr 23	-
24	Fluorescence Spectrometer	ปิโตรเลียมไฮโดรคาร์บอน (น้ำทะเล)	Perkin Elmer	LS 55 / 81440	Perkin Elmer Ltd.	FLR1001-2021	18 Feb 22	17 Feb 23	-
25	Turbidity Meter	ความขุ่น	Oakton	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	22CH1184	5 Sep 22	4 Sep 23	-

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
26	Digestor Unit	Total Kjeldahl Nitrogen (TKN)	FOSS TECATOR	2520auto / 91794469	Sithiporn Associates Co.,Ltd.	2202361-001-01	4 Apr 22	3 Apr 23	-
27	Distillation Unit (Kjeldahl Method)		FOSS TECATOR	KT200 / 91790524	Sithiporn Associates Co.,Ltd.	5874	30 Nov 21	29 Nov 22	-

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

รายการใบรับรองสอบเทียบเครื่องมือหลักประจำห้องปฏิบัติการสำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือสำหรับวิเคราะห์คุณภาพน้ำ									
1	pH Meter	ค่าความเป็นกรด-ด่าง, อุณหภูมิ	Hanna Instrument	HI2020-02 / C0051107	National Food Institute, Ministry of Industry, Thailand	2203135-001-01	8 Jun 22	7 Jun 23	-
2	pH Meter		Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2201793-001-01	1 Mar 22	28 Feb 23	-
3	Analytical Balance (Readability 0.01 mg)	ปริมาณสารแขวนลอย	Mettler-Toledo	AX105DR / 1122100406	National Food Institute, Ministry of Industry, Thailand	2200708-001-01	24 Nov 21	23 Nov 22	-
4	Hot Air Oven		Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	22TM1490	19 Oct 22	18 Oct 23	-
5	Analytical Balance (Readability 0.1 mg)	ไขมันและน้ำมัน	Mettler-Toledo	AB-204S/FACT / 1129361010	National Food Institute, Ministry of Industry, Thailand	2203120-001-01	1 Jun 22	31 May 23	-

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

MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Rods Meter). The humid gas was used as 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 (g) Standard calibration data

Plate	Flow rate m³/min	Pressure [Pa] mmHg	Temperature [Tg] °C	Temperature [Tm] °C	Ag_meter mmHg	Ag_Orifice mmHg	T	Standard Flow [Qs] m³/min
1	0.699	756.468	24.680	23.730	55.667	1.705	1.303	0.647
2	1.001	756.479	24.690	24.180	61.363	3.454	1.855	0.918
3	1.314	756.484	24.550	23.870	41.751	4.935	2.176	1.051
4	1.166	756.510	24.470	23.900	30.652	5.138	2.244	1.118
5	1.410	756.534	24.400	24.150	30.309	7.019	2.757	1.357

Slope (s): 2.04689
Intercept (t): -0.02301
Correlation coefficient (r): 0.99987
Uncertainty (k=2): 0.010 m³/min

Table 2: The results of (g) actual calibration data

Plate	Flow rate m³/min	Pressure [Pa] mmHg	Temperature [Tg] °C	Temperature [Tm] °C	Ag_meter mmHg	Ag_Orifice mmHg	T	Standard Flow [Qs] m³/min
1	0.699	756.468	24.680	23.730	55.667	1.705	0.819	0.649
2	1.001	756.479	24.690	24.180	61.363	3.454	1.167	0.922
3	1.114	756.494	24.550	23.970	41.751	4.935	1.396	1.064
4	1.166	756.510	24.470	23.900	30.652	5.138	1.422	1.121
5	1.410	756.534	24.400	24.150	30.309	7.019	1.751	1.360

Slope (s): 1.28208
Intercept (t): -0.01443
Correlation coefficient (r): 0.99987
Uncertainty (k=2): 0.011 m³/min

End of Certificate of Calibration



เอกสารไม่ควบคุม

Jiranatee Associates Co., Ltd.
40/14-15, 40/39-40,
Pachabaim 1-17, Rd. Sathu-harn, Bangkok,
Bangkok 10005 (Thailand)
Tel: +6628888812
Mobile: +6622899113
E-mail: jna-calibration@jiranatee.com
Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
ASC 70176:2022
CALIBRATION 0367

Flow measurement laboratory
Calibration services department.

CERTIFICATE OF CALIBRATION

Certificate No.: CL-004-05

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MEASUREMENT ITEM: Top Load Orifice
MANUFACTURER: Tech Environmental, Inc.
MODEL/TYPE: TE-9005A
SERIAL NUMBER: 3383
ID NUMBER: UAEJFM 064/2560
CONDITION AS RECEIVED: Used Item
CUSTOMER: United Analytical and Engineering Consultant Co., Ltd.,
85 Soi Udomsak 41, Sukhumvit Road, Bangkok, Phrakhanong,
Bangkok 10260

Calibration procedure:
The Orifice gas flow device was calibrated against
Standard Rotary Displacement Meter (Rods
Meter) Model G55/MC/WZ-40. The W6-05-004
was used as a calibration guideline.

Traceability:
This certificate provides a traceability of the
measurement to recognized the national
standards and to evaluation of the international
system of units (SI) through the VSL (National
Metrology Institute of Netherlands) via Certificate
number: 0221592

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'

RECEIVED DATE: 15 Jul 2022
MEASUREMENT DATE: 25 Jul 2022
ISSUE DATE: 28 Jul 2022

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature: 23.0 ± 1.0 °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 24.7 °C and 52.1 mmHg.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:
[Signature]
[Name] Jiranatee Associates Co., Ltd.



Approved signature:
[Signature]
Mr. Pinyas Booncharoen
Calibration Department Manager

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Certificate of Calibration
WL-21 Wireless Anemometer

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

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0041

Calibration Date: 2022/3/25

Calibration Expiry Date: 2023/3/24

The Result of Calibration

Velocity				
Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	1	0	0.9 - 1.1	Pass
2.0	1.8	0.2	1.8 - 2.2	Pass
5.0	5	0	4.7 - 5.3	Pass
7.0	7.2	0.2	6.0 - 8.0	Pass
10.0	9.9	0.1	9.5 - 10.5	Pass
20.0	20	0	19.0 - 21.0	Pass

Wind Direction				
Measured Value	Actual Value	Deviation	Tolerance	Result
45°	43	2	42 - 48	Pass
135°	135	0	132 - 138	Pass
225°	227	2	222 - 228	Pass
315°	318	3	312 - 318	Pass
0°	0	0	357 - 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
24.2°C	24.8	0.6	23.2-25.2	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1001	3	994-1002	Pass

Environment conditions:

Air temperature: 22 °C
Relative humidity: 62 %
Static pressure: 102.2 kPa

Performed by: [Signature]

Certified by
Head of Engineering department

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Certificate of Calibration

WL-21 Wireless Anemometer

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

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0065

Calibration Date: 2022/3/25

Calibration Expiry Date: 2023/3/24

The Result of Calibration

Velocity				
Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	1.0	0.0	0.9 - 1.1	Pass
2.0	2.0	0.0	1.8 - 2.2	Pass
5.0	4.8	0.2	4.7 - 5.3	Pass
7.0	7.1	0.1	6.0 - 8.0	Pass
10.0	9.8	0.2	9.5 - 10.5	Pass
20.0	19.8	0.2	19.0 - 21.0	Pass

Wind Direction				
Measured Value	Actual Value	Deviation	Tolerance	Result
45°	43	2	42 - 48	Pass
135°	136	1	132 - 138	Pass
225°	225	0	222 - 228	Pass
315°	315	0	312 - 318	Pass
0°	2	2	357 - 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
24.2°C	24.2	0.0	23.2-25.2	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	997	1	994-1002	Pass

Environment conditions :

Air temperature: 22 °C
Relative humidity: 62 %
Static pressure: 102.2 kPa

Performed by:

Jim Lin

Certified by
Head of Engineering department

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Certificate of Calibration

WL-21 Wireless Anemometer

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

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0052

Calibration Date: 2022/3/25

Calibration Expiry Date: 2023/3/24

The Result of Calibration

Velocity				
Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	0.9	0.1	0.9 - 1.1	Pass
2.0	1.9	0.1	1.8 - 2.2	Pass
5.0	4.8	0.2	4.7 - 5.3	Pass
7.0	7.0	0	6.0 - 8.0	Pass
10.0	9.9	0.1	9.5 - 10.5	Pass
20.0	20.0	0	19.0 - 21.0	Pass

Wind Direction				
Measured Value	Actual Value	Deviation	Tolerance	Result
45°	45	0	42 - 48	Pass
135°	137	2	132 - 138	Pass
225°	223	2	222 - 228	Pass
315°	316	2	312 - 318	Pass
0°	1	1	357 - 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
24.2°C	24.0	0.2	23.2-25.2	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1000	2	994-1002	Pass

Environment conditions :

Air temperature: 22 °C
Relative humidity: 62 %
Static pressure: 102.2 kPa

Performed by:

Jim Lin

Certified by
Head of Engineering department

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Certificate of Calibration

Customer

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

Certificate No : 23-ACT-406
Request No : Req-2022-1080

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : I
Manufacturer : SVANTEK Range : 94 , 114 dB / 1000 Hz
Model : SV 35A Intrusion 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 : 15 June 2022
Calibration Date : 1 July 2022
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 2023
THD Multimeter	2015	1047765	NIMT	2 February 2023

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

Note

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

Calibrated By :

Mr. Noppon Luangart
Service Calibration Engineer

Approved By :

Mr. Pucit Mathavorn
Calibration Engineer Supervisor

Issue Date : 1 July 2022

Certificate of Calibration

WL-21 Wireless Anemometer

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

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0058

Calibration Date: 2022/3/25

Calibration Expiry Date: 2023/3/24

The Result of Calibration

Velocity				
Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	1.0	0.0	0.9 - 1.1	Pass
2.0	1.9	0.1	1.8 - 2.2	Pass
5.0	5.0	0.0	4.7 - 5.3	Pass
7.0	7.2	0.2	6.0 - 8.0	Pass
10.0	9.8	0.2	9.5 - 10.5	Pass
20.0	20.0	0	19.0 - 21.0	Pass

Wind Direction				
Measured Value	Actual Value	Deviation	Tolerance	Result
45°	47	2	42 - 48	Pass
135°	135	0	132 - 138	Pass
225°	224	1	222 - 228	Pass
315°	315	0	312 - 318	Pass
0°	359	1	357 - 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
24.2°C	24.5	0.3	23.2-25.2	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1000	2	994-1002	Pass

Environment conditions :

Air temperature: 22 °C
Relative humidity: 62 %
Static pressure: 102.2 kPa

Performed by:

Jim Lin

Certified by
Head of Engineering department

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Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : LARSON DAVIS
Model : LxT2/ Microphone 375B02 / Preamplifier PKML x T2B
Serial No.: 0005286 / 011740 / 056087
ID No.: -

Condition As Found : GOOD

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

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

Received Date : 18 JANUARY 2022
Calibration Date : 26 JANUARY 2022
Date of Issue : 28 JANUARY 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchai
(Thanakul Peichurai)

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QF-TS12-04-04-020664

เอกสารไม่ควบคุม



เอกสารไม่ควบคุม

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/130 MOO 13, SOUSUNTHAKORN 41 TAMBON BANG KHAO,
AMPHOR BANG PHU SAMUT PRAKAN PROVINCE 10740 THAILAND
TEL: 0809-2116-5880-1 FAX: 0809-2116-7140



Certificate No : 22-ACT-406
Request No : Req-2022-1080

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	93.82	-0.18	-	-	0.11	0.25
114 dB / 1000 Hz	113.81	-0.19	-	-	0.11	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	1000.00	0.00	-	-	0.10	0.70
114 dB / 1000 Hz	1000.00	0.00	-	-	0.10	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	0.17		-		0.40	2.5
114 dB / 1000 Hz	0.04		-		0.40	2.5

Note :

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

End of Calibration

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เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL22081
Job No. : VC65AC0044
Pages : 4 of 8

Result of calibration:

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
31.0

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

Frequency Weighting	Measured value (dB)
A - weight	30.8
C - weight	30.6
Flat	36.8

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	-0.1	0.1	0.0	± 1.5
1000	-0.2	-0.2	-0.2	± 1.0
8000	3.1	3.2	3.2	±5.0

QF-TS12-04-04-020664

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T. Rth.

Continuation of Calibration Certificate

Cert. No. : ACL22081
Job No. : VC65AC0044
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0
16000	-0.1	0.0	0.1	±5.0 (-∞)

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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T. Rth.

Continuation of Calibration Certificate

Cert. No. : ACL22081
Job No. : VC65AC0044
Pages : 2 of 8

Calibration Procedure : CP-AC-02

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL_BP_05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	I-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

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T. Rth.

Continuation of Calibration Certificate

Cert. No. : ACL22081
Job No. : VC65AC0044
Pages : 3 of 8

Summary of Measurement Result :

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

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Continuation of Calibration Certificate

Cert. No. : ACL22081
Job No. : VC65AC0044
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.2	89.4	0.2	±1.5

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Reth.

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY451-451/1 Sirinthorn Rd., Bangbunru, Bangkok Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22082
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : LARSON DAVIS
Model : LX12 / Microphone 375B02 / Preamplifier PRML x T2B
Serial No. : 0005289 / 011732 / 056076
ID No. : -

Condition As Found : GOOD

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

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

Received Date : 18 JANUARY 2022
Calibration Date : 26 JANUARY 2022
Date of Issue : 28 JANUARY 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Reth.
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL22081
Job No. : VC65AC0044
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
135.0	135.1	0.1	±1.1
134.0	134.1	0.1	±1.1
133.0	133.1	0.1	±1.1
132.0	132.1	0.1	±1.1
131.0	131.1	0.1	±1.1
129.0	129.1	0.1	±1.1
124.0	124.1	0.1	±1.1
119.0	119.1	0.1	±1.1
114.0	114.1	0.1	±1.1
109.0	109.1	0.1	±1.1
104.0	104.1	0.1	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.1	0.1	±1.1
44.0	44.2	0.2	±1.1
39.0	39.6	0.6	±1.1

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T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22081
Job No. : VC65AC0044
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
140	94.0	94.0	0.0	±0.5

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.8	-0.2	1.5 ; -5.0
	2	8	117.0	116.7	-0.3	1.0 ; -2.5
	200	800	134.0	133.9	-0.1	±1.0
Slow	2	8	108.0	107.8	-0.2	1.5 ; -5.0
	200	800	127.6	127.5	-0.1	±1.0
	0.25	1	N/A	N/A	N/A	1.5 ; -5.0
SEL	2	8	N/A	N/A	N/A	1.0 ; -2.5
	200	800	N/A	N/A	N/A	±1.0

10. Peak C sound level

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

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

QF-TS12-04-04-020664

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T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22082
Job No. : VC65AC0044
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

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T. Kitchan

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL22082
Job No. : VC65AC0044
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
29.6

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

Frequency Weighting	Measured value (dB)
A-weight	29.4
C-weight	29.1
Flat	34.8

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	-0.1	0.2	0.2	±1.5
1000	-0.2	-0.2	-0.2	±1.0
8000	2.6	2.6	2.6	±5.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Kitchan

Continuation of Calibration Certificate

Cert. No. : ACL22082
Job No. : VC65AC0044
Pages : 2 of 8

Calibration Procedure : CP-AC-02

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	I-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Kitchan

Continuation of Calibration Certificate

Cert. No. : ACL22082
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8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
140	94.0	94.0	0.0	±0.5

9. Tone burst response

Time Weighting	Tone burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.8	-0.2	1.5 ; -5.0
	2	8	117.0	116.7	-0.3	1.0 ; -2.5
	200	800	134.0	133.9	-0.1	±1.0
Slow	2	8	108.0	107.8	-0.2	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	N/A	N/A	N/A	1.5 ; -5.0
	2	8	N/A	N/A	N/A	1.0 ; -2.5
	200	800	N/A	N/A	N/A	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	±3.0

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Retch.

Continuation of Calibration Certificate

Cert. No. : ACL22082
Job No. : VC65AC0044
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.2	±1.5
89.2	89.4		

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Retch.

Continuation of Calibration Certificate

Cert. No. : ACL22082
Job No. : VC65AC0044
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	-0.1	0.0	±3.0
8000	0.0	0.1	0.0	±5.0
16000	-0.1	0.1	0.1	±5.0 (-∞)

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Retch.

Continuation of Calibration Certificate

Cert. No. : ACL22082
Job No. : VC65AC0044
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Retch.

Certificate No : 22-ACT-249
Request No : Req2022-0629

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 (\pm dB)	Acceptance Limit (\pm dB)
FAST / 37-139	A (dB)	C (dB)	Z (dB)		
STD Setting					
63 Hz	-0.1	-0.1	-0.1	0.2	2.0
125 Hz	-0.1	0.0	0.0		1.5
250 Hz	0.0	0.0	0.0		1.5
500 Hz	0.0	0.0	0.0		1.5
1000 Hz	0.0	0.0	0.0		1.0
2000 Hz	0.0	0.0	0.0		2.0
4000 Hz	0.0	0.0	0.0		3.0
8000 Hz	-0.1	-0.1	0.0		5.0
16000 Hz	-0.1	-0.1	-0.1		+5, -INF

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / 37-139	REF	UUC	ERR		
UUC Weighting	(dB)	(dB)	(dB)		
A	114.00	114.0	0.0	0.2	0.2
C	114.00	114.1	0.1		0.2
Z	114.00	114.1	0.1		0.2

UUC Setting	STD	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
37-139 / A	REF	UUC	ERR		
UUC Time Response	(dB)	(dB)	(dB)		
Fast	114.00	114.0	0.0	0.2	0.1
Slow	114.00	114.0	0.0		0.1
Log	114.00	114.0	0.0		0.1

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

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD. Certificate No : 22-ACT-249
Address : 81 Soi Udonnuek 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok Request No : Req2022-0629
10260

Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2
Manufacturer : LARSON DAVIES Microphone Model : 375A04
Model : LxT2 Microphone S/N : 329334
Serial Number : 4002304 Pre-amplifier Model : PRM16720
ID : UAE.FFM.115.2562 Pre-amplifier S/N : 050099
Resolution : 0.1 dB Intonation Status : Used

Calibration Environment and Details

Temperature : 23 °C \pm 2 °C
Humidity : 50 %RH \pm 20 %RH
Barometric Pressure : 1013 hPa \pm 10 hPa
Received Date : 23 March 2022
Calibrated Date : 1 April 2022
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	Date calibration	Traceability
Standard Microphone	GRAS	40AN	188273	13 September 2022	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	ET4000234	14 June 2022	TSI
Audio Generator	Swatchk	Swach81	131	18 October 2022	WE, 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 Laungjai
Calibration Officer

Approved By :
Mr. Pasi Mathevan
Calibration Engineer Supervisor
Issue Date : 1 April 2022

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

Certificate No : 22-ACT-249
Request No : Req2022-0629

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	UUC		
STD Setting	(dB)		
Initial	114.0	0.1	0.3
Final	114.0		
Deviated	0.0		

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	REF	UUC	ERR		
STD dB	(dB)	(dB)	(dB)		
120.00	120	120.0	0.0	0.3	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	-0.1		1.1
94.00	94	94.0	0.0		1.1
89.00	89	89.0	0.0	0.3	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	49.0	0.0		1.1
44.00	44	44.1	0.1		1.1
39.00	39	39.3	0.3		1.1
34.00	34	34.4	0.4		1.1

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

Certificate No : 22-ACT-249
Request No : Req2022-0629

1. Indication at the calibration check frequency

UUC Setting	Measured	Before Adjust		Adjust		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR		
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)		
1000 Hz 114.00 dB	113.85	113.8	-0.05	113.9	0.05	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTER, Model SV 35A, SN-58879

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(\pm dB)
A	24.7	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(\pm dB)
A	24.1	0.10
C	23.5	0.10
Z	27.8	0.10

4. Acoustic signal test of frequency weightings

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / 37-139	A	C	Z		
STD Setting	(dB)	(dB)	(dB)		
125 Hz	0.1	0.1	0.1	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.4	0.3	0.3	0.60	3.0
8000 Hz	-0.2	-0.3	-0.1	0.70	5.0

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

Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD. Certificate No : 22-MCT-249
Address : 81 Soi Udonrak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok Request No : Req2022-0629
10260

Unit Under Calibration Details

Measurement Item : Sound Level Meter Microphone Class : 2
Manufacturer : LARSON DAVIS Microphone Model : 375A04
Model : LxT2 Microphone S/N : 329334
Serial Number : 0002344 Preamp/Ext Model : P8M16720
ID : UAE.FRM.1152562 Preamp/Ext S/N : 050099
Resolution : 0.1 dB Intention Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 23 March 2022
Calibrated Date : 1 April 2022
Calibration Procedure : In-house method CIP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	13 September 2022	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	ET4000234	14 June 2022	TSI
Audio Generator	Swatch	Swach81	131	18 October 2022	WR 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 Laungjai
Calibration Officer

Approved By :
Mr. Pasi Madhavan
Calibration Engineer Supervisor
Issue Date : 1 April 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the responsible party. **เอกสารไม่ควบคุม**
Date 03/07/19

Certificate No : 22-MCT-249
Request No : Req2022-0629

9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
FAST / A	REF	UUC	ERR	Limit
UUC Range	(dB)	(dB)	(dB)	(± dB)
27-139	43.9	44.1	0.2	1.1
	114	114.0	0.0	1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
A / 37-139	Touchstart	Ref	UUC	ERR		
UUC Time Response	(ms)	(dB)	(dB)	(dB)		
Fast	200	135.0	135.0	0.0	6.3	1.0
	2	118.0	117.8	-0.2		+1.0, -2.5
	0.25	100.0	100.8	0.2		+1.5, -0.0
Slow	200	126.6	126.5	-0.1		1.0
	2	109.0	108.9	-0.1		+1.0, -5.0
	200	129.0	129.0	0.0		1.0
SEL	2	109.0	108.9	-0.1	+1.0, -2.5	
	0.25	100.0	99.9	-0.1	+1.5, -5.0	

11. Peak C sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance
FAST / C / 95-142	REF	UUC	ERR	Limit
STD Setting	(dB)	(dB)	(dB)	(± dB)
Complete cycle	137.4	136.9	-0.50	3.0
Positive half cycle	136.4	136.2	-0.20	2.0
Negative half cycle	136.4	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 the responsible party. **เอกสารไม่ควบคุม**
Date 03/07/19

Certificate No : 22-MCT-249
Request No : Req2022-0629

1. Indication at the calibration check frequency

UUC Setting	Measured	Before Adjust	Adjust	UNCERTAINTY	Acceptance
FAST / A / 27-139	Level	UUC	ERR	UUC	ERR
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)
1000 Hz 114.00 dB	113.85	113.8	-0.05	113.9	0.05
					0.20

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN-58879

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / A / 27-139	UUC	ERR
UUC Weighting	(dB)	(± dB)
A	24.7	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 27-139	UUC	ERR
UUC Weighting	(dB)	(± dB)
A	24.1	0.10
C	23.5	0.10
Z	27.8	0.10

4. Acoustic signal test of frequency weightings

(Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY	Acceptance
FAST / 27-139	A C Z	(± dB)	Limit
STD Setting	(dB) (dB) (dB)	(± dB)	(± dB)
125 Hz	0.1 0.1 0.1	0.50	2.0
1000 Hz	0.0 0.0 0.0	0.00	1.0
4000 Hz	0.4 0.3 0.3	0.00	3.0
8000 Hz	-0.2 -0.3 -0.1	0.70	5.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the responsible party. **เอกสารไม่ควบคุม**
Date 03/07/19

Certificate No : 22-MCT-249
Request No : Req2022-0629

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 27-139	UUC	ERR	Limit
STD Setting	(dB)	(± dB)	(± dB)
Positive one-half cycle	142.9		
Negative one-half cycle	142.7		
Deviated	0.2	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 27-139	UUC	ERR	Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

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 responsible party. **เอกสารไม่ควบคุม**
Date 03/07/19

Certificate No	22-ACT-249
Request No	Req-2022-0829

9. Level linearity including the level range control

Level 1 Uncertainty associated with the level 1 range control		Measured		UNCERTAINTY	Acceptance
UUC Setting	STD	UUC	ERR		Limit
FAST / A	REF	(dB)	(dB)		(± dB)
UUC Range					
35-139	43.9	44.1	0.2	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

EUC Setting	STD	Asynchronous	Measured		UNCERTAINTY	Acceptance
A: 37-139	Tombscore	Ref	EUC (dB)	ERR (dB)		Limit (+ dB)
Time Response	(ms)				(\pm dB)	
Fast	200	135.0	135.0	0.0	0.3	1.0
	2	116.0	117.8	-0.2		+1.0, -2.5
	0.25	109.0	108.8	-0.2		+1.5, -3.8
Slow	200	128.6	128.5	-0.1		1.0
	2	109.0	108.9	-0.1		+1.0, -3.8
SIL	200	129.0	129.0	0.0		1.0
	2	109.0	108.9	-0.1	+1.0, -2.9	
	0.25	100.0	99.9	-0.1	+1.5, -5.8	

11. Peak C Sound level

UUC Setting FAST / C / 95-142	Anticipated REF (μ R)	Measured		UNCERTAINTY (\pm μ R)	Acceptance Limit (\pm μ R)
		UUC	ERR		
		(μ R)	(μ R)		
STD Setting					
Complete cycle	137.4	136.9	-0.50		3.0
Positive half cycle	136.4	136.2	-0.20	0.2	2.0
Negative half cycle	138.4	136.2	-0.20		2.0

The results related only to the items collected. The certificate shall not be reproduced except in full, without written approval of the Director General of the Department of Health.

เอกสารไม่ควบคุม

doi:10.1017/S0007122612000091

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

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Certificate No	22-ACT-249
Request No	Req-2022-0629

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance
EAST / A / 27-139	UUC		Link (\pm dB)
STD Setting	(dB)		
Positive one-half cycle	142.9		
Negative one-half cycle	142.7		
Deviation	0.2	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
EAST / A / J7-139	UUC		Link
STD Setting	(dB)	(\pm dB)	(\pm dB)
Initial	130.0		
Final	138.0		
Deviation	0.0	0.1	0.3

End of Certificate

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

เอกสารไม่ควบคุม

Page 15 of 15

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เอกสารไม่ควบคุม

0000-0001-9351-3379

Certificate No : 22-ACT-034
Request No : Req-2022-0892

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

UUC Setting		Deviation from various Frequency			UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / 37-139		Weighting Response curve				
STD Setting	A (dB)	C (dB)	Z (dB)	0.2		
63 Hz	-0.2	-0.1	0.0			2.0
125 Hz	-0.1	0.0	0.0			1.5
250 Hz	-0.1	0.0	0.0			1.5
500 Hz	-0.1	0.0	0.0			1.5
1000 Hz	0.0	0.0	0.0			1.0
2000 Hz	0.0	0.0	0.0			2.0
4000 Hz	0.0	0.0	0.0			1.0
8000 Hz	-0.1	-0.1	0.0			2
16000 Hz	-0.2	-0.1	-0.1			+5, -INF

5. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / 37-139	REF	UUC (dB)	ERR (dB)		
UUC Weighting	(dB)	(dB)	(dB)	0.2	0.2
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 (\pm dB)	Acceptance Limit (\pm dB)
37-139 / A	REF	UUC (dB)	ERR (dB)		
UUC Time Response	(dB)	(dB)	(dB)	0.2	0.1
Fast	114.00	114.0	0.0		
Slow	114.00	114.0	0.0		
Leq	114.00	114.0	0.0		

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

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.LTD.
Name : 81 Sai Udonnoki 41, Sakharu Road, Bangchak, Prakanong, Bangkok
Address : 10268
Certificate No : 22-ACT-034
Request No : Req-2022-0892

Unit Under Calibration Details

Measurement item : Sound Level Meter
Microphone Class : 2
Manufacturer : LARSON DAVIS
Microphone Model : 375A04
Model : LxT2
Microphone SN : 328361
Serial Number : 0005394
Preamplifier Model : PIMLA2C
ID : UAE.FFM.031/2564
Preamplifier SN : 073810
Resolution : 0.1 dB
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C \pm 2 °C
Humidity : 50 %RH \pm 20 %RH
Barometric Pressure : 1013 hPa \pm 10 hPa
Received Date : 14 January 2022
Calibrated Date : 21 January 2022
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	15 September 2022	GRAS
Multi-frequency Calibrator	Quest	Quest-val	EFA00254	14 June 2022	TSI
Audio Generator	Svanick	Scap081	131	18 October 2022	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 : *me*
Mr. Noppadol Laungan
Calibration Officer

Approved By : *pa*
Mr. Paek Mahatam
Calibration Engineer Supervisor
Issue Date : 21 January 2022

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

Certificate No : 22-ACT-034
Request No : Req-2022-0892

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	UUC (dB)		
STD Setting	(dB)	0.3	0.3
Initial	114.0		
Final	114.0		
Deviation	0.0		

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	REF	UUC (dB)	ERR (dB)		
STD dB	(dB)	(dB)	(dB)	0.3	
129.00	129	129.0	0.0		
134.00	134	134.0	0.0		
129.00	129	129.0	0.0		
134.00	134	134.0	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	93.9	-0.1		
89.00	89	89.0	-0.1		
84.00	84	83.9	-0.1		
79.00	79	78.9	-0.1		
74.00	74	73.9	-0.1		
69.00	69	69.0	0.0		
64.00	64	63.9	-0.1		
59.00	59	59.0	0.0		
54.00	54	54.0	0.0		
49.00	49	49.0	0.0		
44.00	44	44.1	0.1		
39.00	39	39.3	0.3		
34.00	34	34.3	0.3		
31.00	31	31.5	0.5		

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

Certificate No : 22-ACT-034
Request No : Req-2022-0892

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	Level	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)	0.20	0.3
1000 Hz 114.00 dB	113.85	113.9	+0.05	113.9	0.05		

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

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(\pm dB)
UUC Weighting	(dB)	(\pm dB)
A	27.8	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(\pm dB)
UUC Weighting	(dB)	(\pm dB)
A	27.5	0.10
C	27.0	0.10
Z	31.8	0.10

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

UUC Setting	Deviation from various Frequency			UNCERTAINTY	Acceptance Limit
FAST / 37-139	Weighting Response curve				
STD Setting	A	C	Z	(\pm dB)	(\pm dB)
125 Hz	0.0	0.1	0.0	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.2	0.3	0.2	0.60	3.0
8000 Hz	-0.3	-0.3	-0.3	0.70	5.0

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

Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 22-ACT-247
Address : 81 Suk Udonrak 41, Sukhavit Road, Bangkhut, Prakanong, Bangkok Request No : Req-2022-0827
10200

Unit Under Calibration Details

Measurement Item : Sound Level Meter Microphone Class : 2
Manufacturer : LARSON DAVIS Microphone Model : 375A04
Model : Lx72 Microphone SN : 328353
Serial Number : 0065395 Pre-amplifier Model : P8MLATDC
ID : UAEJPM.0322564 Pre-amplifier SN : 073707
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 : 23 March 2022
Calibrated Date : 1 April 2022
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	180273	15 September 2022	GRAS
Multi-frequency Calibrator	Quest	Quesival	EFA000254	14 June 2022	TST
Audio Generator	Swanick	Swan401	121	18 October 2022	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 Luangjai
Calibration Officer

Approved By : 
Mr. Pichit Marthamon
Calibration Engineer Supervisor
Issue Date : 1 April 2022

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

เอกสารไม่ควบคุม

Date: 03/07/19

Certificate No : 22-ACT-034
Request No : Req-2022-0892

9. Level linearity including the level range control

EUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF	UUC	ERR	
FAST / A	(dB)	(dB)	(dB)		
EUC Range:					
37-139	42.8	43.0	0.2	0.3	1.3
	114	114.0	0.0		1.3

10. Tone burst response

EUC Setting	STD	Anticipated	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
			UUC	ERR		
A / 37-139	Timeburst (ms)	(dB)	(dB)	(dB)		
Fast	200	135.0	135.0	0.0	0.3	1
	2	118.0	117.7	-0.3		+1.0, -2.5
	0.25	109.0	108.8	-0.2		+1.5, -5.0
Slow	200	128.6	128.5	-0.1	0.3	1
	2	109.0	108.9	-0.1		+1.0, -5.0
	200	129.0	129.0	0.0		1
SEL	2	109.0	109.1	+0.1	0.2	+1.0, -2.5
	0.25	100.0	100.0	0.0		+1.5, -5.0

11. Peak C Sound level

EUC Setting	Anticipated	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF	UUC	ERR	
FAST / C / 95-142	(dB)	(dB)	(dB)		
STD Setting					
Complete cycle	137.4	136.8	-0.60	0.2	3.0
Positive half cycle	136.4	136.1	-0.30		2.0
Negative half cycle	136.4	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 the issuing organization.

เอกสารไม่ควบคุม

Date: 03/07/19

Certificate No : 22-ACT-247
Request No : Req-2022-0827

1. Indication at the calibration check frequency

EUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		Level	UUC	ERR	UUC	ERR	
FAST / A / 37-139	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	
Calibration Setting							
1000 Hz 114.0 dB	113.8	113.8	-0.05	113.9	0.05	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEX, Model SV 35A, SN.39759

2. Self-generated noise, Microphone installed

EUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
EUC Weighting		
A	28.4	0.10

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

EUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
EUC Weighting		
A	26.1	0.10
C	27.7	0.10
Z	32.0	0.10

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

EUC Setting	Deviation from various Frequency			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	Weighting	Response	curve		
FAST / 37-139	A	C	Z		
STD Setting	(dB)	(dB)	(dB)		
125 Hz	0.0	0.1	0.1	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.00	1.0
4000 Hz	0.4	0.5	0.5	0.00	3.0
8000 Hz	0.2	0.1	0.3	0.70	5.0

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

เอกสารไม่ควบคุม

Date: 03/07/19

Certificate No : 22-ACT-034
Request No : Req-2022-0892

12. Overload indication

EUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC	(± dB)	(± dB)
STD Setting	(dB)		
Positive one-half cycle	141.7		
Negative one-half cycle	141.8		
Deviated	-0.1	0.2	1.5

13. High Level Stability

EUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC	(± dB)	(± dB)
STD Setting	(dB)		
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

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

เอกสารไม่ควบคุม

Date: 03/07/19

Certificate No : 22-ACT-247
Request No : Req2022-0627

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance Limit
		REF	UUC	ERR	
FAST / A	(dB)	(dB)	(dB)	(\pm dB)	(+ dB)
37-139	47.4	43.5	0.1	0.3	1.1
	104	114.0	0.0		

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance Limit
			REF	UUC	ERR	
A / 37-139	Timeburst					
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(\pm dB)	(+ dB)
Fast	200	135.0	134.9	-0.1	0.3	1.0
	2	118.0	117.8	-0.2		+1.8, -2.5
	0.25	109.0	108.7	-0.3		+1.5, -5.0
Slow	200	128.6	128.4	-0.2	0.3	1.0
	2	109.0	108.8	-0.2		+1.8, -5.0
	0.25	109.0	109.1	+0.1		+1.8, -2.5
SEL	200	129.0	129.0	0.0	0.3	1.0
	0.25	100.0	99.9	-0.1		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance Limit
		REF	UUC	ERR	
FAST / C / 95-142	(dB)	(dB)	(dB)	(dB)	(\pm dB)
STD Setting	(dB)	(dB)	(dB)	(\pm dB)	(+ dB)
Complete cycle	137.4	136.8	-0.60	0.2	3.0
Positive half cycle	136.4	136.2	-0.20		2.0
Negative half cycle	136.4	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 the issuing organization. Date 06/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-247
Request No : Req2022-0627

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

UUC Setting	Deviation from various Frequency			UNCERTAINTY	Acceptance
FAST / 37-139	Weighting Response curve				Limit
STD Setting	A (dB)	C (dB)	Z (dB)		(\pm dB)
63 Hz	-0.2	-0.1	-0.1	0.2	2.8
125 Hz	-0.1	0.0	0.0		1.5
250 Hz	-0.1	0.0	0.0		1.5
500 Hz	-0.1	0.0	0.0		1.5
1000 Hz	0.0	0.0	0.0		1.0
2000 Hz	0.0	0.0	0.0		2.8
4000 Hz	0.0	0.0	0.0		3.0
8000 Hz	-0.1	-0.1	0.0		5.0
16000 Hz	-0.1	-0.1	-0.1		+5, -INF

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance Limit
		REF	UUC	ERR	
FAST / 37-139	(dB)	(dB)	(dB)	(dB)	(\pm dB)
UUC Weighting	(dB)	(dB)	(dB)	(\pm dB)	(+ dB)
A	114.00	114.0	0.0	0.2	0.2
C	114.00	114.0	0.0		0.2
Z	114.00	114.0	0.0		0.2

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance Limit
		REF	UUC	ERR	
37-139 / A	(dB)	(dB)	(dB)	(dB)	(\pm dB)
UUC Time Response	(dB)	(dB)	(dB)	(\pm dB)	(+ dB)
Fast	114.00	114.0	0.0	0.2	0.1
Slow	114.00	114.0	0.0		0.1
Long	114.00	114.0	0.0		0.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing organization. Date 06/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-247
Request No : Req2022-0627

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC	(\pm dB)	(+ dB)
STD Setting	(dB)	(\pm dB)	(+ dB)
Positive one-half cycle	142.2		
Negative one-half cycle	142.2		
Deviated	0.0	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC	(\pm dB)	(+ dB)
STD Setting	(dB)	(\pm dB)	(+ dB)
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing organization. Date 06/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-247
Request No : Req2022-0627

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC	(\pm dB)	(+ dB)
STD Setting	(dB)	(\pm dB)	(+ dB)
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance Limit
		REF	UUC	ERR	
FAST / A / 37-139	(dB)	(dB)	(dB)	(dB)	(\pm dB)
STD dB	(dB)	(dB)	(dB)	(\pm dB)	(+ dB)
120.00	120	120.0	0.0	0.3	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	49.0	0.0		1.1
44.00	44	44.1	0.1		1.1
39.00	39	39.3	0.3		1.1
34.00	34	34.4	0.4		1.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing organization. Date 06/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-105
Request No : Req-2022-0229

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

UUC Setting	Deviation from various Frequency			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / 37-139	Weighting Response curve				
STD Setting	A (dB)	C (dB)	Z (dB)	0.2	
65 Hz	-0.2	0.0	0.0		2.0
125 Hz	-0.1	0.0	0.0		1.5
250 Hz	-0.1	0.0	0.0		1.5
500 Hz	-0.1	0.0	0.0		1.5
1000 Hz	0.0	0.0	0.0		1.0
2000 Hz	0.0	0.1	0.0		2.0
4000 Hz	0.0	0.0	0.0		3.0
8000 Hz	0.0	0.0	0.0		5.0
16000 Hz	-0.1	-0.1	-0.1		+5, -4dB

6. Frequency and time weightings at 1kHz

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
FAST / 37-139	UUC (dB)	UUC (dB)	ERR (dB)	0.2	0.2
UUC Weighting	(dB)	(dB)	(dB)		
A	114.00	114.0	0.0		
C	114.00	114.0	0.0	0.2	0.2
Z	114.00	114.0	0.0		

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
37-139 / A	(dB)	(dB)	(dB)	0.2	0.1
UUC Time Response	(dB)	(dB)	(dB)		
Fast	114.00	114.0	0.0		
Slow	114.00	114.0	0.0		
Log	114.00	114.0	0.0	0.2	0.1

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-709-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.LTD. Certificate No : 22-ACT-105
Address : 81 Soi Udonnask 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok Request No : Req-2022-0229
10260

Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2
Manufacturer : LARSON DAVIS Microphone Model : 375A04
Model : LaT2 Microphone S/N : 329350
Serial Number : 0003186 Preamplifier Model : FRMLAT2C
ID : UAE.EFM.033/2564 Preamplifier S/N : 073812
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 : 31 January 2022
Calibrated Date : 11 February 2022
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	Day calibration	Traceability
Standard Microphone	GRAS	40AN	108273	15 September 2022	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	EFA990234	14 June 2022	TSI
Audio Generator	Swanick	Swan401	131	18 October 2022	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. Niggadol Luangnam
Calibration Officer

Approved By :


Mr. Pait Mahaveon
Calibration Engineer Supervisor

Issue Date : 11 February 2022

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FM-709-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate No : 22-ACT-105
Request No : Req-2022-0229

7. Long Term Stability

UUC Setting	Measured UUC (dB)	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / A / 37-139	UUC (dB)	0.1	0.3
STD Setting	(dB)		
Initial	114.0		
Final	114.0	0.1	0.3
Deviated	0.0		

8. Level linearity on the reference level range

UUC Setting	Anticipated REF (dB)	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
FAST / A / 37-139	(dB)	(dB)	(dB)	0.3	1.1
STD dB	(dB)	(dB)	(dB)		
129.00	129	129.0	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	93.9	-0.1		
89.00	89	88.9	-0.1		
84.00	84	83.9	-0.1		
79.00	79	78.9	-0.1		
74.00	74	73.9	-0.1		
69.00	69	68.9	-0.1		
64.00	64	63.9	-0.1		
59.00	59	58.9	-0.1		
54.00	54	53.9	-0.1		
49.00	49	48.9	-0.1		
44.00	44	44.0	0.0		
39.00	39	39.2	0.2		
34.00	34	34.3	0.3		

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FM-709-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate No : 22-ACT-105
Request No : Req-2022-0229

1. Indication at the calibration check frequency

UUC Setting	Nominal Level (dB)	Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
FAST / A / 37-139	Level (dB)	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)	0.20	0.3
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)		
1000 Hz 114.00 dB	113.85	113.9	+0.05	113.9	0.05	0.20	0.3

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

2. Self-generated noise, Microphone installed

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST / 37-139	(dB)	(± dB)
A	27.8	0.10

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

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST / 37-139	(dB)	(± dB)
A	27.8	0.10
C	27.3	0.10
Z	35.1	0.10

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

UUC Setting	Deviation from various Frequency			UNCERTAINTY	Acceptance Limit
	Weighting Response curve				
	A	C	Z		
FAST / 37-139	(dB)	(dB)	(dB)	(± dB)	(± dB)
STD Setting					
125 Hz	0.1	0.1	0.2	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.6	0.5	0.6	0.60	3.0
8000 Hz	0.1	0.0	0.2	0.70	5.0

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FM-709-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.LTD. Certificate No : 22-ACT-105
Address : 81 Soi Udonnask 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok Request No : Req-2022-0229
10260

Unit Under Calibration Details

Measurement Item : Sound Level Meter Microphone Class : 2
Manufacturer : LARSON DAVIS Microphone Model : 375A04
Model : LaT2 Microphone S/N : 329350
Serial Number : 0003786 Pre-amplifier Model : PRLaT2C
ID : U/AE.FPM.033/2564 Pre-amplifier S/N : 073812
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 : 31 January 2022
Calibrated Date : 11 February 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electromagnetics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Day calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Mid-frequency Calibrator	Quest	Quest-cal	EFA990234	14 June 2022	TSI
Audio Generator	Swank	Swan401	131	18 October 2022	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. Niggaon Loangam
Calibration Officer

Approved By : 
Mr. Pait Mahavorn
Calibration Engineer Supervisor
Issue Date : 11 February 2022

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FM-708-SLM-01 Rev.0 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-105
Request No : Req-2022-0229

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / A / 37-139		Level	UUC	ERR	UUC		
Calibrator Setting		(dB)	(dB)	(dB)	(dB)		
1000 Hz 114.00 dB	113.85	113.9	+0.05	113.9	0.05	0.20	0.3

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	27.8	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	27.8	0.10
C	27.3	0.10
Z	35.1	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A	C	Z		
FAST / 37-139					
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
125 Hz	0.1	0.1	0.2	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	3.0
4000 Hz	0.6	0.5	0.6	0.60	3.0
10000 Hz	0.1	0.0	0.2	0.70	3.0

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FM-708-SLM-01 Rev.0 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-105
Request No : Req-2022-0229

9. Level linearity including the level range control

UUC Setting	STD (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
FAST / A	REF				
UUC Range					
37-139	43.2	42.8	-0.4	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD Toneburst (ms)	Anticipated Ref (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
			UUC (dB)	ERR (dB)		
A / 37-139						
UUC Time Response						
Fast	200	135.0	134.9	-0.1	0.3	1.0
	2	118.0	117.8	-0.4		+1.0, -2.5
	0.25	109.0	108.7	-0.3		+1.5, -5.0
Slow	200	128.8	128.5	-0.3	0.3	1.0
	2	109.0	108.9	-0.1		+1.0, -5.0
	200	129.0	129.0	0.0		1.0
SEL	2	109.0	108.9	-0.1	0.3	+1.0, -2.5
	0.25	100.0	100.0	0.0		+1.5, -5.0

11. Peak C Sound level

UUC Setting	REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / C / 95-142		UUC (dB)	ERR (dB)		
STD Setting					
Complete cycle	137.4	136.7	-0.70	0.2	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-708-SLM-01 Rev.0 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-105
Request No : Req-2022-0229

Certificate No : 22-ACT-105
Request No : Req-2022-0229

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Positive one-half cycle	141.7		
Negative one-half cycle	141.8		
Deviated	-0.1	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

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-SLM-01 Rev.0 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-105
Request No : Req-2022-0229

9. Level linearity including the level range control

UUC Setting	STD (dB)	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		REF (dB)	UUC (dB)		
FAST / A					
UUC Range					
37-139	43.2	42.8	-0.4	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD (dB)	Anticipated Ref (dB)	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
			UUC (dB)	ERR (dB)		
A / 37-139						
UUC Time Response	(ms)					
Fast	200	135.0	134.9	-0.1	0.3	1.0
	2	118.0	117.8	-0.4		+1.0, -2.5
	0.25	109.0	108.7	-0.3		+1.5, -5.0
Slow	200	128.8	128.5	-0.3		1.0
	2	109.0	108.9	-0.1		+1.0, -5.0
SEL	200	129.0	129.0	0.0		1.0
	2	109.0	108.9	-0.1		+1.0, -2.5
	0.25	100.0	100.0	0.0		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated REF (dB)	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)		
FAST / C / 95-142					
STD Setting					
Complete cycle	137.4	136.7	-0.70	0.2	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-708-SLM-01 Rev.0 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-105
Request No : Req-2022-0229

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

UUC Setting	Deviation from various Frequency			UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	FAST / 37-139	A (dB)	C (dB)	Z (dB)	
STD Setting					
65 Hz		-0.2	0.0	0.0	0.2
125 Hz		-0.1	0.0	0.0	1.5
250 Hz		-0.1	0.0	0.0	1.5
500 Hz		-0.1	0.0	0.0	1.5
1000 Hz		0.0	0.0	0.0	1.0
2000 Hz		0.0	0.1	0.0	2.0
4000 Hz		0.0	0.0	0.0	3.0
8000 Hz		0.0	0.0	0.0	5.0
16000 Hz		-0.1	-0.1	-0.1	+5, -INF

6. Frequency and time weightings at 1kHz

UUC Setting	STD (dB)	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		REF (dB)	UUC (dB)		
FAST / 37-139					
UUC Weighting					
A	114.00	114.0	0.0	0.2	0.2
C	114.00	114.0	0.0	0.2	0.2
Z	114.00	114.0	0.0	0.2	0.2

UUC Setting	STD (dB)	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		REF (dB)	UUC (dB)		
37-139 / A					
UUC Time Response					
Fast	114.00	114.0	0.0	0.2	0.1
Slow	114.00	114.0	0.0	0.2	0.1
Log	114.00	114.0	0.0	0.2	0.1

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FM-708-SLM-01 Rev.0 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-105
Request No : Req-2022-0229

12. Overload indication

UUC Setting	Measured (dB)	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	UUC		
STD Setting			
Positive one-half cycle	141.7		
Negative one-half cycle	141.8		
Deviated	-0.1	0.2	1.5

13. High Level Stability

UUC Setting	Measured (dB)	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	UUC		
STD Setting			
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

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FM-708-SLM-01 Rev.0 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-105
Request No : Req-2022-0229

7. Long Term Stability

UUC Setting	Measured (dB)	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	UUC		
STD Setting			
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance
		REF	UUC		
FAST / A / 37-139					
STD dB	(dB)	(dB)	(dB)	(± dB)	(± dB)
120.00	120	120.0	0.0	0.3	1.1
124.00	124	124.0	0.0		1.1
128.00	128	128.0	0.0		1.1
132.00	132	132.0	0.0		1.1
136.00	136	136.0	0.0		1.1
140.00	140	140.0	0.0		1.1
144.00	144	144.0	0.0		1.1
148.00	148	148.0	0.0		1.1
152.00	152	152.0	0.0		1.1
156.00	156	156.0	0.0		1.1
160.00	160	160.0	0.0		1.1
164.00	164	164.0	0.0		1.1
168.00	168	168.0	0.0		1.1
172.00	172	172.0	0.0		1.1
176.00	176	176.0	0.0		1.1
180.00	180	180.0	0.0		1.1
184.00	184	184.0	0.0		1.1
188.00	188	188.0	0.0		1.1
192.00	192	192.0	0.0		1.1
196.00	196	196.0	0.0		1.1
200.00	200	200.0	0.0	1.1	
204.00	204	204.0	0.0	1.1	
208.00	208	208.0	0.0	1.1	
212.00	212	212.0	0.0	1.1	
216.00	216	216.0	0.0	1.1	
220.00	220	220.0	0.0	1.1	
224.00	224	224.0	0.0	1.1	
228.00	228	228.0	0.0	1.1	
232.00	232	232.0	0.0	1.1	
236.00	236	236.0	0.0	1.1	
240.00	240	240.0	0.0	1.1	
244.00	244	244.0	0.0	1.1	
248.00	248	248.0	0.0	1.1	
252.00	252	252.0	0.0	1.1	
256.00	256	256.0	0.0	1.1	
260.00	260	260.0	0.0	1.1	
264.00	264	264.0	0.0	1.1	
268.00	268	268.0	0.0	1.1	
272.00	272	272.0	0.0	1.1	
276.00	276	276.0	0.0	1.1	
280.00	280	280.0	0.0	1.1	
284.00	284	284.0	0.0	1.1	
288.00	288	288.0	0.0	1.1	
292.00	292	292.0	0.0	1.1	
296.00	296	296.0	0.0	1.1	
300.00	300	300.0	0.0	1.1	
304.00	304	304.0	0.0	1.1	
308.00	308	308.0	0.0	1.1	
312.00	312	312.0	0.0	1.1	
316.00	316	316.0	0.0	1.1	
320.00	320	320.0	0.0	1.1	
324.00	324	324.0	0.0	1.1	
328.00	328	328.0	0.0	1.1	
332.00	332	332.0	0.0	1.1	
336.00	336	336.0	0.0	1.1	
340.00	340	340.0	0.0	1.1	
344.00	344	344.0	0.0	1.1	
348.00	348	348.0	0.0	1.1	
352.00	352	352.0	0.0	1.1	
356.00	356	356.0	0.0	1.1	
360.00	360	360.0	0.0	1.1	
364.00	364	364.0	0.0	1.1	
368.00	368	368.0	0.0	1.1	
372.00	372	372.0	0.0	1.1	
376.00	376	376.0	0.0	1.1	
380.00	380	380.0	0.0	1.1	
384.00	384	384.0	0.0	1.1	
388.00	388	388.0	0.0	1.1	
392.00	392	392.0	0.0	1.1	
396.00	396	396.0	0.0	1.1	
400.00	400	400.0	0.0	1.1	
404.00	404	404.0	0.0	1.1	
408.00	408	408.0	0.0	1.1	
412.00	412	412.0	0.0	1.1	
416.00	416	416.0	0.0	1.1	
420.00	420	420.0	0.0	1.1	
424.00	424	424.0	0.0	1.1	
428.00	428	428.0	0.0	1.1	
432.00	432	432.0	0.0	1.1	
436.00	436	436.0	0.0	1.1	
440.00	440	440.0	0.0	1.1	
444.00	444	444.0	0.0	1.1	
448.00	448	448.0	0.0	1.1	
452.00	452	452.0	0.0	1.1	
456.00	456	456.0	0.0	1.1	
460.00	460	460.0	0.0	1.1	
464.00	464	464.0	0.0	1.1	
468.00	468	468.0	0.0	1.1	
472.00	472	472.0	0.0	1.1	
476.00	476	476.0	0.0	1.1	
480.00	480	480.0	0.0	1.1	
484.00	484	484.0	0.0	1.1	
488.00	488	488.0	0.0	1.1	
492.00	492	492.0	0.0	1.1	
496.00	496	496.0	0.0	1.1	
500.00	500	500.0	0.0	1.1	
504.00	504	504.0	0.0	1.1	
508.00	508	508.0	0.0	1.1	
512.00	512	512.0	0.0	1.1	
516.00	516	516.0	0.0	1.1	
520.00	520	520.0	0.0	1.1	
524.00	524	524.0	0.0	1.1	
528.00	528	528.0	0.0	1.1	
532.00	532	532.0	0.0	1.1	
536.00	536	536.0	0.0	1.1	
540.00	540	540.0	0.0	1.1	
544.00	544	544.0	0.0	1.1	
548.00	548	548.0	0.0	1.1	
552.00	552	552.0	0.0	1.1	
556.00	556	556.0	0.0	1.1	
560.00	560	560.0	0.0	1.1	
564.00	564	564.0	0.0	1.1	
568.00	568	568.0	0.0	1.1	
572.00	572	572.0	0.0	1.1	
576.00	576	576.0	0.0	1.1	
580.00	580	580.0	0.0	1.1	
584.00	584	584.0	0.0	1.1	
588.00	588	588.0	0.0	1.1	
592.00	592	592.0	0.0	1.1	
596.00	596	596.0	0.0	1.1	
600.00	600	600.0	0.0	1.1	
604.00	604	604.0	0.0	1.1	
608.00	608	608.0	0.0	1.1	
612.00	612	612.0	0.0	1.1	
616.00	616	616.0	0.0	1.1	
620.00	620	620.0	0.0	1.1	
624.00	624	624.0	0.0	1.1	
628.00	628	628.0	0.0	1.1	
632.00	632	632.0	0.0	1.1	
636.00	636	636.0	0.0	1.1	
640.00	640	640.0	0.0	1.1	
644.00	644	644.0	0.0	1.1	
648.00	648	648.0	0.0	1.1	
652.00	652	652.0	0.0	1.1	
656.00	656	656.0	0.0	1.1	
660.00	660	660.0	0.0	1.1	
664.00	664	664.0	0.0	1.1	
668.00	668	668.0	0.0	1.1	
672.00	672	672.0	0.0	1.1	
676.00	676	676.0	0.0	1.1	
680.00	680	680.0	0.0	1.1	
684.00	684	684.0	0.0	1.1	
688.00	688	688.0	0.0	1.1	
692.00	692	692.0	0.0	1.1	
696.00	696	696.0	0.0	1.1	
700.00	700	700.0	0.0	1.1	
704.00	704	704.0	0.0	1.1	
708.00	708	708.0	0.0	1.1	
712.00	712	712.0	0.0	1.1	
716.00	716	716.0	0.0	1.1	
720.00	720	720.0	0.0	1.1	
724.00	724	724.0	0.0	1.1	
728.00	728	728.0	0.0	1.1	
732.00	732	732.0	0.0	1.1	
736.00	736	736.0	0.0	1.1	
740.00	740	740.0	0.0	1.1	
744.00	744	744.0	0.0	1.1	
748.00	748	748.0	0.0	1.1	
752.00	752	752.0	0.0	1.1	
756.00	756	756.0	0.0	1.1	
760.00	760	760.0	0.0	1.1	
764.00	764	764.0	0.0	1.1	
768.00	768	768.0	0.0	1.1	
772.00	772	772.0	0.0	1.1	
776.00	776	776.0	0.0	1.1	
780.00	780	780.0	0.0	1.1	
784.00	784	784.0	0.0	1.1	
788.00	788	788.0	0.0	1.1	
792.00	792	792.0	0.0	1.1	
796.00	796	796.0	0.0	1.1	
800.00	800	800.0	0.0	1.1	
804.00	804	804.0	0.0	1.1	
808.00	808	808.0	0.0	1.1	
812.00	812	812.0	0.0	1.1	
816.00	816	816.0	0.0	1.1	
820.00	820	820.0	0.0	1.1	
824.00	824	824.0	0.0	1.1	
828.00	828	828.0	0.0	1.1	
832.00	832	832.0	0.0	1.1	
836.00	836	836.0	0.0	1.1	
840.00	840	840.0	0.0	1.1	
844.00	844	844.0	0.0	1.1	
848.00	848	848.0	0.0	1.1	
852.00	852	852.0	0.0	1.1	
856.00	856	856.0	0.0	1.1	
860.00	860	860.0	0.0	1.1	
864.00	864	864.0	0.0	1.1	
868.00	868	868.0	0.0	1.1	
872.00	872	872.0	0.0	1.1	
876.00	876	876.0	0.0	1.1	
880.00	880	880.0	0.0	1.1	
884.00	884	884.0	0.0	1.1	
888.00	888	888.0	0.0	1.1	
892.00	892	892.0	0.0	1.1	
896.00	896	896.0	0.0	1.1	
900.00	900	900.0	0.0	1.1	
904.00	904	904.0	0.0	1.1	
908.00	908	908.0	0.0	1.1	
912.00	912	912.0	0.0	1.1	
916.00	916	916.0	0.0	1.1	
920.00	920	920.0	0.0	1.1	
924.00	924	924.0	0.0	1.1	
928.00	928	928.0	0.0	1.1	
932.00	932	932.0	0.0	1.1	
936.00	936	936.0	0.0	1.1	
940.00	940	940.0	0.0	1.1	
944.00	944	944.0	0.0	1.1	
948.00	948	948.0	0.0	1.1	
952.00	952	952.0	0.0	1.1	
956.00	956	956.0	0.0	1.1	
960.00	960	960.0	0.0	1.1	
964.00	964	964.0	0.0	1.1	
968.00	968	968.0	0.0	1.1	
972.00	972	972.0	0.0	1.1	
976.00	976	976.0	0.0	1.1	
980.00	980	980.0	0.0	1.1	
984.00	984	984.0	0.0	1.1	
988.00	988	988.0	0.0	1.1	
992.00	992	992.0	0.0	1.1	
996.00	996	996.0	0.0	1.1	
1000.00	1000	1000.0	0.0	1.1	

Certificate No : 22-ACT-105
Request No : Req-2022-0229

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

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

6. Frequency and time weightings at 1kHz

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
FAST / 37-139	UUC Weighting	(dB)	(dB)	0.2	0.2
A	114.00	114.0	0.0		
C	114.00	114.0	0.0		
Z	114.00	114.0	0.0		

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
37-139 / A	UUC Time Response	(dB)	(dB)	0.2	0.1
Fast	114.00	114.0	0.0		
Slow	114.00	114.0	0.0		
Log	114.00	114.0	0.0		

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

FM-709-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.LTD. Certificate No : 22-ACT-105
Address : 81 Soi Udonnask 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok Request No : Req-2022-0229
10260

Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2
Manufacturer : LARSON DAVIS Microphone Model : 375A04
Model : LaT2 Microphone S/N : 329350
Serial Number : 0003186 Preamplifier Model : FRMLAT2C
ID : UAE.EFM.033/2564 Preamplifier S/N : 073812
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 : 31 January 2022
Calibrated Date : 11 February 2022
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	Day calibration	Traceability
Standard Microphone	GRAS	40AN	108273	15 September 2022	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	EFA990234	14 June 2022	TSI
Audio Generator	Swanick	Swan401	131	18 October 2022	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. Niggadol Luangnam
Calibration Officer

Approved By :


Mr. Pait Mahaveon
Calibration Engineer Supervisor

Issue Date : 11 February 2022

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-709-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate No : 22-ACT-105
Request No : Req-2022-0229

7. Long Term Stability

UUC Setting	Measured UUC (dB)	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / A / 37-139	UUC	0.1	0.3
STD Setting	(dB)		
Initial	114.0		
Final	114.0	0.1	0.3
Deviated	0.0		

8. Level linearity on the reference level range

UUC Setting	Anticipated REF (dB)	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
FAST / A / 37-139	120	120.0	0.0	0.3	1.1
STD dB	(dB)	(dB)	(dB)		
120.00	120	120.0	0.0		
124.00	124	124.0	0.0		
128.00	128	128.0	0.0		
132.00	132	132.0	0.0		
136.00	136	136.0	0.0		
140.00	140	140.0	0.0		
144.00	144	144.0	0.0		
148.00	148	148.0	0.0		
152.00	152	152.0	0.0		
156.00	156	156.0	0.0		
160.00	160	160.0	0.0		
164.00	164	164.0	0.0		
168.00	168	168.0	0.0		
172.00	172	172.0	0.0		
176.00	176	176.0	0.0		
180.00	180	180.0	0.0		
184.00	184	184.0	0.0		
188.00	188	188.0	0.0		
192.00	192	192.0	0.0		
196.00	196	196.0	0.0		

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

FM-709-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate No : 22-ACT-105
Request No : Req-2022-0229

1. Indication at the calibration check frequency

UUC Setting	Nominal Level (dB)	Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
FAST / A / 37-139	1000 Hz 114.00 dB	113.85	113.9	-0.05	113.9	0.05	0.20
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)	(± dB)	(± dB)

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 FAST / 37-139 (dB)	UNCERTAINTY (± dB)
A	27.8	0.10

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

UUC Setting	Measured FAST / 37-139 (dB)	UNCERTAINTY (± dB)
A	27.8	0.10
C	27.3	0.10
Z	35.1	0.10

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

UUC Setting	Deviation from various Frequency			UNCERTAINTY	Acceptance Limit
	Weighting Response curve				
	A (dB)	C (dB)	Z (dB)	(± dB)	(± dB)
FAST / 37-139					
STD Setting					
125 Hz	0.1	0.1	0.2	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	2.0
4000 Hz	0.6	0.5	0.6	0.60	3.0
10000 Hz	0.1	0.0	0.2	0.70	5.0

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

FM-709-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomrak 41, Sukhumvit Road, Bangkok, Pukang, Bangkok 10260
Certificate No : 22-ACT-103
Request No : Req-2022-0230

Unit Under Calibration Details

Measurement Item : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LxT2
Serial Number : 0885402
ID : UAE-IFM-038/2544
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375A04
Microphone S/N : 228688
Preamplifier Model : PRMLXTC2C
Preamplifier S/N : 071540
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 : 31 January 2022
Calibrated Date : 11 February 2022
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	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	13 September 2022	GRAS
Midfrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	SvanteK	Scans401	131	18 October 2022	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 Luangrat
Calibration Officer
Approved By : 
Mr. Paitit Mathavorn
Calibration Engineer Supervisor
Issue Date : 11 February 2022

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-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate No : 22-ACT-103
Request No : Req-2022-0229

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF	UUC		
FAST / A	(dB)	(dB)	(dB)		
UUC Range	(dB)	(dB)	(dB)		
37-139	43.2	42.8	-0.4	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
			REF	UUC		
A / 37-139	Timeburst	(dB)	(dB)	(dB)		
UUC Time Response	(ms)	(dB)	(dB)	(dB)		
Fast	200	135.0	134.9	-0.1	0.3	1.0
	2	118.0	117.6	-0.4		+1.0, -2.5
	0.25	109.0	108.7	-0.3		+1.5, -5.0
Slow	200	128.8	128.5	-0.3	0.3	1.0
	2	109.0	108.9	-0.1		+1.0, -5.0
	200	129.0	129.0	0.0		1.0
SEL	2	109.0	108.9	-0.1	0.3	+1.0, -2.5
	0.25	100.0	100.0	0.0		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF	UUC		
FAST / C / 95-142	(dB)	(dB)	(dB)		
STD Setting	(dB)	(dB)	(dB)		
Complete cycle	137.4	136.7	-0.70	0.2	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-708-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate No : 22-ACT-103
Request No : Req-2022-0230

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		Level	UUC	ERR	UUC		
FAST / A / 37-139	(dB)	(dB)	(dB)	(dB)	(dB)		
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)		
1000 Hz 114.00 dB	113.85	114.8	+0.15	113.9	0.05	0.20	0.5

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
	(dB)	(± dB)
FAST / 37-139		
UUC Weighting		
A	28.1	0.10

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

UUC Setting	Measured	UNCERTAINTY
	(dB)	(± dB)
FAST / 37-139		
UUC Weighting		
A	28.1	0.10
C	27.9	0.10
Z	34.4	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A	C	Z		
FAST / 37-139					
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
125 Hz	0.0	0.1	0.1	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.9	0.9	1.0	0.60	3.0
8000 Hz	0.7	0.7	0.8	0.70	5.0

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FM-708-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate No : 22-ACT-103
Request No : Req-2022-0229

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	UUC		
FAST / A / 37-139			
STD Setting	(dB)	(± dB)	(± dB)
Positive one-half cycle	141.7		
Negative one-half cycle	141.8		
Deviated	-0.1	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	UUC		
FAST / A / 37-139			
STD Setting	(dB)	(± dB)	(± dB)
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

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-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate No : 22-ACT-103
Request No : Req-2022-0230

9. Level linearity including the level range control

EUC Setting	STD	Measured			UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		REF	UUC	ERR		
FAST / A	(dB)	(dB)	(dB)	(dB)	0.3	1.1
UUC Range	(dB)	(dB)	(dB)	(dB)		
37-139	43.2	42.9	-0.3			
	11.4	114.8	0.0			1.1

10. Tone burst response

EUC Setting	STD	Anticipated	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
			Ref	ERR		
A / 37-139	Toneburst (ms)	(dB)	(dB)	(dB)	0.3	1.0
UUC Time Response	(ms)	(dB)	(dB)	(dB)		
Fast	200	135.0	135.0	0.0		
	2	118.0	117.7	-0.3		
	0.25	109.0	108.7	-0.3		
	200	128.6	128.5	-0.1		
Slow	2	109.0	108.9	-0.1		
	200	129.0	129.0	0.0		
SEL	2	109.0	109.0	0.0		
	0.25	109.0	99.9	-0.1		

11. Peak C Sound level

EUC Setting	Anticipated	Measured			UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		REF	UUC	ERR		
FAST / C / 95-142	(dB)	(dB)	(dB)	(dB)	0.2	3.0
STD Setting	(dB)	(dB)	(dB)	(dB)		
Complete cycle	137.4	136.7	-0.70			
Positive half cycle	136.4	136.1	-0.30			
Negative half cycle	136.4	136.2	-0.20			

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FM-709-SLM-03 Rev.0 Issue date 01/07/11

เอกสารไม่ควบคุม

Certificate No : 22-ACT-103
Request No : Req-2022-0230

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

EUC Setting	Deviation from various Frequency			UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	FAST / 37-139	Weighting	Response curve		
STD Setting	A (dB)	C (dB)	Z (dB)	0.2	2.0
63 Hz	-0.2	0.0	0.0		
125 Hz	-0.1	0.0	0.0		
250 Hz	-0.1	0.0	0.0		
500 Hz	-0.1	0.0	0.0		
1000 Hz	0.0	0.0	0.0		
2000 Hz	0.0	0.1	0.0		
4000 Hz	0.0	0.0	0.0		
8000 Hz	0.0	0.0	0.0		
16000 Hz	-0.1	-0.1	-0.1		

6. Frequency and time weightings at 1kHz

EUC Setting	STD	Measured			UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		REF	UUC	ERR		
FAST / 37-139	(dB)	(dB)	(dB)	(dB)	0.2	0.2
UUC Weighting	(dB)	(dB)	(dB)	(dB)		
A	114.00	114.0	0.0			
C	114.00	114.0	0.0			
Z	114.00	114.0	0.0			

EUC Setting	STD	Measured			UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		REF	UUC	ERR		
37-139 / A	(dB)	(dB)	(dB)	(dB)	0.2	0.1
UUC Time Response	(dB)	(dB)	(dB)	(dB)		
Fast	114.00	114.0	0.0			
Slow	114.00	114.0	0.0			
Loq	114.00	114.0	0.0			

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FM-709-SLM-03 Rev.0 Issue date 01/07/11

เอกสารไม่ควบคุม

Certificate No : 22-ACT-103
Request No : Req-2022-0230

12. Overload indication

EUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	UUC	0.2	1.5
STD Setting	(dB)		
Positive one-half cycle	142.2		
Negative one-half cycle	142.3		
Deviated	-0.1		

13. High Level Stability

EUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	UUC	0.1	0.3
STD Setting	(dB)		
Initial	138.0		
Final	138.0		
Deviated	0.0		

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-709-SLM-03 Rev.0 Issue date 01/07/11

เอกสารไม่ควบคุม

Certificate No : 22-ACT-103
Request No : Req-2022-0230

7. Long Term Stability

EUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	UUC	0.1	0.3
STD Setting	(dB)		
Initial	114.0		
Final	114.0		
Deviated	0.0		

8. Level linearity on the reference level range

EUC Setting	Anticipated	Deviation			UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		REF	UUC	ERR		
FAST / A / 37-139	(dB)	(dB)	(dB)	(dB)	0.3	1.1
STD dB	(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	49.0	0.0			
44.00	44	44.0	0.0			
39.00	39	39.0	0.1			
34.00	34	34.0	0.3			

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-709-SLM-03 Rev.0 Issue date 01/07/11

เอกสารไม่ควบคุม

Certificate No : 22-ACT-103
Request No : Req-2022-0230

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)
	STD (dB)	UUC (dB)	ERR (dB)		
63 Hz	-0.2	0.0	0.0	0.2	2.0
125 Hz	-0.1	0.0	0.0		1.5
250 Hz	-0.1	0.0	0.0		1.5
500 Hz	-0.1	0.0	0.0		1.5
1000 Hz	0.0	0.0	0.0		1.0
2000 Hz	0.0	0.1	0.0		2.0
4000 Hz	0.0	0.0	0.0		3.0
8000 Hz	0.0	0.0	0.0		5.0
16000 Hz	-0.1	-0.1	-0.1		+5, -INF.

6. Frequency and time weightings at 1kHz

UUC Setting FAST / 37-139	STD REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
UUC Weighting					
A	114.00	114.0	0.0	0.2	0.2
C	114.00	114.0	0.0		0.2
Z	114.00	114.0	0.0		0.2

UUC Setting 37-139 / A	STD REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
UUC Time Response					
Fast	114.00	114.0	0.0	0.2	0.1
Slow	114.00	114.0	0.0		0.1
Loq	114.00	114.0	0.0		0.1

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-SLM-01 Rev.0 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Name :
Address : R1 Soi Udomsak 41, Sukhumvit Road, Bangkok, Pukangong, Bangkok
10260
Certificate No : 22-ACT-103
Request No : Req-2022-0230

Unit Under Calibration Details

Measurement Item : Sound Level Meter
Microphone Class : 2
Manufacturer : LARSON DAVIS
Microphone Model : 375A04
Model : LxT2
Microphone S/N : 228688
Serial Number : 0085402
Preamplifier Model : PRMLXTC2C
ID : UAE-EPM-038/2544
Preamplifier S/N : 071540
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 : 31 January 2022
Calibrated Date : 11 February 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3, 2013 Electroacoustics - Sound level meters - Part 3: Periodic test
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	13 September 2022	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSM
Audio Generator	SvanteK	Scans401	131	18 October 2022	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 Luangrit
Calibration Officer

Approved By : 
Mr. Pait Muthavorn
Calibration Engineer Supervisor
Issue Date : 11 February 2022

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-SLM-01 Rev.0 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-103
Request No : Req-2022-0230

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting FAST / A / 37-139	Anticipated REF (dB)	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
STD dB					
139.00	139	139.0	0.0	0.3	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	49.0	0.0		1.1
44.00	44	44.0	0.0		1.1
39.00	39	39.0	0.1		1.1
34.00	34	34.0	0.3		1.1

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-SLM-01 Rev.0 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-103
Request No : Req-2022-0230

1. Indication at the calibration check frequency

a) Measurement of the calibration check frequency							
UUC Setting FAST / A / 37-139	Nominal	Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	Level (dB)	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
Calibrator Setting 1000 Hz 114.00 dB	113.85	114.0	+0.15	113.9	0.05	0.20	0.3

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	26.1	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	26.1	0.10
C	27.9	0.10
Z	34.4	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)
	A (dB)	C (dB)	Z (dB)		
STD Setting					
125 Hz	0.0	0.1	0.1	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.9	0.9	1.0	0.60	3.0
8000 Hz	0.7	0.7	0.8	0.70	5.0

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

FM-708-SLM-01 Rev.0 Issue date 01/07/19

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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: 0-2713-3000-24 FAX: 0-2719-9484

Certificate of Calibration

Certificate No.: 22P801
Page: 1 of 2

Equipment: U Tube Manometer

Manufacturer: Dwyer

Model: 5221-35-WIM

Serial No.: -

ID No.: UAE.EFM.178/2501

Condition As-Received: Used Item

Received Date: 03 March 2022

Calibration Date: 12 March 2022

Reference: 2203-0131WSC

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

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1010 mbar

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

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

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-0110-21	09 Aug 2022
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 inH ₂ O				
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 at:-				
- National Institute of Metrology Thailand (NIMT)				

Calibrated by: Suwit Aussamee
Issue Date: 14 March 2022

Approved Signatory: Attapol P.
[] Phalinee Pratsapal
[] Sura Suwanmasri
[x] Attapol Panurach

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a 0282414

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KAO,
AMPHOR BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (0669-2110-5969) FAX: (0669-2110-7140)



Certificate No.: 22-ACT-103

Request No.: Req-2022-0230

9. Level linearity including the level range control

EUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF	ERR		
FAST / A	(dB)	(dB)	(dB)		
UUC Range					
37-139	42.2	42.9	-0.3	0.3	1.1
	11.4	114.8	0.8		1.1

10. Tone burst response

EUC Setting	STD	Anticipated	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
			UUC	ERR		
A / 37-139	Touchstart	Ref	(dB)	(dB)		
UUC Time Response	(ms)	(dB)	(dB)	(dB)		
Fast	200	135.0	135.0	0.0	0.3	1.0
	2	118.0	117.7	-0.3		+1.0, -2.1
	0.25	109.0	108.7	-0.3		+1.5, -5.0
Slow	200	128.6	128.5	-0.1	0.3	1.0
	2	109.0	108.9	-0.1		+1.0, -5.0
	200	129.0	129.0	0.0		1.0
SEL	2	109.0	109.0	0.0	0.3	+1.0, -2.5
	0.25	109.0	99.9	-0.1		+1.5, -5.0

11. Peak C Sound level

EUC Setting	Anticipated	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC	ERR		
FAST / C / 95-142	REF	(dB)	(dB)		
STD Setting	(dB)	(dB)	(dB)		
Complete cycle	137.4	136.7	-0.70	0.2	3.0
Positive half cycle	136.4	136.1	-0.30		2.0
Negative half cycle	136.4	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 the Innovative Instrument Co., Ltd.

PM-708-SLM-03 Rev.0 Issue date 01/07/11

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Cert.No.: 22P801
Page: 2 of 2

Result of calibration:- Without adjustment

Range: 0 inH₂O to 36 inH₂O

Function:- Pressure Measurement

Scale Interval: 0.1 inH₂O (The Fifth Estimate)

Increasing Pressure

UUC Indication					
Applied Pressure	High-port side	Low-port side	ΔP	Error	
(inH ₂ O)	(inH ₂ O)	(inH ₂ O)	(inH ₂ O)	(inH ₂ O)	(inH ₂ O)
0.00	0.00	0.00	0.00	0.00	
2.00	0.98	-0.94	1.92	-0.08	
4.00	2.00	-1.98	3.98	-0.02	
6.00	3.00	-2.98	5.98	-0.02	
8.00	4.00	-3.98	7.98	-0.02	
10.00	5.00	-4.98	9.98	-0.02	
12.00	6.02	-5.96	11.98	-0.02	
14.00	7.02	-6.96	13.98	-0.02	
16.00	8.04	-7.98	16.02	0.02	
18.00	9.04	-8.98	18.02	0.02	
20.00	10.04	-9.98	20.02	0.02	
22.00	11.06	-10.98	22.04	0.04	
24.00	12.06	-12.00	24.06	0.06	
26.00	13.06	-13.00	26.06	0.06	
28.00	14.08	-14.02	28.10	0.10	
30.00	15.08	-15.02	30.10	0.10	
32.00	16.08	-16.04	32.12	0.12	
34.00	17.10	-17.04	34.14	0.14	
35.00	17.90	-17.86	35.76	-0.04	

The uncertainty of measurement was ± 0.11 inH₂O

* UUC = Unit Under Calibration

* ΔP = High-port side - Low-port side

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

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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KAO,
AMPHOR BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (0669-2110-5969) FAX: (0669-2110-7140)



Certificate No.: 22-ACT-103

Request No.: Req-2022-0230

12. Overload indication

EUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / A / 37-139	UUC		
STD Setting	(dB)		
Positive one-half cycle	142.2	0.2	1.5
Negative one-half cycle	142.3		
Deviated	-0.1		

13. High Level Stability

EUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / A / 37-139	UUC		
STD Setting	(dB)		
Initial	138.0	0.1	0.3
Final	138.0		
Deviated	0.0		

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.

PM-708-SLM-03 Rev.0 Issue date 01/07/11

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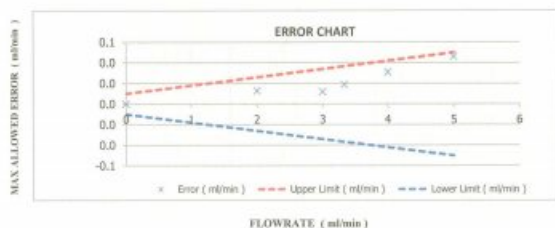
Certificate No. : L202210260-001

Environment : Ambient temperature : (23 ± 2) °C
Relative humidity : (50 ± 15) % RH
Capacity Range : 5 ml/min
Calibration Media : Air
Type : Mass Flowmeter

Unit Under Calibration		Reference Condition : Pressure 101.325 kPa(abs) , 25 °C , Air			
Temperature (°C)	Pressure (kPa)	UUC Reading (ml/min)	STD Reading (ml/min)	Error (ml/min)	Uncertainty (± ml/min)
25.73	101.45	0.000	0.000 *	0.000	0.063
25.37	104.90	2.001	1.988	0.013	0.068
25.12	106.63	3.001	2.989	0.012	0.11
24.66	107.15	3.330	3.311	0.019	0.12
24.23	108.36	4.001	3.970	0.031	0.14
24.17	110.09	5.00	4.954	0.046	0.17

Error = Unit Under Calibration - Standard

Marked * are not included in the NSC-ONSC accreditation schedule for our laboratory.



Page 2 of 3



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD
214 Bangwak Rd. Bangnai Bangkae Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 http://www.mit.in.th



CALIBRATION CERTIFICATE

Certificate No. : L202210260-001
Date Issued : 07-Nov-22

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

Equipment : Mass Flow Meter

Manufacturer : Alicat Scientific
Model : MB-SSCCM-D/SM
Serial No. : 57730
ID No./Tag No. : UAE.EMA2.169/2553
Date Received : 31-Oct-22
Date Calibrated : 05-Nov-22

Calibrated by : Mr. Jame Khaothong

Calibration Method or Calibration Procedure Used

In-house method : CP-34 by comparison against mass flow calibrator.

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

Result of Calibration

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

This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

Approved by: *Sorayuth T.*
(Mr. Sarayuth Tochua)



Page 1 of 3

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เอกสารไม่ควบคุม

Certificate No. : L202210260-001

Note : The actual flow rate is determined by the equation :

$$Q_{Meas} = Q_{Ref} \times \frac{P_{Ref}}{P_{Meas}} \times \frac{T_{Meas}}{T_{Ref}}$$

; Q = Flow rate
; P = Absolute pressure
; T = Absolute temperature
; Subscript "Meas" = Measurement condition
; Subscript "Ref" = Reference condition

Condition As-Received : Used Item

The measurement results and statements of conformity with specification only relate to the item calibrated.

Traceability of Certificate :

The International System of Units (SI) through

NIMT Certificate No. MW-4013-22 for Mass Flow Calibrator (20 SCCM) Serial No. G501971G20, Due 22-Feb-24

End of Certificate

Page 3 of 3



1% ERROR < 1% USE < 0.033 mL/min

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Certificate of Calibration

Certificate No.: 22H1587
Page: 1 of 2

Equipment: Dsl Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE/ANV/127/2550

Condition As-Received: Used Item

Received Date: 20 July 2022

Calibration Date: 22 July 2022

Reference: 2207-0584WSC

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, Bangkok,
Phrahanong, Bangkok 10260

Procedure used: Calibration was 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) Standard Chilled Mirror Hygrometer Sensor	Dew Prime II	31863	19714	17 Sep 2022
2) Standard Humidity/Temperature Meter	400	10240757	TH-0125-21	13 Dec 2022

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 at:-

-National Institute of Standards and Technology (NIST), The United States of America

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Somchai Dumvor
Issue Date: 03 August 2022

Approved Signatory: 

[] Chakrit Waoanjan
[] Pornthip Tameyakul
[] Viporn Tantayawuti

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B 0293723



Certificate of Calibration

Certificate No.: 22P2722
Page: 1 of 2

Equipment: Aneroid Barometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE/ANV/013/2547

Condition As-Received: Used Item

Received Date: 20 July 2022

Calibration Date: 22 July 2022

Reference: 2207-0584WSC

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1010 mbar

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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, Bangkok,
Phrahanong, Bangkok 10260

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

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DP1142	1422505048	MP-0078-22	02 May 2023

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

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

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Surwit Aussamee
Issue Date: 25 July 2022

Approved Signatory: 

[] Phalinoo Prabpaijal
[] Sura Suwannasri
[] Attapol Panurach

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B 0293205



Cert. No.: 22H1587
Page: 2 of 2

Result of Calibration:- Before 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	38	-2.1	1.6
25.0	60.0	57	-3.0	1.8
25.0	80.0	74	-6.0	2.0

Result of Calibration:- After 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	40	-0.1	1.6
25.0	60.0	60	0.0	1.8
25.0	80.0	77	-3.0	2.0

Result of Calibration:- Without Adjustment
Function: Temperature measurement.

Reference Temperature (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.00	20.0	20.0	0.00	0.72
25.04	25.0	25.0	-0.04	0.72
30.01	30.0	30.0	-0.01	0.72
35.04	35.0	35.0	-0.04	0.72
39.98	40.0	40.0	0.02	0.72

UUC* : Unit Under Calibration

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

-00-



Cert.No.: 22P2722
Page: 2 of 2

Result of calibration:- Without adjustment

Function:- Absolute Pressure Measurement

Range: 720 mmHg to 780 mmHg

Scale Interval: 1 mmHg (The Fifth Estimate)

Increasing Pressure

Applied Pressure (mmHg)	718.48	729.33	739.85	750.22	760.90	772.01	785.89
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0	780.0
Error (mmHg)	1.54	0.67	0.15	-0.22	-0.90	-2.01	-6.89

Decreasing Pressure

Applied Pressure (mmHg)	785.90	771.99	760.85	750.17	739.90	729.57	718.62
UUC* Indication (mmHg)	780.0	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-5.90	-1.99	-0.85	-0.17	0.10	0.43	1.38

The uncertainty of measurement was ± 0.24 mmHg

* UUC = Unit Under Calibration

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

-00-

เอกสารไม่ควบคุม
B 1119773

เอกสารไม่ควบคุม
B 1110533

MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2022

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

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CCL159599
Expiration Date : Jul 30, 2022

Dilutor Detail

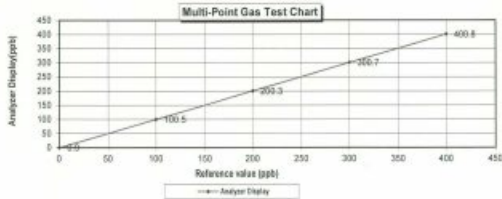
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.90	0.90
Level 2	20.00%	100.0	100.5	0.50	0.50
Level 3	40.00%	200.0	200.3	0.30	0.15
Level 4	60.00%	300.0	300.7	0.70	0.23
Level 5	80.00%	400.0	400.8	0.80	0.20

Remark : Measuring Range 500.0 ppb
Acceptable Limit $\pm 5\%$

Average Difference (%) 0.40



Calculate by

Sirichai Y.
21/4/25

Approve by

Prakhan N.
8, Apr. 2022

MULTI-POINT GAS TEST REPORT

Test Date : Apr 19, 2022

Equipment : Gas Analyzer (NO₂) Model : 42C
Manufacturer : Thermo Electron Corporation Serial Number : 42C-0508011076

Standard Gas Concentration

Sulphur Dioxide (SO₂) 45.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CCL159599
Expiration Date : Jul 30, 2022

Dilutor Detail

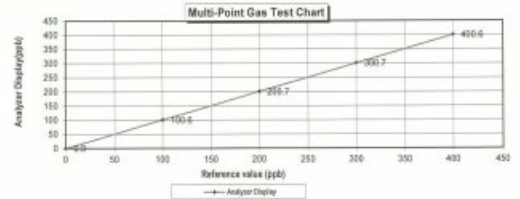
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.90	0.90
Level 2	20.00%	100.0	100.5	0.50	0.60
Level 3	40.00%	200.0	200.7	0.70	0.35
Level 4	60.00%	300.0	300.7	0.70	0.23
Level 5	80.00%	400.0	400.6	0.60	0.15

Remark : Measuring Range 500.0 ppb
Acceptable Limit $\pm 5\%$

Average Difference (%) 0.45



Calculate by

Sirichai Y.
19/4/25

Approve by

Prakhan N.
20, Apr. 2022

MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2022

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

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CCL159599
Expiration Date : Jul 30, 2022

Dilutor Detail

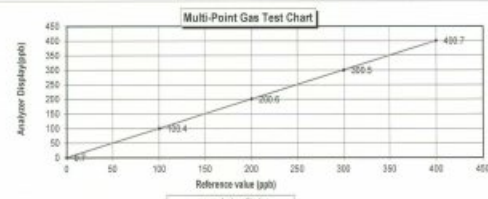
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.7	0.70	0.70
Level 2	20.00%	100.0	100.4	0.40	0.40
Level 3	40.00%	200.0	200.6	0.60	0.30
Level 4	60.00%	300.0	300.5	0.50	0.17
Level 5	80.00%	400.0	400.7	0.70	0.17

Remark : Measuring Range 500.0 ppb
Acceptable Limit $\pm 5\%$

Average Difference (%) 0.35



Calculate by

Sirichai Y.
21/4/25

Approve by

Prakhan N.
8, Apr. 2022

MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2022

Equipment : Gas Analyzer (NO₂) Model : 42C
Manufacturer : Thermo Electron Corporation Serial Number : 0517512000

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CCL159599
Expiration Date : Jul 30, 2022

Dilutor Detail

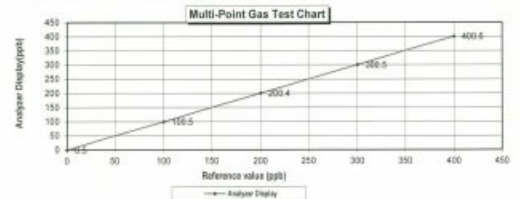
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	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	100.5	0.50	0.50
Level 3	40.00%	200.0	200.4	0.40	0.20
Level 4	60.00%	300.0	300.5	0.50	0.17
Level 5	80.00%	400.0	400.6	0.60	0.15

Remark : Measuring Range 500.0 ppb
Acceptable Limit $\pm 5\%$

Average Difference (%) 0.30



Calculate by

Sirichai Y.
21/4/25

Approve by

Prakhan N.
8, Apr. 2022

MULTI-POINT GAS TEST REPORT

Test Date : Apr 8, 2022

Equipment : Gas Analyzer (SO₂) Model : 431
Manufacturer : Thermo SCIENTIFIC Serial Number : 1200906874

Standard Gas Concentration

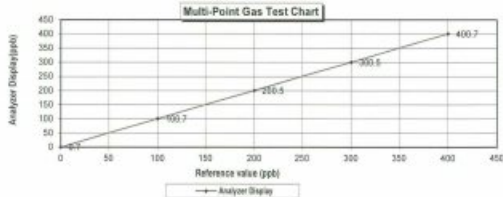
Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail

Manufacturer : Thermo SCIENTIFIC
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.7	0.70	0.70	0.70
Level 2	20.00%	100.0	100.7	0.70	0.70	0.70
Level 3	40.00%	200.0	200.5	0.50	0.25	0.25
Level 4	60.00%	300.0	300.5	0.50	0.17	0.17
Level 5	80.00%	400.0	400.7	0.70	0.17	0.17
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.40



Calculate by

Signature
S. Y. K.

Approve by

Signature
S. Y. K.

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 19, 2022

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

Standard Gas Concentration

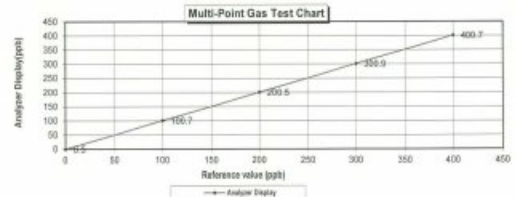
Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail

Manufacturer : Thermo Scientific
Model : 1461
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	100.7	0.70	0.70
Level 3	40.00%	200.0	200.5	0.50	0.25
Level 4	60.00%	300.0	300.9	0.90	0.30
Level 5	80.00%	400.0	400.7	0.70	0.17
Remark : Measuring Range 500.0 ppb			Average Difference (%) 0.38		



Calculate by

Signature
S. Y. K.

Approve by

Signature
S. Y. K.

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : May 3, 2022

Equipment : Gas Analyzer (SO₂) Model : 431
Manufacturer : Thermo SCIENTIFIC Serial Number : 1200906876

Standard Gas Concentration

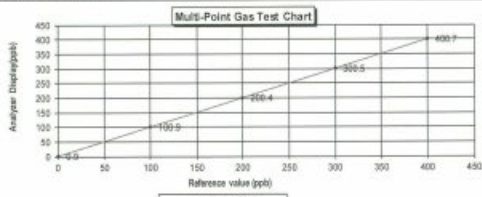
Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail

Manufacturer : Thermo SCIENTIFIC
Model : 1461
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	0.90	0.90	0.90
Level 2	20.00%	100.0	100.9	0.89	0.89	0.89
Level 3	40.00%	200.0	200.4	0.40	0.20	0.20
Level 4	60.00%	300.0	300.5	0.50	0.17	0.17
Level 5	80.00%	400.0	400.7	0.70	0.17	0.17
Remark : Measuring Range			500.0 ppb	Average Difference (%) 0.47		



Calculate by

Signature
S. Y. K.

Approve by

Signature
S. Y. K.

เอกสารไม่ควบคุม

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N185E15A01D3 Reference Number: 123-402135167-1
Cylinder Number: E0143252 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 660
Gas Code: CO, NO, NO₂, SO₂, BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with EPA Method 18 for Analysis of Gases and Collection of Gases (May 2017) documents EPA Method 18.01, using the latest procedures and latest analytical methods. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant interferences which affect the value of this calibration result. All concentrations are on a molar basis unless otherwise noted.

See also the Calibration Report (CR) for this cylinder.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NO ₂	45.00 PPM	45.00 PPM	G1	$\pm 1.4\%$ NIST Traceable	05/14/2021, 06/01/2021
NITROGEN DIOXIDE	45.00 PPM	45.00 PPM	G1	$\pm 1.4\%$ NIST Traceable	05/14/2021, 06/01/2021
SULFUR DIOXIDE	45.00 PPM	45.00 PPM	G1	$\pm 1.4\%$ NIST Traceable	05/14/2021, 06/01/2021
CARBON MONOXIDE	1000 PPM	998.8 PPM	G1	$\pm 0.1\%$ NIST Traceable	05/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20001133	CC109058	45.82 PPM NITROGEN DIOXIDE/NITROGEN	$\pm 1.0\%$	Feb 02, 2025
PRM	12349	D880305	9.81 PPM NITROGEN DIOXIDE/NITROGEN	$\pm 2.5\%$	Feb 25, 2025
QMS	40142389132	CC000081	4.348 PPM NITROGEN DIOXIDE/NITROGEN	$\pm 2.1\%$	Feb 18, 2023
NTRM	16011043	CC040277	45.50 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.8\%$	Jun 17, 2022
NTRM	14000110	CC040277	996.9 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.5\%$	Nov 16, 2025

Instrument/Model	Analytical Principle	Last Multi-point Calibration
Model 6700 AHR0301333 CO	FTR	Jun 03, 2021
Model 6700 AHR0301333 NO	FTR	Jun 03, 2021
Model 6700 AHR0301333 NO ₂	FTR	Jun 03, 2021
Model 6700 AHR0301333 SO ₂	FTR	Jun 03, 2021

Test Data Available Upon Request

NOTES: PO #5221002907
GROSS WT: 28.40 kg
NET WT: 4.73 kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

Approved for Release



เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 22, 2022

Equipment : Gas Analyzer (SO₂) Model : 431
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778111

Standard Gas Concentration

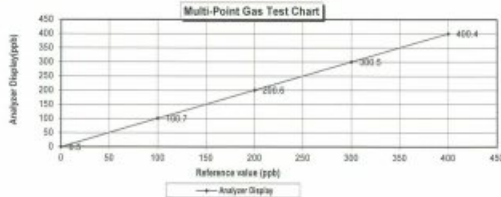
Sulphur Dioxide (SO₂) 44.75 PPM Manufacturer : Thermo SCIENTIFIC
Nitric Oxide (NO) 45.35 PPM Model : 146i
Methane (CH₄) - PPM Serial Number : 1180540071
Carbon Monoxide (CO) 1007
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

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	0.50	0.50	0.50
Level 2 20.00%	100.0	100.7	0.70	0.70
Level 3 40.00%	200.0	201.6	0.80	0.80
Level 4 60.00%	300.0	301.5	0.50	0.17
Level 5 80.00%	400.0	400.7	0.10	0.10
Remark : Measuring Range 500.0 ppb		Average Difference (%)		
: Acceptable Limit $\pm 5\%$		0.35		



Calculate by

Sachin K
22/4/22

Approve by

22/4/22

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : May 3, 2022

Equipment : Gas Analyzer (SO₂) Model : 431
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778111

Standard Gas Concentration

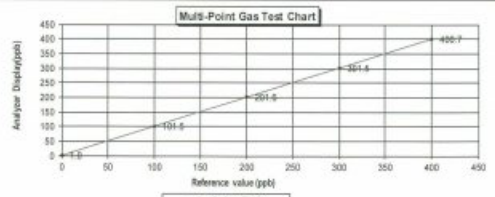
Sulphur Dioxide (SO₂) 44.75 PPM Manufacturer : Thermo SCIENTIFIC
Nitric Oxide (NO) 45.35 PPM Model : 146i
Methane (CH₄) - PPM Serial Number : 1180540071
Carbon Monoxide (CO) 1007
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

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	1.00	1.00	1.00
Level 2 20.00%	100.0	101.5	1.50	1.48
Level 3 40.00%	200.0	201.6	1.60	0.79
Level 4 60.00%	300.0	301.5	1.50	0.50
Level 5 80.00%	400.0	400.7	0.70	0.17
Remark : Measuring Range 500.0 ppb		Average Difference (%)		
: Acceptable Limit $\pm 5\%$		0.79		



Calculate by

22/5/22

Approve by

4/5/22

เอกสารไม่ควบคุม



CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N195E15A01D3
Cylinder Number: E0413252
Laboratory: 124 - Durham (SAP) - NC
PGVP Number: B22021
Gas Code: CO, NO, NO₂, SO₂, BALN

Reference Number: 123-402135167-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 660
Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with EPA Analytical Protocol for Analysis and Certification of Gaseous Calibration Standards (May 2017) documents EPA 820-R-12-017, using the latest procedures. 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 interferences which affect the use of this calibration mixture. All concentrations are on a molar/volume basis unless otherwise noted.

See table for the Calibration (CD) table for 0.1% major gases.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NO ₂	45.00 PPM	45.00 PPM	G1	$\pm 1.4\%$ NIST Traceable	05/14/2021, 06/01/2021
NITROGEN DIOXIDE	45.00 PPM	45.00 PPM	G1	$\pm 1.4\%$ NIST Traceable	05/14/2021, 06/01/2021
SULFUR DIOXIDE	45.00 PPM	45.00 PPM	G1	$\pm 1.4\%$ NIST Traceable	05/14/2021, 06/01/2021
CARBON MONOXIDE	1000 PPM	998.8 PPM	G1	$\pm 0.2\%$ NIST Traceable	05/14/2021, 06/01/2021
NITROGEN	Balance				

ANALYTICAL RESULTS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20001123	CC159599	45.82 PPM NITROGEN DIOXIDE/NITROGEN	$\pm 1.0\%$	Feb 02, 2025
PRM	12309	D880325	9.81 PPM NITROGEN DIOXIDE/NITROGEN	$\pm 2.0\%$	Feb 28, 2025
QMS	40142389132	CC159599	4.348 PPM NITROGEN DIOXIDE/NITROGEN	$\pm 2.1\%$	Feb 18, 2025
NTRM	16011043	CC159599	45.50 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.8\%$	Jun 17, 2022
NTRM	14082110	CC159599	906.9 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.8\%$	Nov 16, 2025

The SPH, PPM or RM listed above is only in reference to the GMS used to fill the cylinder and not part of the product.

CALIBRATION STANDARDS

Instrument/Model	Analytical Principle	Last Multi-point Calibration
Model 6700 AHR2001323 CO	FTIR	Jun 03, 2021
Model 6700 AHR2001323 NO	FTIR	Jun 03, 2021
Model 6700 AHR2001323 NO ₂	FTIR	Jun 03, 2021
Model 6700 AHR2001323 SO ₂	FTIR	Jun 03, 2021

Test Data Available Upon Request

NOTES: PO #5221002907
GROSS WT: 28.40kg
NET WT: 4.73kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

Approved for Release

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : May 3, 2022

Equipment : Gas Analyzer (SO₂) Model : 431
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778111

Standard Gas Concentration

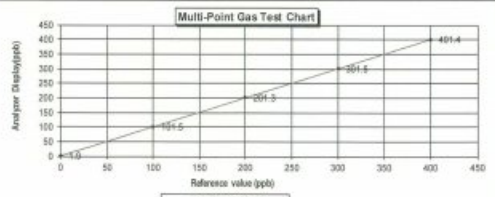
Sulphur Dioxide (SO₂) 44.75 PPM Manufacturer : Thermo SCIENTIFIC
Nitric Oxide (NO) 45.35 PPM Model : 146i
Methane (CH₄) - PPM Serial Number : 1180540071
Carbon Monoxide (CO) 1007
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

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	1.9	1.90	1.90
Level 2 20.00%	100.0	101.5	1.50	1.48
Level 3 40.00%	200.0	201.3	1.30	0.65
Level 4 60.00%	300.0	301.5	1.50	0.50
Level 5 80.00%	400.0	401.4	1.40	0.35
Remark : Measuring Range 500.0 ppb		Average Difference (%)		
: Acceptable Limit $\pm 5\%$		0.97		



Calculate by

22/5/22

Approve by

4/5/22

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 26, 2022

Equipment : Gas Analyzer (CO) Model : 481
 Manufacturer : Thermo Scientific Serial Number : 1180540074

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.35	PPM	Model :	1461
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007	PPM		
Cylinder No. :	CC199599			
Expiration Date :	Jul 30, 2022			

Dilutor Detail

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.5	0.5	0.5
Level 2 20.00%	10.0	10.5	4.8	4.8
Level 3 40.00%	20.0	20.3	1.5	1.5
Level 4 60.00%	30.0	30.6	2.0	2.0
Level 5 80.00%	40.0	40.5	1.2	1.2
Remark : Measuring Range	50.0 ppm	Average Difference (%)	1.99	

Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart

Calculate by Sitchai y.
 26.4.15

Approve by Prachin K.
 29. Apr. 2022

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 29, 2022

Equipment : Gas Analyzer (CO) Model : 481
 Manufacturer : Thermo Scientific Serial Number : 1180540068

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.35	PPM	Model :	1461
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007	PPM		
Cylinder No. :	CC199599			
Expiration Date :	Jul 30, 2022			

Dilutor Detail

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.4	0.4	0.4
Level 2 20.00%	10.0	10.5	0.5	4.8
Level 3 40.00%	20.0	20.3	0.3	1.5
Level 4 60.00%	30.0	30.6	0.6	2.0
Level 5 80.00%	40.0	40.4	0.4	1.0
Remark : Measuring Range	50.0 ppm	Average Difference (%)	1.92	

Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart

Calculate by Sitchai y.
 29.4.15

Approve by Prachin K.
 29. Apr. 2022

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 26, 2022

Equipment : Gas Analyzer (CO) Model : APMA-370
 Manufacturer : Horiba Serial Number : YH3AG7T

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.35	PPM	Model :	1461
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007	PPM		
Cylinder No. :	CC199599			
Expiration Date :	Jul 30, 2022			

Dilutor Detail

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.4	0.4	0.4
Level 2 20.00%	10.0	10.3	0.3	2.9
Level 3 40.00%	20.0	20.4	0.4	2.0
Level 4 60.00%	30.0	30.6	0.6	2.0
Level 5 80.00%	40.0	40.5	0.5	1.2
Remark : Measuring Range	50.0 ppm	Average Difference (%)	1.69	

Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart

Calculate by Sitchai y.
 26.4.15

Approve by Prachin K.
 29. Apr. 2022

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 29, 2022

Equipment : Gas Analyzer (CO) Model : 481
 Manufacturer : Thermo Scientific Serial Number : 1180540069

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.35	PPM	Model :	1461
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007	PPM		
Cylinder No. :	CC199599			
Expiration Date :	Jul 30, 2022			

Dilutor Detail

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.5	0.5	0.5
Level 2 20.00%	10.0	10.4	0.4	3.8
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	40.4	0.4	1.0
Remark : Measuring Range	50.0 ppm	Average Difference (%)	2.01	

Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart

Calculate by Sitchai y.
 29.4.15

Approve by Prachin K.
 29. Apr. 2022

Page 1 of 1

เอกสารไม่ควบคุม

Certificate of Calibration

WL-21 Wireless Anemometer

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

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0004

Calibration Date: 2022/2/22

Calibration Expiry Date: 2023/2/21

The Result of Calibration

Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	0.9	0.1	0.9 - 1.1	Pass
2.0	2	0	1.8 - 2.2	Pass
5.0	4.8	0.2	4.7 - 5.3	Pass
7.0	7.1	0.1	6.9 - 7.1	Pass
10.0	9.7	0.3	9.5 - 10.5	Pass
20.0	20	0	19.8 - 21.0	Pass

Measured Value	Actual Value	Deviation	Tolerance	Result
45°	48	3	42 - 48	Pass
135°	134	1	132 - 138	Pass
225°	227	2	222 - 228	Pass
315°	315	0	312 - 318	Pass
0°	1	1	357 - 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
22.6°C	22.1	0.4	21.5-23.5	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1000	2	994-1002	Pass

Environment conditions:

Air temperature: 24 °C

Relative humidity: 58 %

Static pressure: 118.3 kPa

Performed by:

Jim Lin

Certified by
Head of Engineering department

This certificate may not be published or reproduced, except in full, unless obtaining permission in writing form from Scarlet Tech Ltd.
4F-3, No. 347, 2nd Sec, Heping E. Rd., Daan Dist, Taipei City 106, Taiwan

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 26, 2022

Equipment : Gas Analyzer (CO)

Model : AFMA-370

Manufacturer : Horiba

Serial Number : YRLHTB7G

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM
Nitric Oxide (NO)	45.35	PPM
Methane (CH ₄)	-	PPM
Carbon Monoxide (CO)	1007	PPM
Cylinder No. :	CC159599	
Expiration Date :	Jul 30, 2022	

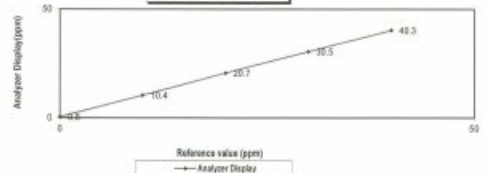
Dilutor Detail

Manufacturer :	Thermo SCIENTIFIC
Model :	146
Serial Number :	1180540071

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.5	0.5	0.5
Level 2 20.00%	10.0	0.4	3.8	3.8
Level 3 40.00%	20.0	0.7	3.4	3.4
Level 4 60.00%	30.0	0.5	1.6	1.6
Level 5 80.00%	40.0	0.3	0.7	0.7
Remark : Measuring Range	50.0 ppm			
	Acceptable Limit ± 5%		Average Difference (%)	2.02

Multi-Point Gas Test Chart



Calculate by

26, 4, 15

Approve by

22, Apr, 2022

Page 1 of 1

เอกสารไม่ควบคุม

Envi Equipment Service Co., Ltd.

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

Tel. 098 362 9152, 089 478 7885

E-mail: sales@envi-ees.com

Certificate No. : E22-08034

Page : 1 of 6

CERTIFICATE OF CALIBRATION

Customer	: United Analyst and Engineering Consultant Co., Ltd.
Address	: 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Description of Equipment	: Console meter
Manufacturer	: Apex Instrument
Model Number	: XC-572-V
Serial Number	: 1701018
ID./Control No.	: -
Environment Conditions	: Temperature (25 ± 2) °C : Humidity (50 ± 15) % RH
Cal. Date	: 17/08/2022
Issue Date	: 17/08/2022

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

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

Result of Calibration

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

Calibrated by : Mr. Sanya Sangnil

Approved by :

(Mr. Mana Puchkud)
Technical Manager

เอกสารไม่ควบคุม

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E04N185E15A01D3	Reference Number:	123-402135167-1
Cylinder Number:	E04143252	Cylinder Volume:	144.4 CF
Laboratory:	124 - Durham (SAP) - NC	Cylinder Pressure:	2015 PSIG
PGVP Number:	B22021	Valve Outlet:	660
Gas Code:	CO, NO, NOX, SO2, BALN	Certification Date:	Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Approval Protocol for Analytical Laboratories of Chemical Calibration Standards (May 2017) document EPA 820-P-12-001, using the latest procedures level. 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 interferences which affect the use of this calibration module. All considerations are to be made by the user of this calibration module.

The following table shows the results of the calibration.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.00 PPM	G1	± 1.4% NIST Traceable	03/14/2021, 06/01/2021
NITROGEN DIOXIDE	45.00 PPM	45.00 PPM	G1	± 1.4% NIST Traceable	03/14/2021, 06/01/2021
SULFUR DIOXIDE	45.00 PPM	44.88 PPM	G1	± 1.0% NIST Traceable	06/14/2021, 06/01/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	± 0.7% NIST Traceable	06/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20001133	CC109058	45.82 PPM NITROGEN DIOXIDE/NITROGEN	± 1.0%	Feb 02, 2025
PRM	12309	D880305	9.81 PPM NITROGEN DIOXIDE/NITROGEN	± 2.0%	Feb 02, 2025
QMS	40142389182	CC300081	4.348 PPM NITROGEN DIOXIDE/NITROGEN	± 2.1	Feb 16, 2023
NTRM	16011043	CC010277	45.50 PPM SULFUR DIOXIDE/NITROGEN	± 0.8%	Jun 17, 2022
NTRM	14080110	CC049277	906.9 PPM CARBON MONOXIDE/NITROGEN	± 0.6%	Feb 16, 2025

The SRM, PRM or QMS value shown is only in reference to the QMS used to the sample and not part of the product.

Instrument/Make/Model	Analytical Principle	Last Multi-point Calibration
Nelder 6700 AirQuattro333 CO	FTIR	Jun 03, 2021
Nelder 6700 AirQuattro333 NO	FTIR	Jun 03, 2021
Nelder 6700 AirQuattro333 NO2	FTIR	Jun 03, 2021
Nelder 6700 AirQuattro333 SO2	FTIR	Jun 03, 2021

Test Data Available Upon Request

NOTES: PO #5221002907

GROSS WT: 28.40kg

NET WT: 4.73kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

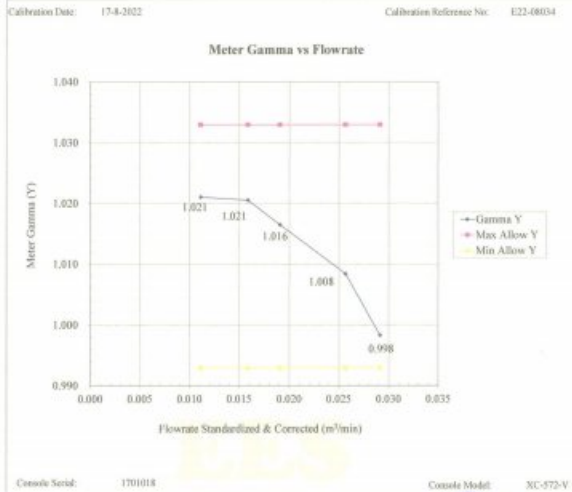
Approved for Release



CERT 308.01

เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	17/08/2022	10:20 AM	Std Temp	293	K
Console Serial Number	1701018	Calibration Reference No.	E22-08034			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	755.99			K _i	0.386	
DGM Serial Number	00002030	Calibration Meter Gamma	0.999			Console Leak Check	PASS	



เอกสารไม่ควบคุม

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

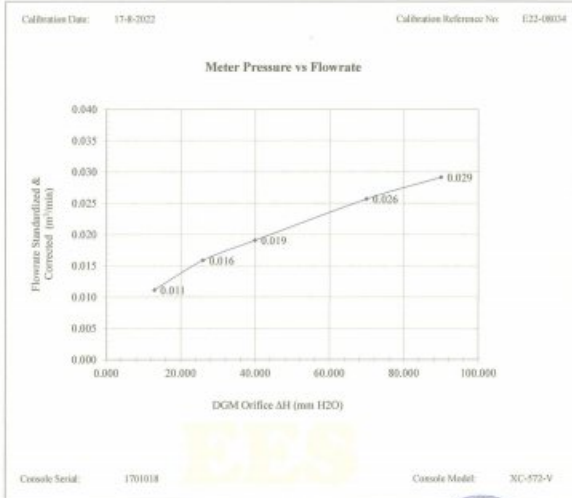
Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	17/08/2022	10:20 AM	Std Temp	293	K
Console Serial Number	1701018	Calibration Reference No.	E22-08034			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	755.99			K _i	0.386	
DGM Serial Number	00002030	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Data									
Metering Console					Calibration Meter				
Run Time	DGM Orifice	Volume	Volume	Outlet Temp	Outlet Temp	Volume	Volume	Outlet Temp	Outlet Temp
Elapsed	DH	Initial	Final	Temp Initial	Temp Final	Initial	Final	Temp Initial	Temp Final
(Q)	(Pa)	(V _{std})	(V _{act})	(t _{std})	(t _{act})	(V _{std})	(V _{act})	(t _{std})	(t _{act})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
12.50	13.0	1910.8900	1911.0300	27	27	85.69988	85.84334	27	27
12.55	13.0	1911.0300	1911.1700	27	27	85.84334	85.98642	27	27
8.80	26.0	1911.1810	1911.3210	27	27	85.99774	86.14128	26	26
8.80	26.0	1911.3210	1911.4610	28	28	86.14128	86.28450	26	26
14.62	40.0	1911.4740	1911.7540	28	28	86.29780	86.58438	26	26
14.60	40.0	1911.7540	1912.0340	28	28	86.58438	86.86982	26	26
10.83	70.0	1912.0450	1912.3250	28	28	86.88992	87.16578	25	25
10.83	70.0	1912.3250	1912.6050	29	29	87.16578	87.45004	25	25
9.47	90.0	1912.6190	1912.8990	29	29	87.46412	87.74662	25	25
9.47	90.0	1912.8990	1913.1790	29	29	87.74662	88.02862	25	25



เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	17/08/2022	10:20 AM	Std Temp	293	K
Console Serial Number	1701018	Calibration Reference No.	E22-08034			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	755.99			K _i	0.386	
DGM Serial Number	00002030	Calibration Meter Gamma	0.999			Console Leak Check	PASS	



เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	17/08/2022	10:20 AM	Std Temp	293	K
Console Serial Number	1701018	Calibration Reference No.	E22-08034			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	755.99			K _i	0.386	
DGM Serial Number	00002030	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Data									
Results									
Standardized Data					Dry Gas Meter				
Dry Gas Meter		Calibration Meter		Value	Variation	Flowrate		Variation	Variation
(V _{std})	(Q _{std})	(V _{act})	(Q _{act})			Std & Corr	(ΔH ₀)		
m ³	m ³ /min	m ³	m ³ /min	(Y)	(ΔY)	(Q _{std&corr})	mm H ₂ O	(ΔH ₀)	(ΔH ₀)
0.136	0.011	0.139	0.011	1.022	0.809	0.011	46.816	-1.144	
0.136	0.011	0.139	0.011	1.028	0.807	0.011	46.632	-0.528	
0.137	0.016	0.140	0.016	1.022	0.909	0.016	45.525	-1.635	
0.137	0.016	0.139	0.016	1.019	0.806	0.016	45.728	-1.431	
0.274	0.019	0.279	0.019	1.019	0.806	0.019	48.607	1.447	
0.274	0.019	0.278	0.019	1.014	0.602	0.019	48.584	1.725	
0.276	0.025	0.278	0.026	1.009	-0.003	0.026	47.409	0.249	
0.276	0.025	0.278	0.026	1.007	-0.006	0.026	47.609	0.449	
0.276	0.029	0.276	0.029	0.999	-0.014	0.029	47.509	0.349	
0.276	0.029	0.276	0.029	0.997	-0.016	0.029	47.678	0.518	
1.013					Y Average	47.160		ΔH ₀ Average	

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is 40.02.
For ΔH₀, orifice pressure differential that equates to 0.75 cfm (0.0212 m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.1 inches (5.1mm) H₂O.



เอกสารไม่ควบคุม

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.501 % Vol	2431/19	Unde	16-Jul-23
Oxygen (O ₂) 10.00 % Vol	2453/19	Unde	18-Jul-23
Oxygen (O ₂) 21.00 % Vol	2426/19	Unde	16-Jul-23
Carbon monoxide (CO) 80.23 ppm	2396/19	Unde	15-Jul-21
Carbon monoxide (CO) 301.4 ppm	2397/19	Unde	16-Jul-21
Carbon monoxide (CO) 1002 ppm	2424/19	Unde	17-Jul-21
Nitric Oxide (NO) 10.04 ppm	2446/19	Unde	17-Jul-21
Nitric Oxide (NO) 150.2 ppm	2309/19	Unde	07-Jul-21
Nitric Oxide (NO) 320.9 ppm	2431/19	Unde	16-Jul-21
Sulphur Dioxide (SO ₂) 50.28 ppm	2410/19	Unde	21-Jul-21
Sulphur Dioxide (SO ₂) 100.9 ppm	4942/20	Unde	28-Nov-22
Sulphur Dioxide (SO ₂) 600.0 ppm	2398/19	Unde	16-Jul-21
Nitrogen Dioxide (NO ₂) 10.20 ppm	2529/19	Unde	27-Aug-21
Nitrogen Dioxide (NO ₂) 80.37 ppm	2379/19	Unde	14-Jul-21
Nitrogen Dioxide (NO ₂) 200.8 ppm	2347/19	Unde	10-Jul-21

Measured room conditions

Temperature : 25.0 °C Humidity : 46.7 %RH Pressure : 1012.5 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1021.6 mbar

Calibration results (without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O ₂ (%Vol)	2.501	2.45	-0.051	0.20
O ₂ (%Vol)	10.00	9.89	-0.11	0.40
O ₂ (%Vol)	21.00	21.13	0.13	0.80
CO (ppm)	80.23	81	0.77	2.8
CO (ppm)	301.4	300	-1.4	11
CO (ppm)	1002	989	-13	34
NO (ppm)	10.04	8.4	-2.64	3.0
NO (ppm)	150.2	150	-0.2	5.0
NO (ppm)	320.9	315	-5.9	10
SO ₂ (ppm)	50.28	50	-0.28	5.0
SO ₂ (ppm)	100.9	102	1.1	5.0
SO ₂ (ppm)	600.0	598	-2.0	14
NO ₂ (ppm)	10.20	11	1.10	1.5
NO ₂ (ppm)	80.37	82	1.73	5.0
NO ₂ (ppm)	200.8	202	1.6	5.0

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

FM-CL-09-C Rev.8

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Issued Date 26/02/16

ENTECH INDUSTRIAL SOLUTION CO., LTD.
171/21 Soi Ngamwongwan 47 Yaek 48, Tsongrongphong, Lakai, Bangkok 10210 THAILAND Tel: 0-2779-8888 Fax: 0-2775-8888 info@entech.co.th
Tax ID : 0-10558605991 www.entech.co.th

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



บริษัท เอ็นเทคคิวทีพี เทคส์ จำกัด (สำนักงานใหญ่)
48/194-5 ซอยประดิษฐ์มนูธรรม 19 ถนนประดิษฐ์มนูธรรม แขวงลาดพร้าว เขตคลองจั่น กรุงเทพมหานคร 10230
TEL (862) 515-0145-50 FAX (862) 515-0144 www.entech.co.th E-mail : info@entech.co.th

No. RA 111/22

Certificate of Calibration

Customer : United Analyst and Engineering Consultant Co., Ltd.
Address : 81 Soi Udomak 41, Sukhumvit Road., Bangchak, Prakanong, Bangkok, 10260.
Calibration location : Executive Trading Limited,
Address : 48/194-5 Soi Praditmanutham 19, Pradit Manutham Road, Latphrao, Bangkok 10230

Tools :
Instrument : Gas Detector
Product : RAE Systems
Model Name : MiniRAE3000
Serial Number : 592-925267

Environmental Condition :
Temperature : (25 ± 3) °C
Relative Humidity : (37 ± 15) %
Pressure : 760 mmHg

Date of Calibration : July 21, 2022
Due Date of Calibration : July 21, 2023
Calibration Method : This instrument has been calibrated using calibration gases. Test and calibration data is On file with Executive trading limited.
Reference Standard : Isobutylene Standard Gas 100 ppm; Lot number 304-402089381-1.
Exp Date: 14 May 2025.

Test Result

Sensor Type	Reference Concentration	Before Cal.	After Cal.	Error Reading	Result
PID	0.0 ppm (Air Zero)	0.0 ppm	0.0 ppm	0.0 ppm	Pass
PID	100 ppm (Isobutylene)	110.1 ppm	100.0 ppm	0.0 ppm	Pass

Flow Rate of Pump : 482 cc/min.

Accuracy : ± 2 % at calibration point

Calibrated By : Sutinthom S.
(Mr. Sutinthom Saitae)
Service Engineer

Approved By : Sutinthom S.
(Mr. Sutinthom Saitae)
Service Engineer Manager

The results relate only to the items tested or calibrated.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the company.

เอกสารไม่ควบคุม

Date of issue : 12-May-21

Instrument description : Flue gas Analyzer
Instrument model : Testo 350 New
Instrument serial no. : 60899508
ID no. or control no. : UAE.EPM.008/2560
Manufacturer : testo AG
Probe description : -
Probe model : -
Probe serial : -
Customer name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Customer address : 81 SOI UDOMAK41,SUKHUMVIT ROAD,BANGCHAK PRAKANONG BANGKOK 10260

Total pages of certificate : 2 Pages
Receiving no. : L-211143
Receiving date. : 10-May-21
Parameter of calibration : Gas Calibration/Oxygen 2.501,10.00,21.00 %vol, Carbon Monoxide 80.23,301.4,1002 ppm, Nitric Oxide 10.04,150.2,320.9 ppm, Sulphur Dioxide 50.28,100.9,600.0 ppm, Nitrogen Dioxide 10.20,80.37,200.8 ppm)

Condition of UUC. : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory
Temperature : 23 ± 5 °C
Humidity : 55 ± 15 %RH
Calibration place : 171/21 Soi Ngamwongwan 47 Yaek 48, Tsongrongphong, Lakai, Bangkok 10210
Calibration procedure no. : WT-CL-28-C

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

Date of calibration : 12-May-21

Kwanchoi K.
Mr. Kwanchoi Khandung
Calibration Technician

Nongluck W.
Mrs. Nongluck Wangwattae
Technical Manager

FM-CL-09-C Rev.8

Page 1 of 2

Issued Date 26/02/16

ENTECH INDUSTRIAL SOLUTION CO., LTD.
171/21 Soi Ngamwongwan 47 Yaek 48, Tsongrongphong, Lakai, Bangkok 10210 THAILAND Tel: 0-2779-8888 Fax: 0-2775-8888 info@entech.co.th
Tax ID : 0-10558605991 www.entech.co.th

เอกสารไม่ควบคุม

Certificate No : 22-AFM-039
Report No : Req-2022-0398

Result of Calibration :

Flow Setting	STD Flow Reading	UUC Flow Reading	Correction Flow	Uncertainty
(L/min)	(L/min)	(L/min)	(L/min)	(L/min)
1.6	1.586	1.57	0.016	0.024
10	9.99	9.40	0.59	0.14
20	19.98	18.94	1.04	0.28
90	90.1	88.10	2.0	1.3
100	99.9	95.02	4.9	2.6
150	150.4	145.83	4.6	3.8
200	200.2	192.71	7.5	5.2

Note

STD : Standard

UUC : Unit Under Calibration

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.

RAE-708-AFM-01 Rev.00 Issue date 01/07/23

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Honeywell Analytics - Singapore Office
17 Changi Business Park Central 1
Singapore 499571
Cat Ref: 06021



Honeywell THE POWER OF CONNECTED Gas Detection

CERTIFICATE OF Attendance

It is hereby certified that

Mr Suttiwong Kongthongsang
(Executive Trading Limited)

has attended the

RAE Products & Maintenance Refresher Training Course

Conducted by

RAE Systems BY HONEYWELL

on **30th July 2021**

Conducted by : Desmond Tan
Service Engineer/Technical Trainer
Date of Issue : 30th July 2021
Valid for 1 year from date of issue

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5144 MITTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10259
TEL: 0-2715-3899-24 FAX: 0-2715-9494



Certificate of Calibration

Certificate No.: 22P2724
Page : 1 of 2

Equipment : Aneroid Barometer

Manufacturer: Barigo

Model: 111MS

Serial No.: -

ID No.: UAE.EMAZ.0672552

Condition As-Received: Used Item

Received Date: 20 July 2022

Calibration Date: 22 July 2022

Reference: 2207-0584WSC

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (60 ± 15) %

Atmospheric Pressure: 1010 mbar

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

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

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

Condition of this result of calibration

1.Reference standards Instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DP142	1422590546	MP-0076-22	02 May 2023

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

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

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

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

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

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

8.This Certificate is traceable to the International System of Unit maintained at:-
National Institute of Metrology Thailand (NIMT)

Calibrated by : Suttiwong Kongsang
Issue Date : 25 July 2022

Approved Signatory :
[] Phalinee Pratsaporn
[] Sura Suwananasi
[] Atsapol Panurach

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0293207

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7139 MOO 13, SOI SUNTANAKORN 11 TAMBON BANG KAOE,
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10140 THAILAND
TEL: 0669-2116-5869-1 FAX: 0669-2116-7141



Page 1/2

Certificate of Calibration

Customer

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

Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260

Certificate No : 22-AFM-039

Report No : Req-2022-0398

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator

Sensor Model : -

Manufacturer : TSI

Sensor Serial Number : -

Model : 5100

Serial Number : 51002052063

ID : UAE.EFM.162/2564

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 1 °C

Humidity : 55 %RH ± 20 %RH

Barometric Pressure : 1010 kPa ± 10 kPa

Received Date : 14 February 2022

Calibration Date : 22 March 2022

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Calibrator 3 Standard flow	19051011993	Sensidyne	20 May 2022
Air Flow Meter	Calibrator 3 High flow	18501012012	Sensidyne	21 May 2022
Air Flow Meter	4045 F	4045 0513 001	MET	10 January 2023

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 %.

Calibration By :
Mr. Nopadol Luangrat
Service Calibration Engineer

Approved By :
Mr. Pasi Mathawan
Calibration Engineer Supervisor
Issue Date : 22 March 2022

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.

RAE-708-AFM-01 Rev.00 Issue date 01/07/19

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Cert. No.: 22H1586
Page: 2 of 2

Result of Calibration:-

Before 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	38	-2.1	1.6
25.0	60.0	57	-3.0	1.8
25.0	80.0	74	-6.0	2.0

Result of Calibration:-

After 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	40	-0.1	1.6
25.0	60.0	60	0.0	1.8
25.0	80.0	77	-3.0	2.0

Result of Calibration:-

Function:	Temperature measurement.			
	Standard	UUC*		Uncertainty
	Temperature	Reading	Error	of Measurement
	(°C)	(°C)	(°C)	(°C)
	20.00	20.5	0.50	0.72
	25.04	25.0	-0.04	0.72
	30.01	30.0	-0.01	0.72
	35.04	34.5	-0.54	0.72
	39.98	39.0	-0.98	0.72

UUC* : Unit Under Calibration

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

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[Signature]

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a 1119774



Cert.No.: 22P2724
Page: 2 of 2

Result of calibration:- Without adjustment

Function:- Absolute Pressure Measurement Range: 720 mmHg to 780 mmHg
Scale Interval: 1 mmHg (The Fifth Estimate)

Increasing Pressure

Applied Pressure (mmHg)	717.16	727.91	738.69	749.36	759.90	771.01	783.82
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0	780.0
Error (mmHg)	2.84	2.09	1.11	0.65	0.10	-1.01	-3.82

Decreasing Pressure

Applied Pressure (mmHg)	783.79	770.96	758.88	746.29	738.71	727.84	717.11
UUC* Indication (mmHg)	780.0	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-3.79	-0.96	0.12	0.71	1.29	2.16	2.89

The uncertainty of measurement was ± 0.24 mmHg

* UUC = Unit Under Calibration

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

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[Signature]

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a 1119531

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/19 MOO 13, SOI 90 THAKHONG-11 TAMBON BANGKOK
AMPHOE BANG PHAI SAMUT PRABHAT PROVINCE 10540 THAILAND
TEL: 0809 2119-5500 / FAX: 0809 2119-7148



Certificate of Calibration

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

Certificate No.: 22-ACT-373
Request No.: Roq-2022-0840

Unit Under Calibration Details

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

Calibration Environment and Details

Temperature: (23 ± 2 °C)
Humidity: (50 ± 20 %RH)
Barometric Pressure: (1013 ± 10.0 hPa)
Received Date: 19 May 2022
Calibration Date: 8 June 2022
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 2023
THD Multimeter	2015	1047765	NIMT	2 February 2023

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: *[Signature]*
Mr. Nopphad Luangart
Service Calibration Engineer

Approved By: *[Signature]*
Mr. Paet Mathavorn
Calibration Engineer Supervisor
Issue Date: 8 June 2022

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

เอกสารไม่ควบคุม
a 1119774



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES J: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL: 0-2717-3889-24 FAX: 0-2719-9488



Certificate of Calibration

Certificate No.: 22H1586
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer
Manufacturer: Berigo
Model: -
Serial No.: -
ID No.: UAE.ANV.004/2548

Condition As-Received: Used Item

Received Date: 20 July 2022

Calibration Date: 22 July 2022

to 27 July 2022

Reference: 2207-058W5C

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 J: Equipment Calibration and Testing Services.

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

81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, 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) Standard Chilled Mirror Hygrometer Sensor	Dew Prime II	31863	19714	17 Sep 2022
2) Standard Humidity/Temperature Meter	400	10240757	TH-0125-21	13 Dec 2022

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 maintained at:-

- National Institute of Standards and Technology (NIST), The United States of America
- National Institute of Metrology Thailand (NIMT)

Calibrated by: Sornchai Dumvor
Issue Date: 03 August 2022

Approved Signatory: *[Signature]*
() Chakrit Wawerjue
() Pornthippan Tameyaku
() Viporn Tantayawutti

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a 0293722

Certificate No : 22-ACT-060
Request No : Req-2022-0228

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1. Indication at the calibration check frequency

EUC Setting	Nominal Level (dB)	Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		EUC (dB)	ERR (dB)	EUC (dB)	ERR (dB)		
FAST / A / 25 - 138							
Calibrator Setting							
1000 Hz 134.00 dB	93.95	93.7	-0.25	93.8	-0.05	0.10	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Broad Stereo, Model SV 35A, SN: 59079

2. Self-generated noise, Microphone installed

EUC Setting	Measured	UNCERTAINTY
FAST / 25 - 138		
EUC Weighting	(dB)	(± dB)
A	14.9	0.10

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

EUC Setting	Measured	UNCERTAINTY
FAST / 25 - 138		
EUC Weighting	(dB)	(± dB)
A	11.5	0.10
C	16.9	0.10
Z	22.5	0.10

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

EUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A (dB)	C (dB)	Z (dB)		
FAST / 25 - 138					
STD Setting	(dB)	(dB)	(dB)		
125 Hz	-0.1	0.1	0.0	0.50	1.5
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.1	0.1	0.1	0.60	1.0
8000 Hz	-1.4	-1.5	-1.4	0.70	1.0

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

PM-709-03-M-01 Rev.0 Issue date 01/03/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-373

Request No : Req-2022-0840

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 2 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	94.02	0.02	-	-	0.11	0.40
114 dB / 1000 Hz	114.10	0.10	-	-	0.11	0.40

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 2 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	999.00	0.10	-	-	0.10	1.7
114 dB / 1000 Hz	999.00	0.10	-	-	0.10	1.7

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

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

Note :

- 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

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

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Certificate No : 22-ACT-060
Request No : Req-2022-0228

Page 3/6

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

EUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A (dB)	C (dB)	Z (dB)		
FAST / 25 - 138					
STD Setting	(dB)	(dB)	(dB)		
63 Hz	-0.2	-0.1	0.0	0.2	2.0
125 Hz	-0.1	0.0	0.0	0.2	1.5
250 Hz	-0.1	0.0	0.0	0.2	1.5
500 Hz	0.0	0.1	0.0	0.2	1.5
1000 Hz	0.0	0.0	0.0	0.2	1.0
2000 Hz	0.0	0.1	0.0	0.2	2.0
4000 Hz	0.0	0.0	0.0	0.2	3.0
8000 Hz	0.1	0.1	0.0	0.2	5
16000 Hz	-1.3	-1.4	0.0	0.2	+5, -INF.

6. Frequency and time weightings at 1kHz

EUC Setting	STD REF	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		EUC (dB)	ERR (dB)		
FAST / 25 - 138					
EUC Weighting	(dB)	(dB)	(dB)		
A	94.00	94.0	0.0	0.2	0.2
C	94.00	94.0	0.0	0.2	0.2
Z	94.00	94.0	0.0	0.2	0.2

EUC Setting	STD REF	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		EUC (dB)	ERR (dB)		
25 - 138 / A					
EUC Time Response	(dB)	(dB)	(dB)		
Fast	94.00	94.0	0.0	0.1	0.1
Slow	94.00	94.0	0.0	0.2	0.1
Log	94.00	94.0	0.0	0.1	0.1

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.

PM-709-03-M-01 Rev.0 Issue date 01/03/19

เอกสารไม่ควบคุม

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udonsook 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Certificate No : 22-ACT-060
Request No : Req-2022-0228

Unit Under Calibration Details

Measurement Item :	Sound Level Meter	Microphone Class : 2
Manufacturer :	RION	Microphone Model : UC-52
Model :	NL-42	Microphone S/N : 188531
Serial Number :	00706870	Preamplifier Model : N80-24
ID :	0/AE/EPH/020/2564	Preamplifier S/N : 01221
Resolution :	0.1 dB	Instrument Status : Good

Calibration Environment and Details

Temperature :	22 °C ± 2 °C
Humidity :	50 %RH ± 20 %RH
Barometric Pressure :	1013 hPa ± 10 hPa
Received Date :	31 January 2022
Calibrated Date :	2 February 2022
Calibration Procedure :	16-voice method CP-01-M-01 based on IEC 61672-1:2003 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	188275	15 September 2022	GRAS
Multi-frequency Calibrator	Quant	Quant-cal	EFA000234	14 June 2022	TSI
Audio Generator	Sonytek	Sonytek01	151	18 October 2022	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. Suppachon Luanjant
Calibration Officer

Approved By :

Mr. Paet Mutharom
Calibration Engineer Supervisor

Issue Date : 3 February 2022

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.

PM-709-03-M-01 Rev.0 Issue date 01/03/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-080
Request No : Req-2022-0228

12. Overload indication

EUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 25 - 138	UUC	(\pm dB)	(\pm dB)
STD Setting	(dB)		
Positive one-half cycle	139.4		
Negative one-half cycle	139.3		
Deviasi	0.1	0.2	1.5

13. High Level Stability

EUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 25 - 138	UUC	(\pm dB)	(\pm dB)
STD Setting	(dB)		
Initial	137.0		
Final	137.0		
Deviasi	0.0	0.1	0.3

End of Certificate

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

PM 708-5234-01 Rev A Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-080
Request No : Req-2022-0228

7. Long Term Stability

EUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 25 - 138	UUC	(\pm dB)	(\pm dB)
STD Setting	(dB)		
Initial	94.0		
Final	94.0		
Deviasi	0.0	0.1	0.3

8. Level linearity on the reference level range

EUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 25 - 138	REF	UUC	ERR	(\pm dB)
STD dB	(dB)	(dB)	(dB)	(\pm dB)
137.00	137	137.0	0.0	0.8
136.00	136	136.0	0.0	0.8
135.00	135	135.0	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	49.0	0.0	1.1
44.00	44	44.0	0.0	1.1
39.00	39	39.0	0.0	1.1
34.00	34	34.0	-0.1	1.1
29.00	29	29.0	-0.1	1.1
24.00	24	24.0	-0.1	1.1
19.00	19	19.0	-0.1	1.1
14.00	14	14.0	-0.1	1.1
9.00	9	9.0	-0.1	1.1
4.00	4	4.0	-0.2	1.1

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

PM 708-5234-01 Rev A Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING
CONSULTANT CO.,LTD.
Address : 81 Soi Udonrak 41, Sakumvit Road, Bangchak, Prakanong,
Bangkok 10260
Certificate No : 21-ACT-187
Request No : Req-2021-0523

Unit Under Calibration Details

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

Calibration Environment and Details

Temperature : (23 \pm 2 °C)
Humidity : (50 \pm 20 %RH)
Barometric Pressure : (1013 \pm 10.0 hPa)
Received Date : 27 April 2021
Calibration Date : 28 May 2021
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	14 May 2022
THD Multimeter	2015	1047765	NIMT	22 January 2022

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

Note

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

Calibrated By : Mr. Noppadon Luangat
Service Calibration Engineer
Approved By : Mr. Pachi Mathavom
Calibration Engineer Supervisor
Issue Date : 28 May 2021

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

เอกสารไม่ควบคุม

Certificate No : 22-ACT-080
Request No : Req-2022-0228

9. Level linearity including the level range control

EUC Setting	STD	Measured	UNCERTAINTY	Acceptance Limit
FAST / A	REF	UUC	ERR	(\pm dB)
EUC Range	(dB)	(dB)	(dB)	(\pm dB)
25 - 138	29.5	29.5	0.1	1.1
	94	94.0	0.0	1.1

10. Tone burst response

EUC Setting	STD	Anticipated	Measured	UNCERTAINTY	Acceptance Limit
A / 25 - 138	Toneburst	Ref	UUC	ERR	(\pm dB)
EUC Time Response	(ms)	(dB)	(dB)	(dB)	(\pm dB)
	200	134.0	134.1	+0.1	1.0
Fast	2	117.0	117.0	0.0	+1.0, -2.5
	0.25	108.0	107.9	-0.1	+1.5, -5.0
Slow	200	127.4	127.6	0.0	1.0
	2	108.0	108.0	0.0	+1.0, -5.0
	200	128.0	128.0	0.0	1.0
SEL	2	108.0	108.0	0.0	+1.0, -2.5
	0.25	99.0	99.0	-0.1	+1.5, -5.0

11. Peak C Sound level

EUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance Limit
FAST / C / 25 - 138	REF	UUC	ERR	(\pm dB)
STD Setting	(dB)	(dB)	(dB)	(\pm dB)
Complete cycle	133.4	133.3	-0.10	3.0
Positive half cycle	132.4	132.2	-0.20	2.0
Negative half cycle	132.4	132.2	-0.20	2.0

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

PM 708-5234-01 Rev A Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-610
Request No : Req-2022-1770

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error	(%)	Limit
Calibrator Setting	(s)	(s)	(Pa ² /s)	(Pa ² /s)	(%)		(%)
1000 Hz 114 dB	120.00	120	3.19	3.20	+0.31	3.0	-21, +28

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 / 60-140	A	C	(± dB)	Limit
STD Setting	(dB)	(dB)	(± dB)	(± dB)
50 Hz	0.4	0.4	0.40	2.0
125 Hz	-0.3	-0.4	0.40	1.5
250 Hz	0.0	0.0	0.40	1.5
500 Hz	0.0	0.0	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	-0.1	-0.1	0.40	2.0
4000 Hz	0.2	0.2	0.40	3.0
8000 Hz	-0.7	-0.8	0.40	5.0

The results related only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of the Issuing Laboratory. Page 1/17/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-610
Request No : Req-2022-1770

3. Linearity of response to steady signals

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

UUC Setting	FAST / A / High											
1000 Hz	Ref	(dB)	80.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0		
	Level A	(dB)	80.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0		
	Error	(dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8000 Hz	Ref	(dB)			80.0	90.0	100.0	110.0	120.0	130.0	140.0	
	Level A	(dB)			80.0	89.0	100.0	110.0	120.0	130.0	140.0	
	Error	(dB)			0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8	
	Level A	(dB)						87.8	93.8	103.8	113.8	
	Error	(dB)						0.0	0.0	0.0	0.0	0.0
Tolerances Limit	(±dB)							1.0				
UNCERTAINTY	(±dB)							0.27				

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error	(%)	Limit
Calibrator Setting	(s)	(s)	(Pa ² /s)	(Pa ² /s)	(%)		(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00		
1000 Hz 110 dB	45	45	0.30	0.31	+2.00		
1000 Hz 110 dB	90	90	1.00	1.01	+1.00	4.3	
1000 Hz 110 dB	180	180	2.00	2.02	+1.00		
1000 Hz 120 dB	36	36	4.00	4.03	+0.75		
1000 Hz 120 dB	72	72	8.00	8.05	+0.63		
1000 Hz 120 dB	90	90	10.00	10.13	+1.30	3.8	
1000 Hz 120 dB	180	180	20.00	20.22	+1.10		
1000 Hz 120 dB	360	360	40.00	40.34	+0.85		
1000 Hz 120 dB	720	720	80.00	80.48	+0.61		

The results related only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of the Issuing Laboratory. Page 1/17/19

เอกสารไม่ควบคุม

Certificate No : 21-ACT-187
Request No : Req-2021-0523

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range	Without Adjustment (dB)		Adjustment (dB)		Uncertainty	Acceptance limit
(dB)	Measured	Error	Measured	Error	(± dB)	Class 1 (± dB)
94 dB / 1000 Hz	93.81	-0.19	-	-	0.11	0.25
114 dB / 1000 Hz	113.83	-0.17	-	-	0.11	0.25

Frequency of Sound pressure level

Calibration Range	Without Adjustment		Adjustment		Uncertainty	Acceptance limit
(Hz)	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)	(± %)	Class 1 (± %)
94 dB / 1000 Hz	999.97	0.003	-	-	0.02	0.70
114 dB / 1000 Hz	999.98	0.002	-	-	0.02	0.70

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

Calibration Range	Without Adjustment	Adjustment	Uncertainty	Acceptance limit
(Hz)	Measured (%)	Measured (%)	(± %)	Class 1 (± %)
94 dB / 1000 Hz	0.18	-	0.17	2.5
114 dB / 1000 Hz	0.04	-	0.17	2.5

Note :

- 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

The results related only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of the Issuing Laboratory. Page 1/17/19

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD. Certificate No : 22-ACT-610
Address : 81 Soi Udomsak 41, Sakharavit Road, Banghak, Prakanong, Bangkok 10260 Request No : Req-2022-1770

Unit Under Calibration Details

Measurement item : Noise dosimeter Microphone Class : 2
Manufacturer : SVANTER Microphone Model : SV 27B5
Model : SV 104B5 Microphone S/N : 08647
Serial Number : 67627 Pre-amplifier Model : -
ID : UAE-EPM1062561 Pre-amplifier S/N : -
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 21 September 2022
Calibrated Date : 22 September 2022
Calibration Procedure : In-house method G1-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Multi-frequency Calibrator	Quest	Quest-eval	188272	29 June 2023	TSL
Standard Microphone	GRAS	40AN	188273	15 November 2022	GRAS
Sine Generator	Svanick	SwaadH	131	18 October 2022	W&K Electronic
Timer	EXTech	-	05-ACT	24 March 2023	TPA

Note

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

Calibrated By : 
Mr. Nopphon Lungsart
Calibration Officer

Approved By : 
Mr. Patti Mahasarak
Calibration Engineer Supervisor
Issue Date : 22 September 2022

The results related only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of the Issuing Laboratory. Page 1/17/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-033

Request No : Req-2022-0881

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa ² /s)	(Pa ² /s)	(%)		
1000 Hz 134 dB	120.00	120	3.23	3.20	-0.03	3.0	-21 ~ +26

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY (± dB)	Tolerances Limit (± dB)
	A	C		
FAST / 55-140	(dB)	(dB)	(± dB)	(± dB)
STD Setting				
90 Hz	-0.3	-0.3	0.40	2.0
125 Hz	-0.3	-0.3	0.40	1.5
250 Hz	-0.3	-0.1	0.40	1.5
500 Hz	-0.3	-0.2	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.4	0.3	0.40	2.0
4000 Hz	0.2	0.3	0.40	3.0
8000 Hz	-1.8	-1.8	0.40	5.0

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

เอกสารไม่ควบคุม

date 01/07/19

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa ² /s)	(Pa ² /s)	(%)		
4000 Hz 95 dB	2846	2840	1.00	1.00	0.00	0.01	-0.29 ~ 0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa ² /s)	(Pa ² /s)	(%)		
Burst 1 ms, 93 dB	2846	2846	1.00	1.00	0.00		-21 ~ +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00	3.0	-21 ~ +41
Burst 1 ms, 108 dB	143	143	1.00	1.01	+1.00		-21 ~ +41

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	UUC	Different			
Calibrator Setting	(s)	(s)	(Pa ² /s)	(%)			
Continuous Rectangle +			10.86				
Continuous Rectangle -	7		10.86	0.00	2.4		-21 ~ +26

* Indicates non accredited

End of Certificate

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

เอกสารไม่ควบคุม

date 01/07/19

Certificate No : 22-ACT-033

Request No : Req-2022-0881

3. Linearity of response to steady signals

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

UUC Setting	FAST / A / High									
	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	124.0	120.0	130.0
1000 Hz	Level A	(dB)	54.2	80.3	90.1	100.1	110.1	124.6	120.0	130.0
	Error	(dB)	-0.8	0.3	0.1	0.1	0.1	0.6	0.0	0.0
8000 Hz	Ref	(dB)			88.9	98.9	108.9	122.9	118.9	126.9
	Level A	(dB)			88.0	98.0	108.0	122.0	118.0	126.0
	Error	(dB)			0.0	0.0	0.0	0.0	0.0	-0.1
63 Hz	Ref	(dB)						87.8	93.8	103.8
	Level A	(dB)						87.8	93.8	103.8
	Error	(dB)						0.0	0.0	0.0
Tolerances Limit	(±dB)							1.0		
UNCERTAINTY	(±dB)							0.27		

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa ² /s)	(Pa ² /s)	(%)		
1000 Hz 110 dB	27	27	0.30	0.30	0.00		
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	1.01	+1.00	4.3	
1000 Hz 110 dB	180	180	2.00	2.02	+1.00		
1000 Hz 120 dB	36	36	4.00	4.03	+0.75		
1000 Hz 120 dB	72	72	8.00	8.05	+0.63		
1000 Hz 120 dB	90	90	10.00	10.13	+1.30		
1000 Hz 120 dB	180	180	20.00	20.22	+1.10	3.8	
1000 Hz 120 dB	360	360	40.00	40.34	+0.85		
1000 Hz 120 dB	720	720	80.00	80.49	+0.61		

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เอกสารไม่ควบคุม

date 01/07/19

Certificate of Calibration

Customer

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

Certificate No : 22-ACT-033

Address : 81 Soi Udonrak 41, Sukhumvit Road, Bangkok, Pratinok, Bangkok 10260

Request No : Req-2022-0881

Unit Under Calibration Details

Measurement Item : Noise detector
Microphone Class : 1
Manufacturer : SVANTEK
Microphone Model : SV27
Model : SV104
Microphone S/N : 96602
Serial Number : 91925
Preamplifier Model : -
ID : UAEEM.165/2564
Preamplifier S/N : -
Resolution : 0.1 dB
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Revised Date : 14 January 2022
Calibrated Date : 21 January 2022
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	S/N	Doc calibration	Traceability
Multi-frequency Calibrator	Quest	Quest-val	108272	14 June 2022	TSI
Standard Microphone	GRAS	40AN	108273	15 September 2022	GRAS
Signal Generator	Svanwil	SvanWH	131	18 October 2022	WK Electric
Timer	EXTTECH	-	05-ACT	29 March 2022	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. Nopphol Luangrat
Calibration Officer

Approved By : 
Mr. Pait Mahavorn
Calibration Engineer Supervisor
Issue Date : 21 January 2022

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date 01/07/19

Calibration Note : Certificate No : 21-LXM-154
UUC Adjustment : Zero adjustment before use Request No : Req2021-0418
Page : 1/2

Result of Calibration :

UUC Range (h)	Standard (h)	UUC Reading (h)	Correction (h)	Uncertainty (h-h)
2000	0	0	0	0.58
	50	49	1	
	100	99	1	
	200	199	1	
	300	299	1	
	400	398	2	
	600	601	-1	
	800	799	1	
	1000	1003	-3	
	1200	1206	-6	
	1400	1402	-2	
	1600	1597	3	
	1800	1793	7	
	2000	1987	13	
	3000	2980	20	
20000	4000	3970	30	
	5000	4970	30	

End of Certificate

Calibrated By : 
Mr. Noppan Luang

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerance Limit
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	(Pa ² /h)	(Pa ² /h)
Calibrator Setting	(h)	(h)	(Pa ² /h)	(Pa ² /h)	(Pa ² /h)		
4000 Hz 95 dB	2846	2846	1.00	0.99	-0.01	0.01	-0.29 - 0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerance Limit
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	(%)	(%)
Calibrator Setting	(h)	(h)	(Pa ² /h)	(Pa ² /h)	(%)		
Burst 1 ms, 95 dB	2846	2846	1.00	0.99	-1.00		-21 - +20
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00	3.0	-21 - +42
Burst 1 ms, 105 dB	143	143	1.00	1.00	0.00		-21 - +42

5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement		UNCERTAINTY	Tolerance Limit
FAST / A / 55-140	UUC	UUC	Difference	(%)	(%)
Calibrator Setting	(h)	(Pa ² /h)	(%)		
Continuous Rectangle +		10.86			
Continuous Rectangle -	7	10.86	0.00	2.4	-21 - +20

* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovator Instrument Co., Ltd.
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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
33/44 PATTASAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2713-3000-27 FAX: 0-2719-9484



Cert.No.: 22CH541
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : EcoSense
Model : pH100A
Serial No. : JC03335
ID No. : UAE.EFM.062/2582/ENV pH.02/62)
Condition As-Received: Used Item
Received Date : 18 April 2022
Calibration Date : 19 April 2022
Reference : 2204-0341 IWS-C1
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10250
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lemgagtrakul

Approved by : 
Approved Signatory

(/) Mace Bukrua
(/) Saithip Meangmai
(/) Warakorn Lemgagtrakul

Issue Date : 21 April 2022

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 & Equipment Calibration and Testing Services.

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.LTD.
Name : H1 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong,
Bangkok 10250
Certificate No : 21-LXM-154
Request No : Req2021-1418
Page : 1/2

Unit Under Calibration Details

Instrument Name : Digital Lux Meter
Manufacturer : EXTECH
Model : 407026
Serial Number : A016005
Resolution : 1 lx
ID Number : UAE.EFM.018/2559
Range Calibration : 2000 , 20000 lx
Instrument Status : Used

Calibration Environment and Details

Temperature : 25 °C ± 2 °C
Humidity : 60 %RH ± 20 %RH
Received Date : 29 October, 2021
Calibrated Date : 12 November, 2021
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 26 October 2021, Certificate No.: TP-1026-21

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. Pakt Mathaveon
Calibration Engineer Supervisor
Issue Date : 12 November, 2021

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

A 0039922

PM-508-LXM-01 Rev.00 Issue Date: 01/07/19



Cert.No.: 22TW45
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HEDH0008
ID No. : UAE.EFM.086/2564(EFM.DO.05/64)
Received Date : 17 February 2022
Test Date : 18 February 2022
Reference : 2202-0608WSC-9
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 Sirithuan
Approved by :
(/) Mahee Bufrussa
(/) Sathip Meangmai
(/) Warakorn Lernagatrakul
Issue Date : 23 February 2022

เอกสารไม่ควบคุม
B 0281726



Cert.No.: 22CH541
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	21E2682	25 Aug 2022
2) Ref. Standard Thermometer	4982054	110RC044	21I1201	26 Oct 2022

This certification is traceable to the International System of Unit maintained at:-
- Traceable to National Institute of Metrology (Thailand), NIMT
2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	788995	01 Jan 2024
pH 6.863	CPA chem	766822	04 Sep 2022
pH 10.015	CPA chem	766824	04 Sep 2022

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 Fluke at pH (4,7)(7,10)

Unit Under Calibration	Nominal Value		Standard Voltage Input		Actual Reading		Uncertainty of Measurement (±)	Coverage factor k
	pH	mV	mV	pH	mV	pH		
pH Meter S/N : JC03335	4.00	177.48	177	4.01	0.58	2.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00		
	7.00	0.00	0	7.00	0.58	2.00		
	10.00	-177.48	-177	10.01	0.58	2.00		

เอกสารไม่ควบคุม
a 1104906



Cert.No.: 22TW45
Page.: 2 of 2

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 9KOE0107

Titration Method (Azide Modification Method)	DO Meter Reading	Standard Deviation
(mg/L)	(mg/L)	(mg/L)
8.08	8.08	0.0045

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may concerned intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

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เอกสารไม่ควบคุม
a 1096176



Cert.No.: 22CH541
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N. 2202029IA605377	4.008	4.01	173	0.0079	2.00
	6.863	6.98	-2	0.011	2.00
	6.863	6.98	-2	0.011	2.00
	10.015	10.01	-178	0.0082	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -
- Serial No. : 2202029IA605377
Dimension of probe;
- Length : 110 mm.
- Diameter : 12 mm.
- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.002	25.1	0.098	0.13	2.00
30.0	30.003	30.1	0.097	0.13	2.00
35.0	35.002	35.1	0.098	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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a 1104905



Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : YSI
Model : Pro 30
Serial No. : 18C103131
ID No. : UAE.EFM.203/2561(ENV.SCT.01/01)
Condition As-Received: Used Item
Received Date : 30 August 2022
Calibration Date : 31 August 2022
Reference : 2208-1040WSC-2
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure: In -house method :
- CP-CH6 by direct measurement
with certified reference material (CRM)
- CP-CH6 by comparison with standard thermometer

Calibrated by : Warakorn Lemgagrakul

Approved by : 
Approved Signatory

(✓) Malee Butkrusa
() Sathip Meangmai
() Warakorn Lemgagrakul

Issue Date : 2 September 2022


The Uncertainties are for a confidence probability of approximately 95%

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

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A 0044830



Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HEDH0008
ID No. : UAE.EFM.086/2564(EFM.DO.05/04)
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10250
Location : TPA On Site Calibration Laboratory
Received Order : 17 February 2022
Calibrated Date : 21 February 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Kunchit Promprat
Approved by : 
Approved Signatory
(✓) Pornthippa Tameysakul
(✓) Malee Butkrusa
() Suwit Imjai
Issue Date : 23 February 2022

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 : Equipment Calibration and Testing Services.

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A 0038236



Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	211977	17 Sep 2022
2) Ref. Std. Thermometer	4982054	110RC044	2111201	26 Oct 2022

This certification is traceable to the International System of Unit maintained at:-
- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials :-

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

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 µS/cm	CPA Chem	794129	14 Feb 2023
12.880 mS/cm	CPA Chem	794130	14 Feb 2023

- 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 1413.0 µS/cm

Conductivity Electrode Serial No.: 18C100559

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
1413.0 µS/cm	1433 µS/cm	1413 µS/cm	9.2 µS/cm	2.00
12.880 mS/cm	12.81 mS/cm	12.72 mS/cm	0.086 mS/cm	2.00

Remark : - UUC* = Unit Under Calibration

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A 1124592



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2202-0608WSC-10
Procedure Used :-

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	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1523	2188080	2111273	22 Nov 2022

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.

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N: 8KOED107

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	80	24.999	25.0	0.001	0.16	2.00
30.0	80	30.003	30.0	-0.003	0.16	2.00
35.0	80	34.998	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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A 1096246



Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : PRO30 COND-T
- Serial No. : 18C100559

Dimension of probe;

- Length : 7 mm.
- Diameter : 2.5 mm.
- Immersion Depth : 90 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)	Coverage factor k
25.0	25.004	24.9	-0.104	0.13	2.00
30.0	30.001	29.9	-0.101	0.13	2.00
35.0	35.002	34.9	-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 %.

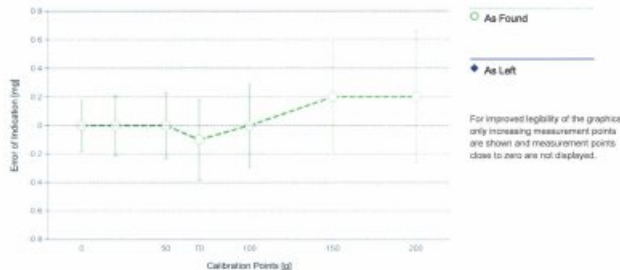
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Valu.

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a 1124591

Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.18 mg	2
2	0.1000 g	0.1000 g	0.0000 g	0.19 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.19 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.19 mg	2
5	10.0000 g	9.9999 g	-0.0001 g	0.20 mg	2
6	20.0000 g	20.0000 g	0.0000 g	0.21 mg	2
7	50.0000 g	50.0000 g	0.0000 g	0.23 mg	2
8	70.0001 g	70.0000 g	-0.0001 g	0.28 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.29 mg	2
10	150.0000 g	150.0002 g	0.0002 g	0.40 mg	2
11	200.0001 g	200.0003 g	0.0002 g	0.46 mg	2



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor $k=2$ which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	WS60	Date of Issue:	23-Feb-2022
Certificate Number:	C208581631	Calibration Due Date:	14-Aug-2023
Thermo Hygrometer			
Equipment No.:	IN161	Date of Issue:	14-Jun-2021
Certificate Number:	21H1220	Calibration Due Date:	01-Jun-2022

Mettler-Toledo (Thailand) Ltd.
848/4 - 848/5 Lasaie Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0362
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company:	United Analyst and Engineering Consultant Co., Ltd.	Contact:	Suwat Chotnook
Address:	3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak		
City:	Phra Khanong		
Zip / Postal:	10260		
State / Province:	Bangkok		
Order Number:			

Weighing Device

Manufacturer:	Mettler Toledo	Instrument Type:	Weighing Instrument
Model:	AB204-S	Asset Number:	UAE-AIR.0192550
Serial No.:	1128312528	Terminal Model:	N/A
Building:	N/A	Terminal Serial No.:	N/A
Floor:	2	Terminal Asset No.:	N/A
Room:	Balance Room 2 (206)		
Range:	Max. Capacity	Readability (d)	
1	220 g	0.0001 g	

Procedure

Calibration Guideline:	EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work instruction:	CPW002/20
This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.	
The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.	
In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.	

	Temperature	Humidity
As Found	Start: 22.5 °C End: 21.4 °C	Start: 56.1 % End: 63.2 %

As Found Calibration Date:	07-Apr-2022	Calibrator:	Suwat Chotnook
As Left Calibration Date:	N/A		
Issue Date:	08-Apr-2022	Approved Signatory:	Rassakorn Tassanachaisakul
			<input checked="" type="checkbox"/> Rassakorn Tassanachaisakul
			<input type="checkbox"/> Santi Jinyom
			<input type="checkbox"/> Sureshet Sukkate

Remarks

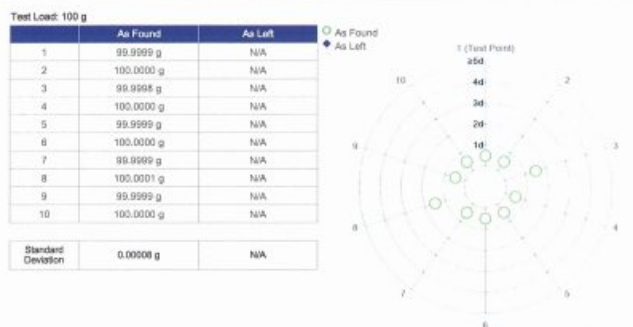
Equipment condition: Good
Next calibration according to customer's procedure
Calibration data not decide by calibration laboratory
Test weight by Filter pan : 1 g = 0.9999 g, 3 g = 3.0000 g, 5 g = 5.0000 g

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Results

Repeatability



Eccentricity





REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °CRelative humidity 55 ± 20 %RH

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

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

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

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 90 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

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FM-708-02 R01 1/11/2021

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with $k=2$ in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $3.0 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

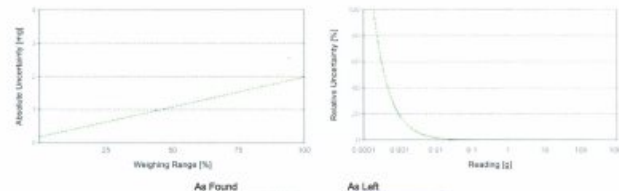
Linearization of Uncertainty Equation

Range	d	Max	As Found	As Left
1	0.0001 g	220 g	$U_1 = 0.19 \text{ mg} + 0.00817 \text{ mg/g} \cdot R$	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found	As Left
0.0220 g	0.19 mg	0.86%
0.2200 g	0.19 mg	0.087%
2.2000 g	0.21 mg	0.0095%
22.0000 g	0.37 mg	0.0017%
220.0000 g	2.0 mg	0.00090%



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REPORT OF CALIBRATION

Certificate No. : SP22-016

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
	0.5787	0.5755	0.0032	0.0031	2.00
	1.0490	1.0436	0.0054	0.0029	2.00
	2.1900	2.1847	0.0053	0.0075	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5607	0.5588	0.0019	0.0034	2.00
	1.0247	1.0232	0.0015	0.0035	2.00
	2.1229	2.1211	0.0018	0.0082	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5236	0.5197	0.0039	0.0029	2.00
	0.9634	0.9625	0.0009	0.0028	2.00
	1.9763	1.9752	0.0011	0.0070	2.00
546.1	0.0000	-0.0001	0.0001	0.0028	2.00
	0.5191	0.5171	0.0020	0.0031	2.00
	1.0003	0.9984	0.0019	0.0033	2.00
	1.9987	1.9946	0.0041	0.0084	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5523	0.5509	0.0014	0.0030	2.00
	1.0809	1.0799	0.0010	0.0029	2.00
	2.0391	2.0329	0.0062	0.0080	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5601	0.5584	0.0017	0.0031	2.00
	1.0512	1.0498	0.0014	0.0029	2.00
	1.9294	1.9265	0.0029	0.0082	2.00

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FM-708-02 R01 1/11/2021



CERTIFICATE OF CALIBRATION

Certificate No. : SP22-016

Page 1 of 5

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

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

Bangkok 10260

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009

ID No. : N/A

Received Date : 23 May 2022

Calibration Date : 23 May 2022

Issue Date : 26 May 2022

Condition Instrument : Good

Calibrated by :
(Mr. Tanawut Rittidach)
Technical Manager

Approved by :
(Ms. Chonthicha Sangnern)
Quality Manager

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

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

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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

CERTIFICATE OF CALIBRATION

Certificate No. : SP22-008 Page 1 of 5

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

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

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009



ID No. : UAE.WAT.051/2564

Received Date : 20 January 2022

Calibration Date : 20 January 2022

Issue Date : 24 January 2022

Condition Instrument : Good

Calibrated by :  Approved by : 
(Mr. Tanawut Rittidach) (Ms. Chonthicha Sangsri)
Technical Manager Quality Manager

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

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

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REPORT OF CALIBRATION

Certificate No. : SP22-016 Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000 0.7478	0.0001 0.7421	-0.0001 0.0057	0.0050 0.0056	2.00 2.00
257	0.0000 0.8686	0.0000 0.8619	0.0000 0.0067	0.0050 0.0059	2.00 2.00
313	0.0000 0.2912	0.0000 0.2896	0.0000 0.0016	0.0050 0.0051	2.00 2.00
350	0.0000 0.6448	0.0000 0.6403	0.0000 0.0045	0.0050 0.0055	2.00 2.00

FM-708-02 R01 1/11/2021

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

REPORT OF CALIBRATION

Certificate No. : SP22-008 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	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.
Wavelength 0.1 nm.

FM-708-02 R01 1/11/2021

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

REPORT OF CALIBRATION

Certificate No. : SP22-016 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	287.5	0.31	0.18	2.00
334.06	333.5	0.56	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.0	0.59	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	459.7	0.32	0.18	2.00
536.59	536.2	0.39	0.18	2.00
637.98	638.3	-0.32	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.5	-0.03	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.7	-0.30	0.18	2.00
740.72	740.8	-0.08	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.0	0.28	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

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. : SP22-008 Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.0	0.72	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.0	0.81	0.18	2.00
334.06	333.5	0.56	0.18	2.00
360.93	360.0	0.93	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.5	0.44	0.18	2.00
453.66	453.0	0.66	0.18	2.00
460.02	459.5	0.52	0.18	2.00
536.59	536.0	0.59	0.18	2.00
637.98	637.5	0.48	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.0	0.50	0.18	2.00
513.47	513.0	0.47	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.0	0.40	0.18	2.00
740.72	740.5	0.22	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.0	0.03	0.18	2.00
879.28	879.5	-0.22	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The much 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 -

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

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. : SP22-008 Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5787	0.576	0.0027	0.0031	2.00
	1.0490	1.046	0.0030	0.0029	2.00
	2.1900	2.182	0.0080	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.559	0.0017	0.0034	2.00
	1.0247	1.023	0.0017	0.0035	2.00
	2.1229	2.116	0.0069	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.521	0.0026	0.0030	2.00
	0.9634	0.962	0.0014	0.0029	2.00
	1.9763	1.970	0.0063	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.519	0.0001	0.0031	2.00
	1.0003	0.999	0.0013	0.0033	2.00
	1.9987	1.992	0.0067	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
	1.0809	1.080	0.0009	0.0030	2.00
	2.0391	2.031	0.0081	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.560	0.0001	0.0031	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.922	0.0074	0.0079	2.00

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม



Calibration Certificate

Certificate No.: 2203135- 001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsak 41, Sukhumvit Road, Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: HANNA INSTRUMENTS
Model: HI2020-02
Serial No.: C0051107
ID No.: UAE.WAO.005/2557
Order No.: 2203135
Operation No.: 2203135-001
Date of Receipt: 7 June 2022
Date of Calibration: 8 June 2022

Calibrated by Mr.Mansa Somaak Specialist
Approved by (Mr.Pheraphat Tansit) Manager, Division of Calibration Laboratory
Date of Issue: 13 June 2022 Responsible for the Technical Management Team

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

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

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

เอกสารไม่ควบคุม

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. : SP22-008 Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7478	0.747	0.0008	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8686	0.865	0.0036	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2912	0.290	0.0012	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6448	0.640	0.0048	0.0055	2.00

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2203135-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C **Model:** H2020-02
Serial No.: C0051107 **ID No.:** UAE.WAQ.055/2557
Manufacturer: HANNA INSTRUMENTS
Date of Calibration: 8 June 2022 **Page 4 of 5**

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature (23.5 ± 1.0) °C
Relative Humidity (53 ± 3) %

Condition of this results of Calibration:

1. Calibration Method :
- In house method: W-TB-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 0851/54	24-Jun-22	TISTR
Platinum Resistance Thermometer (PRT)	9527A	877332			

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Base, S/N: 341992/2

3. This certificate is traceable to International System of Units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of Calibrated item : ☒ Good
7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

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

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2203135-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C **Model:** H2020-02
Serial No.: C0051107 **ID No.:** UAE.WAQ.055/2557
Manufacturer: HANNA INSTRUMENTS
Date of Calibration: 8 June 2022 **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 : HI11310 S/N : 78743
Dimension of probe : Diameter 12 mm., Length 120 mm.,
Sheath material : Glass

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.001	-0.1	0.099
20.1	20.002	-0.1	0.099
25.2	25.002	-0.2	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 %.

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

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2203135-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 0.1 mV
Manufacturer: HANNA INSTRUMENTS **Model:** H2020-02
Serial No.: C0051107 **Type:** Bench top
ID No.: UAE.WAQ.005/2557
Date of Calibration: 8 June 2022 **Page 2 of 5**

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature (23.5 ± 1.5) °C **Relative Humidity:** (53 ± 5) %
Condition of Equipment: Good Condition
Condition of this Results of Calibration

1. Calibration Method : In house method : W-CC-002 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	2708007	Fuke	SGL-21F-6687	24 June 2022
2.2 Digital Thermometer	2708007	Fuke	CC-640599-01	30 October 2022
2.3 Thermo-Hygro Meter	NPI.BTH005/18	PCNPPE	QR22-0301	18 February 2023
Certified Reference Material	Lot No.	Manufacturer	Ref. N	Expires Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	805203	CPAchem	PH216.L5	21 April 2024
2.5 pH buffer 6.865 (Primary pH buffer Solution)	805204	CPAchem	PH217.L5	21 April 2024
2.6 pH buffer 10.01 (Primary pH buffer Solution)	805205	CPAchem	PH220.L5	21 April 2023
2.7 pH buffer 7.00 (Standard pH buffer Solution)	805206	CPAchem	PH107.L5	21 April 2023

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

- 3.1 Instruments No.2.1 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0075
- 3.2 Instruments No.2.2 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0081
- 3.3 Instruments No.2.3 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0292
- 3.4 Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method: Harmed call using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
- 3.5 Certified Reference Material No.2.7 traceable to BM RefH H-27 Lot# 04.06.2021; BM RefH H-28 Lot# 28.05.2021; BM RefH H-27 Lot# 04.06.2021; BM RefH H-28 Lot# 28.05.2021, the Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

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.

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

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2203135-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 0.1 mV
Manufacturer: HANNA INSTRUMENTS **Model:** H2020-02
Serial No.: C0051107 **Type:** Bench top
ID No.: UAE.WAQ.005/2557
Date of Calibration: 8 June 2022 **Page 3 of 5**

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

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0	414.117	415.9	0.00	0.063	2.00
2	295.811	297.5	2.00	0.063	2.00
4	177.462	179.1	4.00	0.063	2.00
6	59.159	60.8	6.00	0.063	2.00
7	-0.901	1.6	7.00	0.063	2.00
8	-59.159	-57.5	8.00	0.063	2.00
10	-177.463	-175.8	10.00	0.063	2.00
12	-295.812	-294.2	12.00	0.063	2.00
14	-414.119	-412.5	14.00	0.063	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode **Type:** Combined Electrode
Manufacturer: HANNA INSTRUMENTS **Model:** HI11310
Serial No.: 078743 **ID No.:** N/A
Performance of Electrode system (Three-Point Calibration at pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	169.8	96.7	0.0071	2.00
6.865	6.87	6.2	-	0.0075	2.00
10.006	10.01	-174.0	97.0	0.0087	2.00
6.985	6.99	-2.5	-	0.0093	2.00

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

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

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2201793-001-01
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.0102553

Date of Calibration: 1 March 2022 Page 3 of 5

Calibration Results:

1. Calibration of pH Meter

(Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (mV)	Coverage Factor (k)
		mV	pH		
0.00	414.117	414	0.00	0.58	2.00
2.00	295.511	295	2.00	0.58	2.00
4.00	177.442	176	4.00	0.58	2.00
6.00	59.159	59	6.00	0.58	2.00
7.00	-0.001	0	7.00	0.58	2.00
8.00	-59.159	-59	8.00	0.58	2.00
10.00	-177.463	-177	10.00	0.58	2.00
12.00	-295.512	-295	12.00	0.58	2.00
14.00	-414.119	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode

(Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode
Manufacturer: METTLER TOLEDO
Serial No.: 1156882
Type: Combined Electrode
Model: InLab0606
ID No.: N/A

Performance of Electrode system

(Three-Point Calibration at pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.00	180	96.25	0.0076	2.00
6.866	6.86	16	-	0.0079	2.00
10.012	10.01	-162	96.13	0.0094	2.00
6.865	7.00	9	-	0.0087	2.00

P. Jungsantit
1 March 2022

เอกสารไม่ควบคุม

F-CS-012 Revision: 00 Date: 14-12-61

Calibration Certificate

Certificate No.: 2201793-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomek 41, Sukhumvit Road, Bangkok, Prakhonong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter

Manufacturer: METTLER TOLEDO

Model: SevenEasy pH

Serial No.: 1231155210

ID No.: UAE.WAT.0102553

Order No.: 2201793

Operation No.: 2201793-001

Date of Receipt: 21 February 2022

Date of Calibration: 1 March 2022

Calibrated by Mr.Pheraphat Tuanjit
Scientist

Approved by *P. Jungsantit*
(Mr.Nuttapol Niyomchart)
Specialist, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 1 March 2022

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: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2201793-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.0102553
Manufacturer: METTLER TOLEDO

Date of Calibration: 1 March 2022 Page 4 of 5

Location: Chemical Calibration Laboratory, NATIONAL FOOD INSTITUTE

Environment Condition: Ambient Temperature 24 °C ± 1 °C
Relative Humidity 53 % ± 2 %

Condition of this results of Calibration:

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

2. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2116154	PSL-T 0851/64	03-Jun-22	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : - Low Temperature Bath (ISOCAL-5), Model: Europa-6 Plus Basic, S/N: 341592/2

3. This certificate is traceable to International System of Units (SI Units).

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

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

6. Condition of Calibrated Item :

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

P. Jungsantit
1 March 2022

เอกสารไม่ควบคุม

F-CS-012 Revision: 00 Date: 14-12-61

Calibration Report

Certificate No.: 2201793-001-01
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.0102553

Date of Calibration: 1 March 2022 Page 2 of 5

Location: Chemical Calibration Laboratory, NATIONAL FOOD INSTITUTE

Environment Condition: Ambient Temperature : (23.5 ± 1.5) °C Relative Humidity : (53 ± 5) %

Condition of Equipment: Good Condition

Condition of this Results of Calibration

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

2. Reference Standards / Certified Reference Material

Instrument	Serial (ID No.)	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2706007	Fluke	SCL-21P-0887	24 June 2022
2.2 Digital Thermometer	2706007	Fluke	CC-640599-01	30 October 2022
2.3 Thermo-Hygro Meter	NFI.BTH050418	PCNPE	QR22-0195	27 January 2023

Certified Reference Material	Lot No.	Manufacturer	Ref N	Expiry Date
2.4 pH buffer 4.006 (Primary pH buffer Solution)	741239	CPAchem	PH216.L5	19 April 2023
2.5 pH buffer 6.865 (Primary pH buffer Solution)	741240	CPAchem	PH217.L5	19 April 2023
2.6 pH buffer 10.01 (Primary pH buffer Solution)	741242	CPAchem	PH220.L5	19 April 2022
2.7 pH buffer 7.00 (Standard pH buffer Solution)	735636	CPAchem	PH107.L5	16 March 2022

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

- Instruments No 2.1 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0075
- Instruments No 2.2 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0061
- Instruments No 2.3 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0292
- Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method: Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is according to ISO 17034 and ISO/IEC 17025
- Certified Reference Material No. 2.7 traceable to BSM RefN HI-7 LoN 30.04.2020; BSM RefN HI-9 LoN 28.05.2020; BSM RefN HI-8 LoN 30.04.2020; BSM RefN HI-10 LoN 28.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is according to ISO 17034 and ISO/IEC 17025

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.

P. Jungsantit
1 March 2022

เอกสารไม่ควบคุม

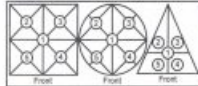
F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม
SPCC-FM-C24-06: 23 Nov 2020



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2204-0542OC-1
Result of calibration

Cert.No.: 22MM210
Page: 3 of 3



Maximum difference between off-center and central loading (g)
0.0002

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

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.00000	0.00000	0.016	2.13
0.05	0.05001	-0.00001	0.016	2.13
0.1	0.10001	-0.00001	0.017	2.11
1	1.00002	-0.00002	0.019	2.05
5	5.00003	-0.00003	0.026	2.00
20	20.00008	-0.00008	0.049	2.00
50	50.00010	-0.00010	0.080	2.00
80	80.00014	-0.00014	0.15	2.00
100	100.0001	-0.0001	0.21	2.00
150	150.0001	-0.0001	0.29	2.00
200	200.0001	-0.0001	0.35	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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 22MM210
Page: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : XSR205
Serial No. : C09071872
ID No. : UAE.WAO.012/2563
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phakhanong,
Bangkok 10260
Location : Balance Room
Received order : 26 April 2022
Calibration Date : 26 April 2022
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : Kunchit Promprat
Approved by :
() Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Injai
Issue Date : 29 April 2022

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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM304
Page: 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UF 55
Serial No. : B212.0411
ID No. : UAE.WAO.005/2556
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 : 7 April 2022
Calibration Date : 7 April 2022
Ambient Temperature : (28 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattansongpaiboon

Approved by :
Approved Signatory

() Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Injai

Issue Date : 18 April 2022

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

A 0040245



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2204-0542OC-1
Procedure used :-

Cert.No.: 22MM210
Page: 2 of 3

Calibration were conducted using in-house calibration procedure CP-0801 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	-	70RC138	MM-0009-21	3 Feb 2023

- 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.

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

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

Range capacity : 0 g to 81 g Resolution 0.00001 g
81 g to 220 g Resolution 0.0001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
80	80.00004	-0.00004	0.15	2.00
200	199.9999	+0.0001	0.35	2.00

After Adjustment :

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

Applied Weight (g)	Standard Deviation of Reading (g)
80	0.000008
200	0.00005

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2202934-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Sol Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR204
Serial No.: C117635043
ID No.: UAE.WAS.012/2564
Order No.: 2202934
Operation No.: 2202934-001
Date of Receipt: 13 May 2022
Date of Calibration: 13 May 2022

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: 25 May 2022

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



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2204-00150C-1
Procedure Used :-

Cert. No.: 22TM304
Page.: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY41021843	22LM4	10 Jan 2023

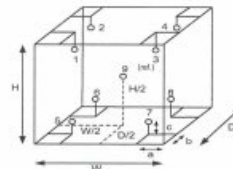
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

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 = 0.80 m
H = 0.75 m
Capacity = 0.30 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	28
REL.Humid. (%)	56	55
AC Supply (Volt)	221	224

Ref. Std. ID No. : @ Calibration Point (°C)		
Position :	(120 , 180)	(104)
1	21-04TC-01	18-04RTD-01
2	21-04TC-02	18-04RTD-02
3	21-04TC-03	18-04RTD-03
4	21-04TC-04	18-04RTD-04
5	21-04TC-05	18-04RTD-05
6	21-04TC-06	18-04RTD-06
7	21-04TC-07	18-04RTD-07
8	21-04TC-08	18-04RTD-08
9 (ref.)	21-04TC-09	18-04RTD-09

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

a 1104316

Calibration Report

Certificate No.: 2202934-001-01
Equipment: Electronic Balance
Model: XSR204
Serial No.: C117635043
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g
ID No.: UAE.WAS.012/2564

Date of Calibration: 13 May 2022 **Page 2 of 4**

Environment Condition: Ambient Temperature: 22.3 ± 0.1 °C Relative Humidity: 47 ± 3 %

Place of Calibration: Balance room (Water Analysis Unit), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NPI Method W-HA-001 3n-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	M22041375	23 April 2023

Instrument	Model	Serial No	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	PONPE 490	NPLBTH 010/18	Quality Reborn	QR22-0350	18 February 2023

3. This certification is traceable to SI UNIT

4. This certificate is 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	0.000333
200	0.000332

2. Off-Center Error:

A mass of 50 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)
50.000	50.000	50.000	50.000	50.000	50.000	0.000

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

a 1104315

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater
Meter Model : HI839800-02 Serial No.: 04500052101
Tube Heater : 25 Vial Capacity Accuracy : $\pm 2^{\circ}\text{C}$
Temperature Range : -10°C to 160°C Temperature of Reaction : 150°C
Ambient Temperature : $(25 \pm 2)^{\circ}\text{C}$ Relative Humidity : $(50 \pm 15)\%$ RH
Manufacturer : Hanna Instruments Made in : Romania
Condition As-Received : Used Product Reference : RE220588
Customer name : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,
Phrakhanong, Bangkok 10260
Received date : 29 April 2022
Calibrate date : 9 May 2022
Issue date : 10 May 2022
Calibrated Location : Hanna Instruments (Thailand) Ltd.
Calibration Procedure : This calibrator was conducted by using in-house: calibration procedure
CP-04 by using certified reference material

Calibrated by :

Mr. Pichit Pethong
Calibration Engineer

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).

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2202934-001-01

Equipment: Electronic Balance

Model: XSR204

Serial No.: C117635043

Capacity: 220 g

Manufacturer: METTLER TOLEDO

Resolution: 0.0001 g

ID No.: UAE.WAS.012/2564

Date of Calibration: 13 May 2022

Page 3 of 4

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
Unread	0.00000	0.0000	0.0000	0.000085	2.00
0.01	0.01000	0.0100	0.0000	0.000085	2.00
0.02	0.02000	0.0200	0.0000	0.000085	2.00
0.05	0.05000	0.0500	0.0000	0.000085	2.00
0.1	0.10001	0.1000	0.0000	0.000085	2.00
0.2	0.20001	0.2000	0.0000	0.000085	2.00
0.5	0.50002	0.5000	0.0000	0.000085	2.00
1	1.00001	1.0000	0.0000	0.000086	2.00
2	2.00003	2.0000	0.0000	0.000086	2.00
3	3.00004	3.0000	0.0000	0.000087	2.00
5	5.00002	5.0000	0.0000	0.000087	2.00
10	10.00001	10.0000	0.0000	0.000088	2.00
20	20.00004	20.0000	0.0000	0.000092	2.00
30	30.00005	30.0001	-0.0001	0.00010	2.00
40	40.00008	40.0001	0.0000	0.00011	2.00
45	45.00010	45.0001	0.0000	0.00013	2.00

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

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2202934-001-01

Equipment: Electronic Balance

Model: XSR204

Serial No.: C117635043

Capacity: 220 g

Manufacturer: METTLER TOLEDO

Resolution: 0.0001 g

ID No.: UAE.WAS.012/2564

Date of Calibration: 13 May 2022

Page 4 of 4

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
50	50.00004	50.0001	-0.0001	0.00011	2.00
55	55.00006	55.0001	0.0000	0.00012	2.00
60	60.00005	60.0001	-0.0001	0.00012	2.00
65	65.00007	65.0002	-0.0001	0.00013	2.00
70	70.00008	70.0002	-0.0001	0.00013	2.00
75	75.00010	75.0002	-0.0001	0.00013	2.00
80	80.00009	80.0002	-0.0001	0.00014	2.00
85	85.00011	85.0002	-0.0001	0.00014	2.00
90	90.00012	90.0002	-0.0001	0.00015	2.00
100	100.00008	100.0003	-0.0002	0.00016	2.00
120	120.00011	120.0003	-0.0002	0.00018	2.00
150	150.00012	150.0004	-0.0003	0.00021	2.00
200	200.00015	200.0004	-0.0003	0.00028	2.00

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

***** End *****

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

เอกสารไม่ควบคุม



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2202-0448OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 22TM90
Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor #
20.0	19.5	19.4	0.30	0.58	1.0	0.55	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.154	20.013	20.356	19.939	19.834	19.761	19.817	19.824	19.922

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-

Man.

เอกสารไม่ควบคุม
A 1096041



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-27 FAX: 0-2719-9484



Cert. No.: 22TM90
Page.: 1 of 3

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : Arco
Model : UC4-1320
Serial No. : 13URC4S013201
ID No. : UAE.WAO.015/2561
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 17 February 2022
Calibration Date : 17 February 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Kunchit Prompratt

Approved by :
Approved Signatory

(/) Pornthippa Tameyakul
(/) Malee Butkrues
(/) Suwit Imjai

Issue Date : 22 February 2022

The Uncertainties are for a confidence probability of approximately 95 %

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

เอกสารไม่ควบคุม
A 0038099



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-27 FAX: 0-2719-9484



Cert. No.: 22TM305
Page.: 1 of 3

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : ARCO
Model : UR-1320
Serial No. : -
ID No. : UAE.WAO.018/2551
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 7 April 2022
Calibration Date : 7 April 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanaspongpaiboon

Approved by :
Approved Signatory

(/) Pornthippa Tameyakul
(/) Malee Butkrues
(/) Suwit Imjai

Issue Date : 18 April 2022

The Uncertainties are for a confidence probability of approximately 95 %

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

เอกสารไม่ควบคุม

A 0040246



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2202-0448OC-1
Procedure Used :-

Cert. No.: 22TM90
Page.: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 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	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44035217	21LM30	23 Dec 2022

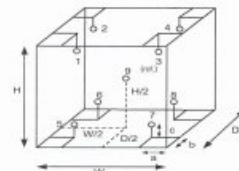
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details :	Dimension of Chamber :
a = 10 cm	D = 0.62 m
b = 10 cm	W = 1.2 m
c = 10 cm	H = 1.2 m
	Capacity = 0.89 m ³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	28
REL.Humid. (%)	68	75
AC Supply (Volt)	226	226

Position :	Ref. Std. ID No.:
1	18-10RTD-01
2	18-10RTD-02
3	18-10RTD-03
4	18-10RTD-04
5	18-10RTD-05
6	22-10RTD-10
7	18-10RTD-07
8	18-10RTD-08
9 (ref.)	18-10RTD-09

Man.

เอกสารไม่ควบคุม
A 1096042



Cert. No.: 22TM306
Page.: 1 of 3

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : ARCO
Model : UR-1320
Serial No. : -
ID No. : UAE.WAO.006/2553
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phraekhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 7 April 2022
Calibration Date : 7 April 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanapongpaiboon

Approved by :
Approved Signatory
() Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Injai

Issue Date : 18 April 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services & Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0040247



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2204-0015OC-2
Procedure Used :-

Cert. No.: 22TM305
Page.: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 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	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY41021843	22LM4	10 Jan 2023

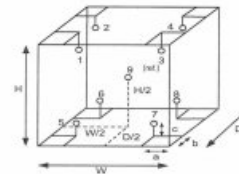
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details : Dimension of Chamber :
a = 10 cm D = 0.62 m
b = 10 cm W = 1.2 m
c = 10 cm H = 1.2 m
Capacity = 0.89 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	27
REL.Humid. (%)	56	59
AC Supply (Volt)	222	221

Position :	Ref. Std. ID No.:
1	18-04RTD-01
2	18-04RTD-02
3	18-04RTD-03
4	18-04RTD-04
5	18-04RTD-05
6	18-04RTD-06
7	18-04RTD-07
8	18-04RTD-08
9 (ref.)	18-04RTD-09

เอกสารไม่ควบคุม

a 1104314



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2204-0015OC-3
Procedure Used :-

Cert. No.: 22TM306
Page.: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 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	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY41021843	22LM4	10 Jan 2023

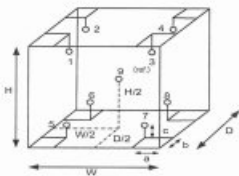
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details : Dimension of Chamber :
a = 10 cm D = 0.62 m
b = 10 cm W = 1.2 m
c = 10 cm H = 1.2 m
Capacity = 0.89 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	27
REL.Humid. (%)	59	57
AC Supply (Volt)	221	220

Position :	Ref. Std. ID No.:
1	18-04RTD-01
2	18-04RTD-02
3	18-04RTD-03
4	18-04RTD-04
5	18-04RTD-05
6	18-04RTD-06
7	18-04RTD-07
8	18-04RTD-08
9 (ref.)	18-04RTD-09

เอกสารไม่ควบคุม

a 1104312



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2204-0015OC-2
Result of Calibration :- (*) Without Adjustment

Cert. No.: 22TM305
Page.: 3 of 3

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	20.0	20.0	0.50	0.44	1.1	0.64	2

Calibration Point (°C)	Measured Temperature (°C)								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.080	20.056	19.866	19.826	19.655	19.656	19.819	19.979	19.899

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

a 1104313



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2204-0016OC-1
Procedure Used :-

Cert. No.: 22TM563
Page.: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 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	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

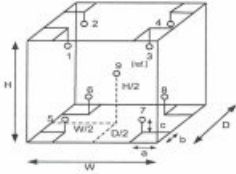
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details : Dimension of Chamber :

a = 5.0 cm	D = 0.50 m
b = 5.0 cm	W = 0.64 m
c = 5.0 cm	H = 0.80 m
	Capacity = 0.26 m ³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	26
REL Humid. (%)	60	62
AC Supply (Volt)	220	220

Position :	Ref. Std. ID No.:
1	15RTD2/11
2	15RTD2/12
3	15RTD2/13
4	15RTD2/14
5	15RTD2/15
6	15RTD2/16
7	15RTD2/17
8	15RTD2/18
9 (ref.)	15RTD2/19

เอกสารไม่ควบคุม

a 1104310



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2204-0015OC-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 22TM306
Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	20.0	19.9	0.33	0.68	1.4	0.50	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.176	20.413	19.711	19.637	20.218	20.286	19.639	19.642	19.922

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

a 1104311



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2204-0016OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 22TM563
Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
35.0	35.0	35.0	0.12	0.53	0.79	0.30	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
35.0	35.170	35.167	34.938	34.844	34.816	34.854	34.584	34.730	34.780

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 %.

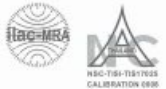
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เอกสารไม่ควบคุม

a 1104309



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM563
Page.: 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : Mammart
Model : IPP 280
Serial No. : V815.0187
ID No. : UAE.MIC.003/2559
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 7 April 2022
Calibration Date : 7 April 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Prawat Sodavitchit

Approved by :
Approved Signatory

() Pormthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai

Issue Date : 18 April 2022

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

A 0040248



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2202-0444OC-4
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source

Cert. No.: 22TM334
 Page.: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.572	44.514	44.507	44.530	44.565

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.5	0.10	0.042	0.15	2

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

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

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม
 a 1096054



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
 5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
 TEL. 0-2717-3000-21 FAX. 0-2719-9484



Cert. No.: 22TM334
 Page.: 1 of 3

Certificate of Calibration

Equipment : Water Bath
 Manufacturer : Memmert
 Model : WNE 14
 Serial No. : L416.0612
 ID No. : UAE.MIC.003/2560
 Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangchak, Phrakhanong,
 Bangkok 10260
 Microbiology Laboratory
 Location :
 Received Order : 17 February 2022
 Calibration Date : 17 February 2022
 Ambient Temperature : (26 ± 10) °C
 Relative Humidity : (50 ± 30) %
 Calibrated by : Suwit Imjai
 Approved by :
 () Pornthippa Tameyakul
 (/) Malee Butkruea
 Issue Date : 22 February 2022

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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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
 5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
 TEL. 0-2717-3000-21 FAX. 0-2719-9484



Cert. No.: 22TM565
 Page.: 1 of 3

Certificate of Calibration

Equipment : Water Bath
 Manufacturer : Memmert
 Model : WNE 14
 Serial No. : L414.1407
 ID No. : UAE.MIC.006/2556
 Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangchak, Phrakhanong,
 Bangkok 10260
 Location : Microbiology Laboratory
 Received Order : 7 April 2022
 Calibration Date : 7 April 2022
 Ambient Temperature : (26 ± 10) °C
 Relative Humidity : (50 ± 30) %
 Calibrated by : Prawit Sodavitchit
 Approved by :
 () Pornthippa Tameyakul
 (/) Malee Butkruea
 () Suwit Imjai
 Issue Date : 18 April 2022



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2202-0444OC-4
 Procedure Used :-

Cert. No.: 22TM334
 Page.: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

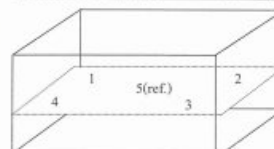
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	21	65	229
Finished of Calibration	22	57	230



Front

Position :	Ref. Std. ID No.:
1	70RC143
2	70RC144
3	70RC145
4	70RC146
5(ref.)	70RC147

The Uncertainties are for a confidence probability of approximately 95 %

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เอกสารไม่ควบคุม

เอกสารไม่ควบคุม
 a 1096055

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lassaie Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: United Analyst and Engineering Consultant Co., Ltd.
Address: 3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak
City: Phra Khanong Contact: Suwit Chotnirk
Zip / Postal: 10260
State / Province: Bangkok
Order Number: 

Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: MS603S/01 Asset Number: UAE.MIC.0062553
Serial No.: B007010311 Terminal Model: N/A
Building: N/A Terminal Serial No.: N/A
Floor: 2 Terminal Asset No.: N/A
Room: Balance Room (206)

Range	Max. Capacity	Readability (d)
1	620 g	0.001 g

Procedure

Calibration Guideline: EURAMET cg-16 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction: CPW002/20
This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.
The sensitivity span of the weighing instrument was adjusted before calibration with a built-in weight.
In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature	Humidity
As Found	Start: 22.8 °C End: 23.0 °C	Start: 49.9 % End: 58.3 %

As Found Calibration Date: 07-Apr-2022 Calibrator: 
As Left Calibration Date: N/A
Issue Date: 08-Apr-2022
Approved Signatory: 
☒ Kasakorn Tassanacharukul
☐ Santi Jinyom
☐ Suresh Chotnirk



Equipment: Water Bath
Condition As-Received: Used Item
Reference: 2204-0016OC-4
Procedure Used:-

Cert. No.: 22TM565
Page.: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

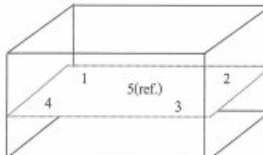
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration:- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental	AC Voltage Supply
	(°C)	(%R.H.)
Beginning of Calibration	26	62
Finished of Calibration	26	65



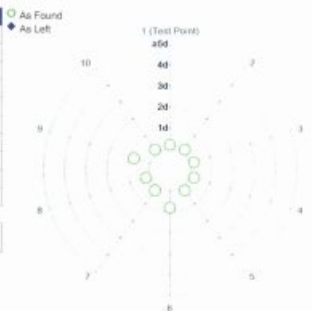
Front

Position :	Ref. Std. ID No.:
1	70RC143
2	70RC144
3	70RC145
4	70RC146
5(ref.)	70RC147

Measurement Results

Repeatability

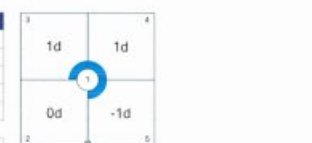
Test Load: 200 g	As Found	As Left
1	200.001 g	N/A
2	200.001 g	N/A
3	200.001 g	N/A
4	200.001 g	N/A
5	200.001 g	N/A
6	200.000 g	N/A
7	200.001 g	N/A
8	200.001 g	N/A
9	200.000 g	N/A
10	200.001 g	N/A
Standard Deviation	0.0004 g	N/A



The "1d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 200 g	As Found	As Left
1	200.001 g	N/A
2	200.001 g	N/A
3	200.002 g	N/A
4	200.002 g	N/A
5	200.000 g	N/A
Maximum Deviation	0.001 g	N/A



The "1d" in the graph represents the readability of the range/interval in which the test was performed.



Equipment: Water Bath
Condition As-Received: Used Item
Reference: 2204-0016OC-4
Result of Calibration:- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 22TM565
Page.: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.424	44.409	44.478	44.470	44.581

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.5	0.22	0.039	0.15	2

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

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

Stability: One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

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

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

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Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with $k=2$ in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $3.0 \cdot 10^{-5} / K$
Temperature range on site for the evaluation of the measurement uncertainty in use: $3 K$

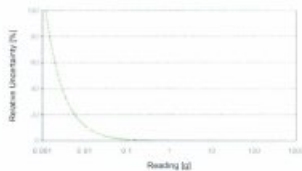
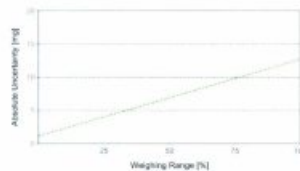
Linearization of Uncertainty Equation

Range		As Found	As Left
d	Max		
1	0.001 g	620 g	$U_1 = 1.2 \text{ mg} + 0.0186 \text{ mg/g} \cdot R$

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

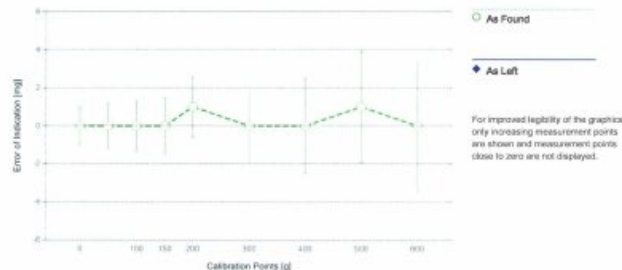
Net Indication	As Found	As Left
0.002 g	1.2 mg	1.9%
0.620 g	1.2 mg	0.20%
6.200 g	1.3 mg	0.021%
62.000 g	2.4 mg	0.0039%
620.000 g	13 mg	0.0021%



Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.000 g	0.000 g	0.000 g	1.0 mg	2
2	0.500 g	0.500 g	0.000 g	1.2 mg	2
3	1.000 g	1.000 g	0.000 g	1.2 mg	2
4	50.000 g	50.000 g	0.000 g	1.2 mg	2
5	100.000 g	100.000 g	0.000 g	1.3 mg	2
6	150.000 g	150.000 g	0.000 g	1.5 mg	2
7	200.000 g	200.001 g	0.001 g	1.6 mg	2
8	300.001 g	300.001 g	0.000 g	2.0 mg	2
9	400.001 g	400.001 g	0.000 g	2.5 mg	2
10	500.001 g	500.002 g	0.001 g	2.9 mg	2
11	600.001 g	600.001 g	0.000 g	3.4 mg	2



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-16. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
554/4 PATTANAKARN ROAD SOI 14, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-27 FAX: 0-2719-9481



Certificate of Calibration

Cert. No.: 22TM89
Page: 1 of 3

Equipment : Autoclave
Manufacturer : ALP
Model : CL-40L
Serial No. : 802664
ID No. : UAE.MIC.014/2550
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Air Analysis Unit
Received Order : 17 February 2022
Calibration Date : 17 February 2022
Ambient Temperature : $(26 \pm 10) ^\circ C$
Relative Humidity : $(50 \pm 30) \%$
Calibrated by : Kunchit Promprat
Approved by :
() Pomsittha Tameyaku
() Malee Butkruea
() Suwit Imjai
Issue Date : 22 February 2022

The Uncertainties are for a confidence probability of approximately 95%

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Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML F1

Weight Set No.: W555 Date of Issue: 06-Jul-2021
Certificate Number: CCM-0137-21-C Calibration Due Date: 07-Jul-2022

Weight Set 2: OIML E2

Weight Set No.: W580 Date of Issue: 23-Feb-2022
Certificate Number: C208581631 Calibration Due Date: 14-Aug-2023

Thermo Hygrometer

Equipment No.: IN161 Date of Issue: 14-Jun-2021
Certificate Number: 21H1220 Calibration Due Date: 01-Jun-2022

Remarks

FACT adjustment functionality activated
Equipment condition: Good
Next calibration according to customer's procedure
Calibration data not decide by calibration laboratory

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.



Request No. 25-65 / 0398

MTC. ACL.No. 486 / 65

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. P2-MEB675610
SUBMITTED BY : United Analyst and Engineering Consultant Co., Ltd.
3. Sol Udomsuk41, 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)

REFERENCE MATERIAL : Traceable to NIST "Agilent Technologies", "Carlo Erba"
Cadmium Lot No. 0108047046, Chromium Lot No. 0106315418, Copper Lot No. 0107480530, Iron Lot No. 0104697565, Lead Lot No. 0104659473, Manganese Lot No. T109228A, Nickel Lot No. 0104978044, Zinc Lot No. 0100792297
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
AMBIENT CONDITIONS : Temperature 22 °C Relative humidity 60 %

The Atomic Absorption Spectrophotometer set 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 
(Mr. Danal Srithongkum)

Approved by 
(Mrs. Thippaya Junee Fortune)
Director of Analytical Chemistry Laboratory
Ref. 2025265020400522001
Calibration Date : 3 February 2022

The results relate only to the items tested/calibrated or value assigned.

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Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : numpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 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
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : sumalee@tistr.or.th

FM.BLMTC.002 Rev.4

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Request No. 25-65 / 0398

1 / 5

MTC. ACL. No. 486 / 65

CALIBRATION DATA

1. Noise Level in term of standard deviation

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

Continue 2 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : numpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 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
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : sumalee@tistr.or.th

FM.BLMTC.002 Rev.4

เอกสารไม่ควบคุม



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2202-0444OC-1
Procedure Used :-

Cert. No.: 22TM89
Page.: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44035217	21LM30	23 Dec 2022

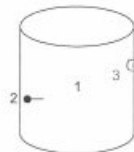
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3**

(** = Categorization of pathogens according to hazard and categories of containment, second edition, 1990)
It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

Result of Calibration :- (*) Without Adjustment**Function of UUC* :** Temperature Source

	Environmental		
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	27	68	226
Finished of Calibration	27	65	226

Position	Description	Ref. Std. ID No.:
1 =	Center of chamber	22-10TC-01
2 =	Temperature sensor	22-10TC-02
3 =	Exhaust port	22-10TC-03

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๑ 1๑๑๑๑1



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2202-0444OC-1
Result of Calibration :- (*) Without Adjustment

Cert. No.: 22TM89
Page.: 3 of 3

Operating parameter Set : Temperature = 122 °C
Sterilization period = 30 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
122	122	1	122.373	0.32	0.12	1.2	2
		2	122.421				
		3	122.292				

Average* : The average of 30 values in each position.**Stability :** One-half of the greatest maximum difference of measured temperature at any one probe.**UUC* :** Unit Under Calibration**Note :** The reported uncertainty of measurement was included stability and excluded uniformity .

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

-๐0๐-

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๑ 1๑๑๑๑๑



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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	0.1003	0.106	0.006	5.68	± 0.008
	0.5015	0.522	0.021	4.09	± 0.017
	1.0030	0.993	-0.010	1.00	± 0.032

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	0.1988	0.197	-0.002	0.91	± 0.014
	0.6958	0.722	0.026	3.77	± 0.022
	1.4910	1.463	-0.028	1.88	± 0.041

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	0.04955	0.054	0.004	8.98	± 0.004
	0.29730	0.317	0.0197	6.63	± 0.006
	0.69370	0.682	-0.0117	1.69	± 0.012

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35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : numpai@tistr.or.th Website: www.tistr.or.th

Office/Laboratory
Soi 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
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : sumalee@tistr.or.th

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2. Precision

Element	Conc. (mg/L)	Absorbance										Ave. Abs.	SD	%RSD
Cd	0.02	0.0074	0.0062	0.0065	0.0062	0.0070	0.0068	0.0070	0.0065	0.0065	0.0069	0.007	0.0004	5.76
	0.30	0.0952	0.0959	0.0951	0.0957	0.0952	0.0950	0.0952	0.0948	0.0956	0.0943	0.095	0.0005	0.49
	0.70	0.2213	0.2180	0.2203	0.2208	0.2234	0.2211	0.2196	0.2219	0.2201	0.2194	0.221	0.0015	0.67
Cr	0.10	0.0096	0.0098	0.0097	0.0102	0.0106	0.0097	0.0098	0.0099	0.0103	0.0093	0.010	0.0004	3.83
	0.30	0.0309	0.0302	0.0300	0.0316	0.0306	0.0299	0.0309	0.0297	0.0311	0.0296	0.030	0.0007	2.20
	0.70	0.0659	0.0667	0.0664	0.0648	0.0656	0.0662	0.0658	0.0638	0.0668	0.0666	0.066	0.0011	1.70
Cu	0.05	0.0080	0.0075	0.0078	0.0075	0.0077	0.0081	0.0080	0.0075	0.0074	0.0076	0.008	0.0003	3.26
	0.30	0.0417	0.0419	0.0412	0.0421	0.0424	0.0420	0.0423	0.0403	0.0418	0.0415	0.042	0.0006	1.47
	0.70	0.0969	0.0965	0.0972	0.0957	0.0961	0.0958	0.0961	0.0963	0.0959	0.0972	0.096	0.0006	0.58
Fe	0.10	0.0090	0.0105	0.0078	0.0099	0.0091	0.0093	0.0096	0.0094	0.0093	0.0084	0.009	0.0007	8.11
	0.50	0.0462	0.0470	0.0464	0.0464	0.0467	0.0462	0.0467	0.0460	0.0468	0.0466	0.047	0.0003	0.67
	1.00	0.0867	0.0886	0.0910	0.0892	0.0897	0.0873	0.0892	0.0885	0.0888	0.0874	0.089	0.0013	1.43
Pb	0.20	0.0091	0.0095	0.0088	0.0087	0.0082	0.0094	0.0090	0.0087	0.0082	0.0090	0.009	0.0004	4.94
	0.70	0.0322	0.0321	0.0324	0.0318	0.0335	0.0326	0.0327	0.0315	0.0336	0.0321	0.032	0.0007	2.09
	1.50	0.0653	0.0645	0.0663	0.0664	0.0652	0.0671	0.0662	0.0666	0.0657	0.0648	0.066	0.0008	1.28
Mn	0.05	0.0092	0.0092	0.0097	0.0087	0.0085	0.0079	0.0096	0.0085	0.0084	0.0099	0.009	0.0007	7.33
	0.30	0.0616	0.0630	0.0632	0.0633	0.0634	0.0628	0.0640	0.0633	0.0640	0.0629	0.063	0.0007	1.08
	0.70	0.1396	0.1366	0.1386	0.1377	0.1386	0.1386	0.1396	0.1380	0.1374	0.1383	0.138	0.0009	0.67
Ni	0.10	0.0102	0.0092	0.0097	0.0104	0.0091	0.0105	0.0105	0.0096	0.0098	0.0102	0.010	0.0005	5.22
	0.50	0.0488	0.0489	0.0489	0.0495	0.0484	0.0490	0.0481	0.0492	0.0495	0.0492	0.049	0.0004	0.91
	1.00	0.0976	0.0979	0.0975	0.0992	0.0977	0.0973	0.0986	0.0962	0.0985	0.0982	0.098	0.0008	0.85
Zn	0.05	0.0340	0.0349	0.0340	0.0352	0.0337	0.0351	0.0344	0.0346	0.0349	0.0343	0.035	0.0005	1.49
	0.30	0.1669	0.1653	0.1628	0.1642	0.1657	0.1637	0.1659	0.1652	0.1654	0.1657	0.165	0.0012	0.72
	0.70	0.3456	0.3467	0.3445	0.3430	0.3422	0.3444	0.3437	0.3438	0.3435	0.3438	0.344	0.0013	0.37

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35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : numpai@tistr.or.th Website: www.tistr.or.th

Office/Laboratory
Soi 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
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : sumalee@tistr.or.th

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Ni	0.099	0.102	0.003	3.03	± 0.007
	0.495	0.489	-0.006	1.21	± 0.010
	0.990	0.975	-0.015	1.52	± 0.020

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	0.050	0.000	0.00	± 0.012
	0.300	0.307	0.007	2.33	± 0.011
	0.700	0.660	-0.040	5.71	± 0.015

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: Dr. Sathit
(Mr. Danai Srithongkum)

Approved by: Dr. Sathit
(Mrs. Thippaya Junvee Fortune)
Director of Analytical Chemistry Laboratory
Calibration date : 3 February 2022

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MTC, ACL No. 486 / 65

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	0.02004	0.019	-0.001	5.19	± 0.004
	0.30060	0.291	-0.010	3.19	± 0.006
	0.70140	0.678	-0.023	3.34	± 0.012

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	0.1002	0.101	0.001	0.80	± 0.007
	0.3006	0.298	-0.003	0.86	± 0.012
	0.7014	0.635	-0.066	9.47	± 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	0.0502	0.046	-0.004	8.37	± 0.004
	0.3012	0.295	-0.006	2.06	± 0.010
	0.7028	0.694	-0.009	1.25	± 0.021

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E-mail : sumalee@tistr.or.th

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Maintenance works basic unit

- tightness visual check inside the Mercur
- visual check if gold-traps are broken
- visual check if spectrometer is contaminated
- visual check of the fluorescence cell
- visual check of the absorption cell, incl. window
- reactor cleaning
- check pump-hose, if necessary change it
- check swivel drive (SEV)
- check drying-hose, output gas-liquid-separator
- test Bubble-Sensor
- check gas flows
- check volume flows, reagents
- recording stray light values
- measurement with 30 ng/l

[illegible]

Maintenance works Autosampler

Serial No.:

- lubricate the dosing-winding (Teflon-grease-spray)
- clean the dosing cylinder, if necessary exchange it
- lubricate the winding system of the height drive with some drops of oil
- check the toothed belt
- check the position of the mechanical stopper (height: 13mm)
- check the pump rate of mixing pump (<14s AS52, typ.7s/<20s AS52S, typ.10s)
- check the pump rate of washing cup
- check the electrical hose connections for good contact
- check the connectors of the magnetic valves
- check the dosing hose for buckling, if necessary exchange it

5 4 3 2 1

Maintenance Protocol

Atomic Fluorescence Spectrometer
mercur DUO /
mercur DUO plus

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Device parameter		nominal value	actual value
visual check general tightness inside the Mercur		o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
visual check Goldtraps		o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
visual check spectrometer			
	Fluorescence cell	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
	Absorption cell, incl. window	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
	lens	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
	Swivel drive (SEV)	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check pump hoses		o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check hoses and hose connectors		o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check and clean reactor		o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check drying hose output Gas-liquid-separator		o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check bubble-sensor		o.k.: <input checked="" type="checkbox"/>	not o.k.: <input type="checkbox"/>
Check gasflow			
	Valve 1	10 Nl/h	10 Nl/h
	Valve 2	50 Nl/h	50 Nl/h
	Valve 3	5 Nl/h	5 Nl/h
	Valve 4	10 Nl/h	10 Nl/h
Check liquidflow			
	Acid	2,5ml/min ± 1 ml	2.5 ml/min
	Red.-agent	2,5ml/min ± 1 ml	2.5 ml/min
	Sample	10ml/min ± 2 ml	10 ml/min
Adventitious light - values		(V)	from file
		100	0
		200	0
		300	0
		350	0
		400	1
		450	4
		500	9
		550	19
		575	27
		600	38

Serial-No.: K17040153

Customer-No.:

Date: 4/02/2022

Carried out by: Mr. Srirachai Fak-on

Maintenance with following Operational Qualification (OQ)
(requires a separate OQ protocol)

☐

Company	የፌዴራል የፖሊስ ኃይል
User	ወልደአብ ገብረ
Department	Lab
Street	ዓ.ፀ.ፀ.ፀ. 41 ቀበሌ
Zip Code, City	አዲስ አበባ 10260
Country	ኢትዮጵያ
Phone	
Fax	
E-mail	

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QC parameters

QC type	Conc. check	QC check samp. 2	---
QC check samp. 1	---	Conc.	---
Error limit	---	Error limit	---
Rep. measurement	off	Reaction	flag + continue
QC std. 1 no.	1(30.000 ng/L)	QC std. 2 no.	3(0.100 ng/L)
QC std. 1 limit	± 20.00%	QC std. 2 limit	± 20.00%
QC std. act.	flag + continue		
Expect. blank abs.	0.0100± 0.0100	Reaction	flag + continue
QC precision	off	Reaction	off
		QC Recal.factor	Off

Calibration settings

Calib. meth	Standard calib.	Calibr. unit	ng/L
No. standards	1	Conversion fac.	1000000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	2
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	Zero
Weighted cal.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

Sample statistics

Stat. mode	Mean	Meas. cycles	3
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	off		

Calibration standards

No	Name	State	Pos	Conc./ ng/L	Ints	SD	RSD/%
1	Cal-Zero	(--)	##	0.000	H: 0.000344 A: 0.004747	0.000040 0.000441	11.85 9.290
2	Cal-Std1	(--)	##	30.000	H: 0.002913 A: 0.03433	0.000069 0.000916	2.371 2.670

Hg

Device parameter	nominal value	actual value
Analytical parameters Fluorescence cell		
Conditions.: max conc.: 10 µg/L PMT-voltage: 453 V		
Blank-solution without enrichment / FBR 30 ng/L	F > 0.0013 RSD < 3 %	F... 0.000344 F... 0.002913 RSD 2.371 %
Conditions.: max conc.: 1,7 µg/L PMT-voltage: 453 V		
Blank-solution with enrichment / FBR 30 ng/L Fok.- factor (F ₂ / F ₁)	F > 0.009 RSD < 3 % > 4	F... 0.001423 F... 0.01136 RSD 0.385 % 2.983
Analytical parameters Absorption cell		
Blank-solution without enrichment / FBR 100 ng/L	Ext. > 0.0021 RSD < 7 %	Ext... 0.0002 Ext... 0.0036 RSD 3.82 %
Comments		

M. Srichai Fak-om.
Signature Technician

การันต์ ศรีสุวิทย์
Signature Customer

4/02/2022

Place, Date (DD/MM/YYYY)

4/02/2022

Place, Date (DD/MM/YYYY)

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Mercur

Software: Analytikjena 2.0.0 version 2.0.0, update 17.12.2021
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Calibration function 1

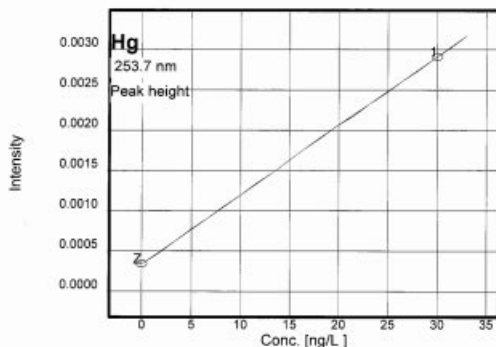
4/02/2022 17:59 Calibration (Peak height)

Ints=k1+k2*conc

k1=0.000344 k2=0.000086

Recal. factor: ---

Slope	0.00009 Ints/(ng/L)	R2-adjusted	1.0000
sc0	1.00000 ng/L		
Lower limit	0 ng/L	Upper limit	33.0 ng/L
Detection limit	---	Deter. limit	---



Measurements and events (sorted by time)

Hg ID	Without Enrichment / FBR / 30 µg/L_PM_4-02-22	Ints	BG	SD	RSD/%	Int. type	Time
Cal-Zero		0.000342				PkH	17:49
		0.000304					17:50
		0.000385					17:51
	0 ng/L	0.000344		0.000040750	11.85		17:51
Cal-Std1		0.002923				PkH	17:56
		0.002840					17:57
		0.002977					17:58
	30.00 ng/L	0.002913		0.000069060	2.371		17:58
Calibration	Calibration function: 01						17:59

Mercur

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Mercur

Report file: C:\WinAAS\TMP\2022\ResultPro_012
Program version: 4.7.9.0 Printed on: 4/02/2022 17:59
Recording started on 4/02/2022 17:46 GMT+7.0

Operator:
Laboratory:
Code:

Remarks:

Method parameters

Method Without Enrichment / FBR / 30 µg/L_PM_4-02-22
Created on 4/02/2022 Time 17:45
Program ---

Parameters Mercur Technique: Hg fluorescence

Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	35 s
PMT	453 V	Peak smoothing	12/5
AZ time	5 s		
Delay	0 s		
Working mode	w/o enrich.	System cleaning	Off
FBR technique	on	Wash time acid	10 s
Pump speed	3	Soaking time	20 s
Sample load time	15 s	Gas load time	10 NL/h
Reaction time	10 s		
Waiting time AZ	5 s		
Delay	0 s		
Purge time1	30 s		
Purge time2	15 s	Gas wash time2	10 NL/h

Hg

Mercur

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QC parameters

QC type	Conc. check	QC check samp. 2	---
QC check samp. 1	---	Conc.	---
Conc.	---	Error limit	---
Error limit	---	Reaction	flag + continue
Rep. measurement	off	QC std. 2 no.	1(30.000 µg/L)
QC std. 1 no.	1(30.000 µg/L)	QC std. 2 limit	± 50.00%
QC std. 1 limit	± 50.00%	Reaction	flag + continue
QC std. act.	flag + continue	Reaction	off
Expect. blank abs.	0.0100± 0.0100	QC Recal.factor	Off
QC precision	off		

Calibration settings

Calib. meth	Standard calib.	Calibr. unit	µg/L
No. standards	1	Conversion fac.	1000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	Zero
Weighted cal.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

Sample statistics

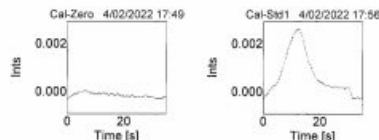
Stat. mode	off	Meas. cycles	1
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	---		

Calibration standards

No	Name	State	Pcs	Conc./ µg/L	Ints	SD	RSD/%
1	Cal-Zero	(--)	##	0.000	H: 0.001423 A: 0.004275	0.000027 0.000307	1.946 7.188
2	Cal-Std1	(--)	##	30.000	H: 0.01046 A: 0.03042	0.000987 0.002621	9.445 9.273

Hg

Peak plots



Hg

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Mercur

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Calibration function 1

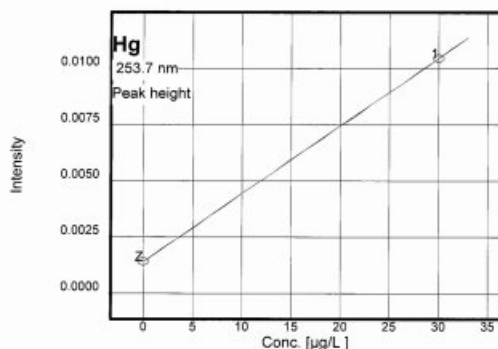
4/02/2022 17:31 Calibration (Peak height)

Ints=k1+k2*conc

k1=0.001423 k2=0.000301

Recal. factor: ---

Slope	0.00030 Ints/(µg/L)	R2-adjusted	1.0000
sc0	1.00000 µg/L		
Lower limit	0 µg/L	Upper limit	33.0 µg/L
Detection limit	---	Deter. limit	---



Calibration standards

No	Name	State	Pcs	Conc./ µg/L	Ints	SD	RSD/%
1	Cal-Zero	(--)	##	0.000	H: 0.001423 A: 0.004275	0.000027 0.000307	1.946 7.188
2	Cal-Std1	(--)	##	30.000	H: 0.01136 A: 0.03294	0.000036 0.000360	0.325 1.094

Hg

Calibration function 2

4/02/2022 17:39 Calibration (Peak height)

Ints=k1+k2*conc

k1=0.001423 k2=0.000331

Recal. factor: ---

Slope	0.00033 Ints/(µg/L)	R2-adjusted	1.0000
sc0	1.00000 µg/L		
Lower limit	0 µg/L	Upper limit	33.0 µg/L
Detection limit	---	Deter. limit	---

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Report file: C:\WinAAS\TMP\2022\ResultPro_011
 Program version: 4.7.9.0 Printed on: 4/02/2022 17:40
 Recording started on 4/02/2022 17:15 GMT+7.0

Operator:
 Laboratory:
 Code:

Remarks:

Method parameters

Method With Enrichment / FBR / 30 µg/L_PM_4-02-22
 Created on 4/02/2022 Time 14:54
 Program ---

Parameters Mercur Technique: Hg fluorescence

Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	20 s
PMT	444 V		
AZ time	5 s	Peak smoothing	12/5
Delay	0 s		

Working mode	Enr. w/o reload.	System cleaning	Off
FBR technique	on	Wash time acid	10 s
Pump speed	3	Soaking time	20 s
Sample load time	10 s	Gas load time	5 NL/h
Reaction time	10 s		
Waiting time AZ	5 s		
Delay	0 s		
Purge time1	20 s		
Purge time2	15 s	Gas wash time2	15 NL/h
Purge time3	10 s	Gas wash time3	15 NL/h
Heat.time coll.1	20 s	Cool. time coll.1	50 s

Hg

Mercur

Report file: C:\WinAAS\TMP\2022\Result\Pro_009
 Program version: 4.7.9.0 Printed on: 4/02/2022 16:09
 Recording started on 4/02/2022 15:55 GMT+7.0

Operator:
 Laboratory:
 Code:

Remarks:

Method parameters

Method Without enrichment / FBR 100 ng/L PM_5-6 Abs cell
 Created on 6/08/2021 Time 11:41
 Program ---

Hg**Parameters Mercur Technique: Hg absorption**

Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	55 s
PMT	242 V		
AZ time	5 s	Peak smoothing	12/5
Delay	0 s		

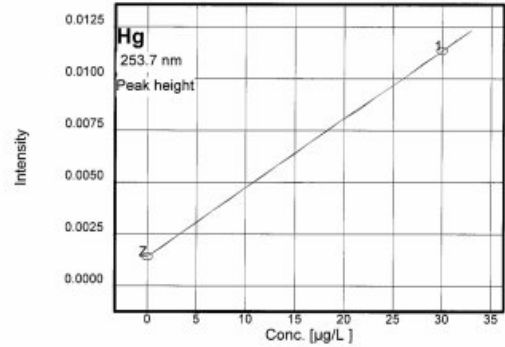
Working mode	w/o enrich.	System cleaning	Acid
FBR technique	off	Wash time acid	15 s
Pump speed	4	Soaking time	20 s
Sample load time	8 s	Gas load time	5 NL/h
Reaction time	12 s		
Waiting time AZ	15 s		
Purge time1	51 s		

QC parameters

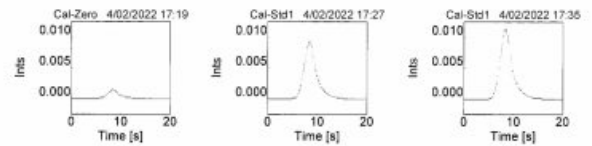
QC type	Conc. check		
QC check samp. 1	---	QC check samp. 2	---
Conc.	---	Conc.	---
Error limit	---	Error limit	---
Rep. measurement	off	Reaction	flag + continue
QC std. 1 no.	1(100.00 ng/L)	QC std. 2 no.	1(100.00 ng/L)
QC std. 1 limit	± 50.00%	QC std. 2 limit	± 0.00%
QC std. act.	flag + continue		
Expect. blank abs.	0.0100± 0.0100	Reaction	flag + continue
QC precision	off	Reaction	off
		QC Recal.factor	Off

Mercur

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**Measurements and events (sorted by time)**

Hg	With Enrichment / FBR / 30 µg/L_PM_4-02-22				4/02/2022	17:15	
ID	Conc.	Ints	BG	SD	RSD/%	Int. type	Time
Cal-Zero		0.001398				PkH	17:19
		0.001453					17:21
		0.001419					17:23
	0µg/L	0.001423		0.000027690	1.946		17:23
Cal-Std1		0.009317				PkH	17:27
		0.01103					17:29
		0.01103					17:31
	30.00µg/L	0.01046		0.0009877	9.445		17:31
Calibration	Calibration function: 01						17:31
Cal-Std1		0.01140				PkH	17:35
		0.01133					17:37
		0.01135					17:39
	30.00µg/L	0.01136		0.000036960	0.325		17:39
Calibration	Calibration function: 02						17:39

Peak plots

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Calibration settings

Calib. meth	Standard calib.	Calibr. unit	ng/L
No. standards	1	Conversion fac.	1000000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	calculated
Weighted cal.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

Sample statistics

Stat. mode	Mean	Meas. cycles	2
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	---		

Calibration standards**Hg**

No	Name	State	Pos	Conc./ ng/L	Abs	SD	RSD/%
1	Cal-Zero	(--)	##	0.00	H: 0.000265 A: 0.003730	0.000062 0.003049	23.66 81.74
2	Cal-Std1	(--)	##	100.00	H: 0.003620 A: 0.054076	0.000138 0.003671	3.821 6.788

Calibration function 1 4/02/2022 16:08 Calibration (Peak height)

Abs=k1+k2*conc

k1=0.000266 k2=0.000034

Recal. factor: ---

Slope	0.00003 Abs/(ng/L)	R2-adjusted	1.0000
sc0	1.00000 ng/L	Charact. conc.	129.953 (ng/L)/1%
Lower limit	0 ng/L	Upper limit	110. ng/L
Detection limit	---	Deter. limit	---

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Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

1. General:

- ☐ Review the instrument performance with the customer and document any recent problems.
- ☐ Perform general inspection of system for cleanliness.

2. Optical checks and Clean:

- ☐ Lamp Alignment/Intensity
- ☐ Sample Compartment and Windows
- ☐ Mirror and Grating Alignment
- ☐ Filter Wheel
- ☐ Cell Holder Alignment

3. Mechanical:

- ☐ Physical inspection – Please write any comments in the additional comments section.
- ☐ Grating Drive Mechanism.
- ☐ Slit Drive Mechanism.
- ☐ Sample Holder

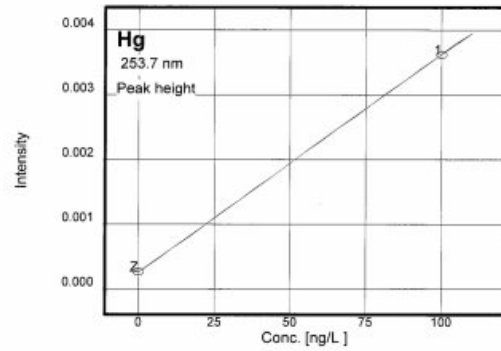
4. Test:

- ☐ Emission Wavelength Accuracy.

Emission Wavelength Accuracy		Actual Value	Validation Criteria
Target Peak (nm)		(nm)	Accuracy Limit +/- (nm)
Target Peak # 1	253.7	253.8	± 1.0 nm
Target Peak # 2	507.3	507.2	± 1.0 nm
Target Peak # 3	626.0	625.8	± 1.0 nm

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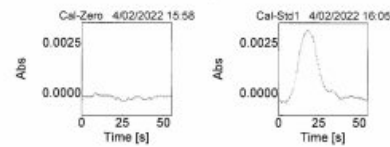
เอกสารไม่ควบคุม



Measurements and events (sorted by time)

Hg ID	Without enrichment / FBR 100 ng/L PM_5-6 Abs cell				4/02/2022 15:55		
	Conc.	Abs	BG	SD	RSD/%	Int. type	Time
Cal-Zero		0.000329				PkH	15:58
		0.000264					16:00
		0.000203					16:02
	0ng/L	0.000265		0.000062901	23.66		16:02
Cal-Std1		0.003486				PkH	16:05
		0.003613					16:06
		0.003763					16:08
	100.ng/L	0.003620		0.00013837	3.821		16:08
Calibration	Calibration function: 01						16:08

Peak plots



Mercur

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Component List

Component	Specific Model	Serial #	Software Version	Configuration Notes
LS55		81440	4.00.03	
-	-	-	-	-
-	-	-	-	-

Parts Lists

Test standard Used				
Part Number (if applicable)	Description			
C 520-7440	Standard Fluorecence Intensity Filter			
B050 7805	Sealed Water Cell			
Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)

Page 2

เอกสารไม่ควบคุม



LS 45/50B/55 - Preventive Maintenance report

Company Name:	United analyst and Engineering Consultant Co.,Ltd.		
Address:	3 Soi Udomsuk 41, Sukumvit Road, Phrakhanong, Bangkok 10260		
User Name :	K. Primpun	WO Number:	WO-01624974
Telephone Number :	02-763-2828	Certificate Number :	FLR1001-2021
Customer Support Engineer :	Tanongsak	P.M. Number	1 of 1
PM Performed: (DD-MMM-YYYY)	18-Feb-2022	Next PM Due Date: (DD-MMM-YYYY)	18-Feb-2023

Scope

The purpose of this PM is to ensure the continued functionality of the PerkinElmer Fluorescence Spectrophotometer by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM. Always check with the customer before making any changes that may affect the customer's analysis should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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Additional Comments

Additional Comments Regarding the PM
Reference intensity low

Review

The PM checks and if applicable performance tests for LS 45:50B:55 have been completed.

This LS 45:50B:55 Passes ☒ Fails ☐ the PM.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:	Date:
<i>Harungrak R.</i>	18-Feb-22 (DD-MM-YYYY)
Authorized Customer Representative:	Date:
<i>วิวัฒน์</i>	18-Feb-22 (DD-MM-YYYY)

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☒ Excitation Wavelength Accuracy.

Excitation Wavelength Accuracy	Actual Value	Validation Criteria
Target Peak (nm)	(nm)	Accuracy Limit +/- (nm)
Target Peak # 1	253.7	254.2 ± 1.0 nm
Target Peak # 2	365.0	365.0 ± 1.0 nm
Target Peak # 3	507.3	507.4 ± 1.0 nm

☒ Emission Slit calibration.

Emission Slit	Actual Value	Validation Criteria
Target Value (nm)	(nm)	Accuracy Limit +/- (nm)
Target Peak # 1	2.5	2.52 ± 0.5 nm
Target Peak # 2	5.0	5.11 ± 0.5 nm
Target Peak # 3	10.0	10.23 + 1.0 / - 0.5 nm

☒ Excitation Wavelength Repeatability.

Emission Slit	Actual Value	Validation Criteria
Target Value (nm)	(nm)	Accuracy Limit +/- (nm)
Target Peak # 1	2.5	2.45 ± 0.5 nm
Target Peak # 2	5.0	4.67 ± 0.5 nm
Target Peak # 3	10.0	10.21 + 1.0 / - 0.5 nm

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN) CALIBRATION AND TESTING EQUIPMENT SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484

Cert.No.: 22CH1184
Page.: 1 of 2

Certificate of Calibration

Equipment : Turbidity Meter
Manufacturer : Oakton
Model : T100IR
Serial No. : 1120501017
ID. No. : UAE.WAT.056/2563
Condition As-Received: Used Item
Received Date : 31 August 2022
Calibration Date : 05 September 2022
Reference : 2208-1106WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 20) %
Calibration Procedure : In - house method : CP-CH11
based on direct measurement by
using Formazin standard solution
Calibrated by : Walalak Sirithean
Approved by : *Walalak Sirithean*
Approved Signatory
(✓) Malee Butkruea
() Saithip Meangmai
() Warakorn Lernagatrakul
Issue Date : 6 September 2022

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 Calibration and Testing Equipment Services.

เอกสารไม่ควบคุม

☒ Water Raman Sensitivity

	Actual Value
Signal to Noise	394 : 1
Drift	0.00

☒ Stray Light

	Actual Value
Stray Light at 290nm	3.27
Stray Light at 300nm	0.77

5. Accessory (where applicable):

- ☐ Micro Plate Reader
- ☐ Integrating Sphere
- ☐ Multi Cell Holder
- ☐ Water Jacketed Cell Holder
- ☐ etc.

6. Review:

- ☒ Review with the customer PM work performed.
- ☒ Review with the customer routine maintenance procedures.
- ☒ Discuss recommended customer-supplied materials to have on hand
- ☒ Attach PM sticker.
- ☐ Update Logbook.

เอกสารไม่ควบคุม

Customer Service Report

Date: 30/11/21
 Customer: UAE
 Instrument: KT 200

Report No: 5874
 Address: 3388 Sirinrat Building, 25th - 26th Floor, Unit No. 3388/90, Rama IV Road, Klongton, Klongtoey, Bangkok, Thailand 10110
 Serial: 91790524

Hours	Travel To Customer	Labour	Travel From Customer
Start	8.00	9.00	10.00
Finish	18.00	19.00	15.00

Application	Special	Standard
Normal	Courtesy Visit	Installation
Distributor	PMA Onboarding	Quote
Internal	Warranty	Repair
Digital Service	Sales Support	Remote

PO/Quote Number: 11255983
 PMA Type: Foss Care Pro Contract No. 11255983

Details of Work / Test	Condition / Status
- Check Instrument	OK
- Check PM Kit for KT 200	Pass
- Check Safety Valve	Pass
- Check Rubber Gasket	Pass
- Check Seal	Pass
- Check Heating Element	Pass
- Check New Panel PCB	Pass
- Check Safety door	Pass
- Clean & Lubricant	Pass
- Check Leaked	Pass
- Check Valve 11 set 30ml for 20ml	Pass

Part No.	Batch	Description	Qty
10009965	11255983	Foss PM Kit KT 200	1
15750814	79.08.21	Safety Valve	1
15750825	09.11.20	Rubber Gasket for Heating Element	2
1000512	02.08.21	Heating Element	1
1000512	16.11.20	Seal	1
1000512	16.11.20	KT 200 new panel PCB	1
1000512	16.11.20	Safety door complete	1

I confirm this report is accurate and complete

Signed FOSS: [Signature]
 Name: [Name]
 Signed Customer: [Signature]
 Name: [Name]

Would you be willing to participate in a brief survey in order to tell us how we performed? []

เอกสารไม่ควบคุม


 Cert.No.: 22CH1184
 Page: 2 of 2

Condition of this calibration result

1. Reference Standard Instruments :
 This certification is traceable to the International System of unit (SI unit) through Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due date
1) Thermo-Hygrograph	1103328	130EC010	22H1313	12 June 2023
2) Electronic Balance	N03679	140RC001	21MM429	21 Sep 2022

2. Standard Material : The Formazin suspension has been prepared gravimetric from

Material	Manufacturer	Lot No.	Assay
1) Hexamethylenetetramine	HIMEDIA	0000493947	99.65%
2) Hydrazinium Sulfate	HIMEDIA	0000522014	99.40%

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

Calibration result

Performing five - Formazin suspension standard curve by using 0,20,100,400,800 NTU
 Turbidity Meter Serial Number : 1120501017

Standard Formazine suspension (NTU)	UUC* Reading (NTU)	Uncertainty of Measurement (± NTU)	Coverage Factor k
0	0.00	0.0062	2.00
20	20.1	0.39	2.00
100	102	0.74	2.00
400	403	1.5	2.13
800	804	2.1	2.20

Remark :
 - UUC* = Unit Under Calibration
 - NTU = Nephelometric Turbidity Units

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

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๑ 1124976

SITHIPORN
associates

Preventive Maintenance Protocol

Instrument: Digestor unit Model: 2520auto S/N: 91794469
 Customer: บริษัท อุตสาหกรรมอาหารและเครื่องดื่ม จำกัด Job No. MS63FOT0084B

Introduction

A maintenance protocol provides a systematic and functional means of maintaining a specific instrument type. The certified performed PM interval depends on the operational conditions, and is based on our extensive experience and knowledge of manufacturing and maintaining analytical instruments.

Apart from sample throughput, the environmental conditions also need to be taken into account. Demanding environments, such as high ambient temperature, humidity, dirtiness etc can measurably shorten component lifetime and also the maintenance and component replacement intervals.

The content of this protocol is subject to change over time. In order to ensure you the correct parts, please make sure to indicate serial number and date of installation when contacting you FOSS representative.

Maintenance Procedure

Check and Cleaning

Step	Action	OK
1	Check cables, electrical connections and power supply AC 220 volts	<input checked="" type="checkbox"/>
2	Check the function of power switch	<input checked="" type="checkbox"/>
3	Check the function of temperature controller	<input checked="" type="checkbox"/>
4	Check the display and keypad function	<input checked="" type="checkbox"/>
5	General cleaning	<input checked="" type="checkbox"/>
6	Check the time of heating up to 420°C (D5 6 and 8 ~ 30 mins, D520 and 40 ~ 40 mins)	<input checked="" type="checkbox"/>
7	Check the digestion time with external watch	<input checked="" type="checkbox"/>
8	Check the temperature in second of test tube	<input checked="" type="checkbox"/>

Temp. setting	T1	T2	T3	T4	T5	Mean value
420°C 890.0	896.0	892.7	892.9	890.6	891.1	893.04

Remark: _____

Customer's Signature: [Signature]
 Engineer's Signature: [Signature]
 Date: 30/11/2021

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FOSS Preventive Maintenance Protocol

Instrument: Kjeltec™ 2100
 Recommended PM interval (whichever occurs first between interval and no. of samples analysed): 12 months
 Preventive maintenance kit (P/N): 10009965

Introduction

A maintenance protocol provides systematic and functional means of maintaining a specific instrument type. The recommended PM interval depends on the operational conditions and is based on our extensive experience and knowledge of manufacturing and maintaining analytical instruments.

Apart from sample throughput, the environmental conditions also need to be considered. A demanding environment, such as high ambient temperature, humidity, dirtiness etc can measurably shorten component lifetime and also the maintenance and component replacement intervals.

NOTE!

The content of this protocol is subject to change over time. In order to safeguard that you obtain the correct parts, please make sure to indicate serial no and date of installation when contacting your FOSS representative.

Dedicated Analytical Solutions

FOSS Analytical A/S
 69 Skangrovevej
 DK-3400 Hillerød
 Denmark

Tel +45 7010 3376
 Fax +45 7010 3371
 E-mail support@foss.dk
 Web www.foss.dk

FOSS Analytical AB
 Box 70
 SE-263 21 Högabods
 Sweden

Tel +46 42 361500
 Fax +46 42 340349
 E-mail support@foss.dk
 Web www.foss.dk

เอกสารไม่ควบคุม



CERTIFICATE OF CALIBRATION GAS CHROMATOGRAPH MASS SPECTROMETER

Certificate No.: SV2205/20385

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

Address: 3 Soi Udomsuk 41 Sukhumvit Rd. Bangchak
Phrakhanong Bangkok Thailand 10260

Instruments Model: MS Scion-SQ S/N GQS1203F021
GC 451-GC S/N BR1203M099
AUTO SAMPLER CP8400 S/N BR1203M331

Standard Reference Number: 393065201

Procedure Document Number: 394207000

System Test

PM perform and Diagnostic Test	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Air Water Check Test	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Tune Test EI	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Signal to Noise Test (EI) SCAN	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Injection EI Area Precision Test	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Injection EI RT Precision Test	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
User Demonstration	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

Engineer Somchai P.
Somchai Pohtongkam

Date 19 May 2022

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.: WS80 Date of Issue: 23-Feb-2022
Certificate Number: C206561631 Calibration Due Date: 14-Aug-2023

Thermo Hygrometer

Equipment No.: 3N161 Date of Issue: 14-Jun-2021
Certificate Number: 21H1220 Calibration Due Date: 01-Jun-2022

Remarks

FACT adjustment functionality activated
Value of the built-in weight adjusted
Equipment condition: Good
Next calibration according to customer's procedure
Calibration data not decide by calibration laboratory
Test weight by Fiber pan : 1 g = 1.0000 g, 3 g = 3.0000 g, 5 g = 5.0000 g

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with $k=2$ in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $2.5 \cdot 10^{-6} / K$
Temperature range on site for the evaluation of the measurement uncertainty in use: $3 K$

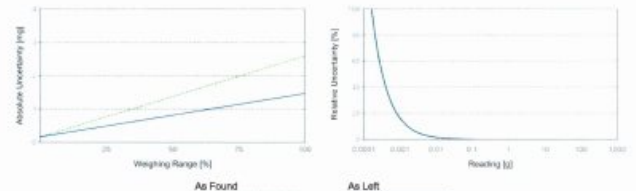
Linearization of Uncertainty Equation

Range	As Found	As Left
d Max		
1 0.0001 g 220 g	$U_1 = 0.16 \text{ mg} + 0.0111 \text{ mg/g} \cdot R$	$U_1 = 0.16 \text{ mg} + 0.00982 \text{ mg/g} \cdot R$

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found	As Left
0.0220 g	0.16 mg 0.73%	0.16 mg 0.73%
0.2200 g	0.16 mg 0.074%	0.16 mg 0.073%
2.2000 g	0.18 mg 0.0084%	0.17 mg 0.0079%
22.0000 g	0.40 mg 0.0018%	0.29 mg 0.0013%
220.0000 g	2.6 mg 0.0012%	1.5 mg 0.0006%



SCION™

Operational Qualification Protocol

For SCION Instrument

Name and Model:

Serial Number:

System ID Number:

Publication no. 394207000

Revision A

November 2011

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Contact

Scion Customer Service and Support uses a Customer Relationship Management (CRM) system. The interaction with this system offers the Customer immediate benefits including the contact center or help desk.

Scion worldwide service & support offices can be found from Scion website:



www.scion.com/support.html

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2.0 Qualification Representative and Reviewer Details

2.1 Qualification Representative Details

Each person responsible for executing any part of this Protocol must complete the table below, providing a sample of their signature and initials, and recording the date the Qualification was performed.

Qualification representatives are nominated to execute and verify the completeness of the test protocol and correctness of all entries.

All testing must be performed in accordance with procedures outlined in this manual. The representative must be trained and qualified to perform the procedures outlined in this document.

A copy of their appropriate qualifications is to be inserted into "Qualification Representative Details" on page 30.

Name (Print)	SOMCHAI POHTONGKAM
Title	ENGINEER
Signature	<i>Somchai P.</i>
Initials	SOMCHAI
Date	19 MAY 22

Name (Print)	
Title	
Signature	
Initials	
Date	

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2.3 Quality Assurance/Control Details

As Quality Assurance/Control (QA/QC), who is empowered to approve instrument compliance documents, I approve the procedures in the SCION Operational Qualification Protocol, which I may have amended, I accept the qualification of the Qualification Representative, and I will review and initial the results.

Name (Print)	
Title	
Signature	
Initials	
Date	

Name (Print)	
Title	
Signature	
Initials	
Date	

เอกสารไม่ควบคุม

1.0 Revision History

This qualification protocol is updated as necessary, which includes the event of any regulatory changes to Title 21 of the Code of Federal Regulations (21 CFR) Parts 210 and 211 (if applicable), any software or hardware changes, or updates that may impact on regulatory compliance.

Issue Number	Date	Comments

เอกสารไม่ควบคุม

3.0 Customer Responsibilities

The customer shall ensure that the Preventive Maintenance (PM) or Installation Qualification (IQ) up to point 9.11 is completed. A customer representative should be available at all times during the Operational Qualification Protocol.

Note The Operational Qualification Protocol test procedure should be performed after significant repairs, and at least once a year.

Qualification Rep. Initials	<i>Sadun P.</i>	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

2.2 Reviewer Details

Each representative responsible for reviewing any part of this protocol must record their details in the following tables, providing a sample of their signature and initials, and recording the date the qualification was performed.

An employee or designee of the company operating the instrument must review these qualification procedures. All calculations and data will be checked by the reviewer. Data review must be performed in accordance with the qualification guidelines "Qualification Guidelines and GMP Documentation" on page 10 and in compliance with current Good Manufacturing Practice (cGMP) as specified by 21 CFR Parts 210 and 211.

Documentation supporting training in the area of data review and cGMP must be carefully maintained and reviewed by the instrument owner.

Reviewer representatives are responsible for reviewing the completeness of the qualification protocol and accuracy of all entries.

Name (Print)	CHANA CHANSRI
Title	ENGINEER
Signature	<i>Chana Chansri</i>
Initials	
Date	19 MAY 2022

Name (Print)	
Title	
Signature	
Initials	
Date	

เอกสารไม่ควบคุม

4.4 Exception Reports

An exception to the protocol occurs when the observed result differs from the acceptance criteria or expected result.

All exceptions to the protocol must be documented in the Exception Report. The Exception Report includes a detailed description of the exception and resolution by the Qualification Representative.

Each Exception Report shall be issued with a unique identification number in the form ERID-XX-X. This number is generated by the page number on which the exception occurred followed by a sequential number indicating each exception found on the page.

For example, if an exception occurs on page 34, the Exception Report shall be identified as 'ERID-34-1'. If another exception occurs on page 34, the second report shall be identified as 'ERID-34-2'. This identification number should be recorded in the 'Pass / Fail / N/A' field after each test.

Each Exception Report must be signed by the Qualification Representative and the Reviewer as evidence of approval.

The Exception Report is inserted in the appropriately named appendix and numbered as per Section 4.3 of this protocol.

Qualification Rep. Initials	Sachin P	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

4.0 Qualification Guidelines and GMP Documentation

4.1 Qualification Summary

At the end of qualification execution, all tables and data entry fields must be completed and all test results, where specified, must be printed and attached to the protocol.

The Qualification Representative and the Reviewer must sign (signature or initials) and date each page that has a signature field. This represents agreement and acceptance of all data and information on the signed page.

Note Scion does not provide instructions for full Qualification of the personal computer (PC) used to operate the SCION. If further qualification of the PC is required the end-user must contact the PC manufacturer.

Note Scion does not provide full qualification instructions for non-Scion manufactured accessories. Limited instructions may be supplied. If qualification of a non-Scion accessory is required, the end user must contact the accessory manufacturer.

4.2 Qualification Guidelines

The following are general guidelines for performing the qualification tests in accordance with cGMP for the Manufacturing, Processing, Packaging, or Holding of Drugs per 21CFR Parts 210 and 211. Additional local requirements may also apply.

- Read the guidelines before starting the qualification.
- Perform all tests exactly as written.
- Use a pen with permanent blue or black ink unless otherwise specified by company policy.
- Neatly strike out any incorrect words or numbers, made while writing comments or recording results, information or data within this Protocol, with a single line. The word(s) crossed out must remain legible. Write the correction as close as possible to the original entry. Write a brief description of the error. For example, write 'Transcription error' or 'Re-written for clarity'. Initial and date the change.
- Entering initials where a signature is requested, and vice versa is permitted. The exception to this is in 2.0: Qualification Representative and Reviewer Details on page 6, where examples of each person's signature and initials are required.
- Use the date format dd Mon yyyy (e.g. 08 Mar 2011) unless otherwise specified by company policy.

เอกสารไม่ควบคุม

4.5 Reference Documents

The following documents are relevant to this Qualification:

- Installation Qualification Protocol
- Completed service report from Preventative Maintenance (PM) schedule

Qualification Rep. Initials	Sachin P	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

- Complete all tables and data fields to comply with this protocol. Blank fields are not permitted. For items that are not applicable, draw a line through the field, and write 'N/A' (Not Applicable). If entire tables or sections of tables are not applicable, strike a line either through the entire table or the specific area and enter 'N/A'. Complete the signature fields on the page.
- Write 'Pass', 'Fail' or 'N/A' as applicable to the test requirement or outcome.
- Ensure that results and/or specific documents are printed and attached to the specified appendix.
- The Qualification Representative and Reviewer must both sign (signature or initials) and date the signature fields on each page. This represents agreement and acceptance of all data and information on the page.

4.3 Page Numbering of Appendices

Each page that is inserted after the appendix is numbered with the letter of the appendix and a sequential number. The appendix page number must be initialed and dated by both the Qualification Representative and the Reviewer.

For example, pages inserted after Appendix C are numbered

C-1, C-2, C-3...etc. along with the initials and date.

If the reverse of each appendix page is left blank, it should be marked 'N/A' and signed and dated.

When the IQ is complete the total number of pages inserted after each appendix is written on the front page of the respective appendix sheet.

Qualification Rep. Initials	Sachin P	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

4.9 Documentation Corrections

Note All original entries must remain legible after corrections are made.

1. Draw a line through the incorrect information.
2. Write the correction as close as possible to the original entry, or enter a footnote.
3. Write a brief description of the error. For example, write "transcription error," "rewritten for clarity," or "correcting wrong entry".
4. Initial and date the change.

Qualification Rep. Initials	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

4.10 Marking Procedures Not Applicable

Some sections may not be relevant for the qualification. To indicate that a procedure or part of a form is unnecessary and that it was not forgotten or inadvertently overlooked:

1. Draw a line through the portion that is not applicable. Write the letters N/A (for not applicable), your initials, and the date near the diagonal line.
2. If a procedural step is unnecessary, select N/A if it is indicated, or write a comment in an Addendum. The Qualification Representative and the Reviewer enter their initials and the date near the line.

Note The Qualification Representative and Reviewer must sign and date all forms, even when part or all of the form is marked N/A.

Qualification Rep. Initials	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

4.6 Required Materials

The following stock solutions are required:

- 100 µg/mL OFN 394204200
- 1 µg/mL OFN 393065201
- 100 µg/mL OFN 393110101
- 10 µg/mL BZP 93065301
- 100 µg/mL BZP 394206200

The above solutions will be used to prepare the following working solutions which will be required to execute this OQ:

Note Refer to Appendix 1 for the preparation of the standard solutions.

Qualification Rep. Initials	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

4.11 Addendums

The following are reasons to complete an addendum sheet:

- A deviation needs documentation.
- Additional information or data needs to be recorded.
- Insufficient space to include the correction on the sheet where the error was made.

Qualification Rep. Initials	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

4.12 Addendum Example

The following is an example of using an addendum sheet to document a deviation.

If some of the items on the sales order were not present, you could do the following:

1. Use an addendum sheet.
2. Write Instrument Delivery on the Procedure line.
3. Write the addendum page number followed by a letter. For example: page 12A, where 12 is the page and A represents the first addendum on that page.
4. Write the plan to obtain the missing items, which may be the following:
 - Scion notified that Part Number XXXXX and XXXX are missing.
 - Scion replied that the parts are in stock and will be sent overnight. While waiting for the parts to arrive, I will continue to set up the instrument.
5. Review the plan with the Reviewer and make the necessary modifications.
6. Document the arrival of the parts and write that this addendum is resolved. Attach a copy of delivery documents and create addendum pages as required.

Qualification Rep. Initials	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

4.7 General Guidelines

The following are general cGMP guidelines.

- Perform each procedure exactly as written.
- Fill in each item on the form or mark it Not Applicable (N/A).
- If an item is marked N/A, initial it and date it.
- The Reviewer reviews and initials all entries recorded by the Qualification Representative.
- Keep all raw data. The Qualification Representative and the Reviewer will initial it, and date it.
- Do not destroy raw data.
- Attach raw data from an instrument, such as the SCION, as an Addendum using the instructions in the following Addendums section.
- If several instruments are qualified simultaneously, reference shared information, such as standard preparation and chemical information, to the document containing the original information by its model and instrument identification number.
- Label all reference standards as required by local regulations.
- Record the time each reference standard was opened.
- Use reference standards within 24 hours of preparation.

Qualification Rep. Initials	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

4.8 Specific Instructions for Documentation

The Reviewer designates specific documentation instructions as follows.

Permanent Ink Color	Blue
Preferred Date Format	19 MAY 22

If more instructions are required: Use an addendum sheet, write the addendum number, and a brief description.

Qualification Rep. Initials	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

5.2 System Description

5.2.1 SCION Description

Installation Date: 2015	Principal Operator:	Phone Number:
Company Information		
Company: United Analyst and Engineering		
Name:	Building:	Installation Site: LAB
Address: 3 Soi Udomsuk 41		
City, State: Bangkok, Bangkok		
Zip/Country: Thailand		
Zip/Country: 10260		
System Description		
SCION: SQ	Serial Number: GQS 1203F021	
Sales Order Number:	Sales Order Addendum Number:	
GC		
Module Type: Scion 151	Serial Number: BR1203M099	
AutoSampler		
Module Type: dp 8400	Serial Number: BR1203M331	
MS Workstation		
Version: MSWS 8.2.1	Serial Number: 01106-6711-BBQ-4500	
Computer Operating System		
Operating System: Windows 7	Version: Pro	Service Pack: -
Computer		
Make: Dell	Model: optiplex	Serial No.: DNNYHSI
Addendum Number(s): 2. System description		Hard Drive: 1TB
		Size/RAM: 16GB
Qualification Rep. Initials: Sathien P.	Reviewer Initials:	QA/QC Initials:
Date: 19 MAY 22	Date:	Date:

5.0 Operational Qualification

This chapter contains the tests to be completed to perform an Operational Qualification for the SCION.

5.1 OQ Preparation

The following must be done before starting the OQ:

1. Preventative Maintenance must have been completed and signed off by the Qualification Representative, Reviewer, and QA/QC person, and attach a copy of the service report and add an addendum number.

Addendum: P.M. Protocol

Qualification Rep. Initials: Sathien P.	Reviewer Initials:	QA/QC Initials:
Date: 19 MAY 22	Date:	Date:

2. OQ must have been completed and signed off by the Qualification Representative, Reviewer, and QA/QC person.

Qualification Rep. Initials: Sathien P.	Reviewer Initials:	QA/QC Initials:
Date: 19 MAY 22	Date:	Date:

3. The QA/QC person must review, approve, append (if necessary), and sign the Pre-execution Approval.

Qualification Rep. Initials: Sathien P.	Reviewer Initials:	QA/QC Initials:
Date: 19 MAY 22	Date:	Date:

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

5.3 Data Sheet Specifications

Run these tests after the instrument has pumped down and is leak free. Use the factory methods. Follow the Installation Procedure, complete this section and the appropriate line of the OQ Summary. Print out the methods and results and attach as addendums. Use the factory test column Br-5ms 15m X 250um X 0.25um.

Table 5-1 TQ Specification

Mode	Concentration	Scan Range	Result †	N/A	Pass	Fail	Addendum
EI Full Scan	1 pg OFN	50-300	S/N ≥500:1				
EI MRM	100 fg OFN	272-222	S/N ≥5000:1				
PCI Full Scan‡	10 pg BZP	80-230	S/N ≥50:1				
NCI Full Scan‡	1 pg OFN	200-300	S/N ≥4000:1				

† The Signal-to-Noise ratio S/N values are based on RMS noise figure.

‡ CI tests use methane gas as reagent gas.

For any tests that did not pass, complete an Addendum for each, write the Addendum number and a brief description.

Qualification Rep. Initials: Sathien P.	Reviewer Initials:	QA/QC Initials:
Date: 19 MAY 22	Date:	Date:

Table 5-2 SQ Specification

Mode	Concentration	Scan Range	Result †	N/A	Pass	Fail	Addendum
EI Full Scan	1 pg OFN	50-300	S/N ≥600:1		✓		
PCI Full Scan‡	100 pg BZP	80-230	S/N ≥600:1		✓		
NCI Full Scan‡	200 fg OFN	200-300	S/N ≥1000:1		✓		

Qualification Rep. Initials: Sathien P.	Reviewer Initials:	QA/QC Initials:
Date: 19 MAY 22	Date:	Date:

4. The Qualification Representative and the Reviewer must sign and date the Pre-execution Approval.

Qualification Rep. Initials: Sathien P.	Reviewer Initials:	QA/QC Initials:
Date: 19 MAY 22	Date:	Date:

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

To complete this section use the factory Scan method on the system CD. Print a copy of the method and add as an addendum.

Addendum N/A

If the hardware is not the same as the factory method, then note this in the addendum and how the hardware available has been configured to compensate. The most common variation here is the sampler, where the Combi Pal has been used instead of the 8400. This will have no impact on results and can be tracked and recorded in the addendum.

Addendum N/A

เอกสารไม่ควบคุม

5.4 EI Precision Test TQ

The following precision tests are for systems with autosamplers only. The test solution is 1 pg/μL OFN test mix part number 393065201.

The following is the required precision for 10 consecutive injections:

Injection	Retention Time	Peak Area
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
% RSD		

As an alternative, a % RSD summary report from MSWS can be added as an addendum.

Addendum N/A

	N/A	Pass	Fail	Addendum
Observed Mass is between 271.6 m/z to 272.4 m/z, which is ± 0.4 of the expected m/z.	✓			
Retention Time $\leq 1\%$ Relative Standard Deviation (RSD).	✓			
Peak Area $\leq 10\%$ Relative Standard Deviation (RSD).	✓			

To complete this section use the factory MRM method on the system CD. Print a copy of the method and add as an addendum.

Addendum N/A

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5.6 Final Evaluation

	N/A	Pass	Fail	Addendum
Is the equipment in normal operation condition?		✓		
Have all of the OQ requirements been completed?		✓		

Qualification Rep. Initials	<u>Sadum P.</u>	Reviewer Initials		QA/QC Initials	
Date	<u>19 MAY 22</u>	Date		Date	

เอกสารไม่ควบคุม

If the hardware is not the same as the factory method, then note this in the addendum and how the hardware available has been configured to compensate. The most common variation here is the sampler, where the Combi Pal has been used instead of the 8400. This will have no impact on results and can be tracked and recorded in the addendum.

5.5 EI Precision Test SQ

The following precision tests are for systems with autosamplers only. The test solution is 1 pg/μL OFN test mix part number 393065201.

The following is the required precision for 10 consecutive injections:

Injection	Retention Time	Peak Area
1	<u>3.670</u>	<u>70230</u>
2	<u>3.668</u>	<u>80953</u>
3	<u>3.669</u>	<u>78832</u>
4	<u>3.667</u>	<u>75823</u>
5	<u>3.668</u>	<u>79060</u>
6	<u>3.669</u>	<u>81491</u>
7	<u>3.670</u>	<u>81684</u>
8	<u>3.671</u>	<u>72531</u>
9	<u>3.670</u>	<u>79852</u>
10	<u>3.668</u>	<u>81366</u>
% RSD	<u>0.03</u>	<u>2.16</u>

As an alternative, a % RSD summary report from MSWS can be added as an addendum.

Addendum _____

	N/A	Pass	Fail	Addendum
Observed Mass is between 271.6 m/z to 272.4 m/z, which is ± 0.4 of the expected m/z.		✓		
Retention Time $\leq 1\%$ Relative Standard Deviation (RSD).		✓		
Peak Area $\leq 10\%$ Relative Standard Deviation (RSD).		✓		

เอกสารไม่ควบคุม

Scion Certified Engineer

Name (Print)	SOMCHAI POHTONGKAM
Title	ENGINEER
Signature	<i>Somchai P.</i>
Initials	SOMCHAI
Date	

6.4 Remarks

เอกสารไม่ควบคุม

6.0 Protocol Approval

6.1 Protocol Acceptance / Approval by Customer

I agree that the procedures and information referenced in this document are applicable.

Instrument(s): Scion 451 SQ with DPS400

Serial Number(s): GQS1203F021

Sales Order Number:

Company Name: United Analyst and Engineering Consultant Co. Ltd.

I agree that the Operational Qualification Protocol has been satisfactorily completed.	<input checked="" type="checkbox"/>
I confirm that the Operational Qualification Protocol has not been completed, because of these failed (non-passed) items	<input type="checkbox"/>

Authorized Customer Representative

Name (Print)	
Title	
Signature	
Initials	
Date	

เอกสารไม่ควบคุม

Appendices

Each page that is inserted after the appendix is numbered with the letter of the appendix and a sequential number. The appendix page number must be initialed and dated by both the Qualification Representative and the Reviewer.

For example, pages inserted after Appendix C are numbered C-1, C-2, C-3... etc along with the initials and date.

If the reverse of each appendix page is left blank it should be marked NA and signed and dated.

When the OQ is complete the total number of pages inserted after each appendix is written on the front page of the respective appendix sheet.

6.2 Operational Qualification Protocol Assignment

This Operational Qualification Protocol document is used for:

Operational Qualification Protocol as final test at Scion	<input type="checkbox"/>
Operational Qualification Protocol after Installation Qualification	<input type="checkbox"/>
Operational Qualification Protocol after Preventive Maintenance and OQ completion.	<input checked="" type="checkbox"/>

6.3 Protocol Acceptance / Protocol Approval by Scion

I agree that the procedures and information referenced in this document are applicable.

Instrument(s): Scion 451 SQ with DPS400

Serial Number(s): GQS1203F021

Sales Order Number:

Company Name: United analyst and Engineering Consultant Co. Ltd.

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

B.1 Exceptions

Each Exception Report shall be issued with a unique identification number in the form of ERID-XX-X. This number is generated by the page number on which the exception occurred followed by a sequential number indicating each exception found on the page.

For example, if an exception occurs on page 34, it shall be identified as Exception Report 'ERID-34-1'. If another exception occurs on page 34, the second exception shall be identified as 'ERID-34-2'. This identification number should be recorded in the pass/fail field after each test.

Insert Exception Reports (if any) after this page.

No. of Pages Inserted	N/A
-----------------------	-----

This area is intentionally left blank.

เอกสารไม่ควบคุม

Addendum Procedure: P.M. Protocol Page Number: 1

Qualification Rep. Initials	<i>Somchai P.</i>	Reviewer Initials		QA/QC Initials	
Date	19 MAY 12	Date		Date	

เอกสารไม่ควบคุม

A.1 Qualification Representative Details

The Qualification Representative is to insert a copy of their appropriate qualification(s) after this page.

No. of Pages Inserted	
-----------------------	--

This area is intentionally left blank.

เอกสารไม่ควบคุม

	
<h1>Certificate</h1>	
It is hereby certified that	
Mr. Somchai Pohtongkam	
Has successfully completed the Service & Application Training for	
Scion Chromatography Products	
Training Contents were:	
Hardware Operation, Software operation, Data analysis and Installation, & Troubleshooting of Model:	
SCION GC, GCMS SQ, GCMS TQ	
At Techcomp Singapore	
By Mr. Michael Mei (Service Manager)	
On 11 th –15 th July 2016	
 Hans van den Heuvel Commercial Director Scion Instruments	
Date: 19 July 2016	Cert. No.: TSG-SCIONGC-15011602

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PREVENTIVE MAINTENANCE PROTOCOL
FOR GAS CHROMATOGRAPH MASS SPECTROMETER

Model & Serial Number: SQ S/N 3Q31203F021
 Customer : United Analyst and Engineering Consultant Co., Ltd.
 Date: 10 MAY 2022

GC System

- ☒ Clean all system
- ☒ Check circuit board connector and cable
- ☒ Check column oven heater feed - through, fan motor, mount and bearings
- ☒ Check all LED's and readout display
- ☒ Check operation of all heated zones
- ☒ Check flow rates, filters and gases
- ☒ Verify flow controller operation

MS System

- ☒ Check fan motor MS
- ☒ Check circuit board connector and cable
- ☒ Run electronic Diagnostics
- ☒ Check Gas Clean Filter
- ☒ Check for leak system
- ☒ Check turbo pump (system status)
- ☒ Check vacuum oil
- ☒ Check temperature zone
- ☒ Check air/water (mass 18:19; 28)
- ☒ Check HMN
- ☒ Clean Trap (Saturn, MS200, 4000 Series) or Ion source (1200L, 300, SQ, TQ Series)
- ☒ Check Electron multiplier (If close to 2,000 Volts, Change the multiplier)
- ☒ Check Cal Gas (FC-43)
- ☒ Sensitivity (EI Scan Mode S/N Ratio with for OFN)
- ☒ Check %RSD of Area (EI Scan Mode , for OFN)
- ☒ Check %RSD of RT (EI Scan Mode , for OFN)

SIGN :

Engineer : Sirach P.
(Sirach P. Petchonkarn)

Customer :
 (.....)

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Version information

About 451-GC Details

Injector EFCs:

Software Version

Front: 1.35

Middle: 1.35

Rear: 0.0

Serial number

Front: 26254

Middle: 26258

Rear: -1

Ok

Version information

About 451-GC Details

Detector EFCs:

Software Version

Front: 0.0

Middle: 0.0

Rear: 0.0

Serial number

Front: -1

Middle: -1

Rear: -1

Ok

Version information

About 451-GC Details

Auxiliary EFCs:

Software Version

Front: 0.0

Middle: 0.0

Rear: 0.0

Serial number

Front: 0

Middle: 0

Rear: 0

Ok

Version information

About 451-GC Details

Autosampler:

CP84xxMbus: 2.0

CP84xxTS1: 1.0

CP84xxTS6: 1.20

CP84xxTray: 1.20

CP84xxTower: 1.20

CP84xxSyringe: 1.21

CP84xxPlunger: 1.20

GC Application build info:

Ok

Version information

About 451-GC Details

Software Version: 5.09

Hostname: GC_123 (IP: 10.190.65.10)

Mac Address: 00:e0:4b:34:f5:0d

Software Version: 4.05

GC_Application: 27267

LUL_Application: 0

Ok

Version information

About 451-GC Details

Hardware:

Mainboard: 14

Mainboard SerialNr: 200048

Option Board: 0

Option Board SerialNr: 0

Firmware:

I/O Controller: 2.2

I/O Extender: 1.3

Option Board Controller: 0.0

Ok

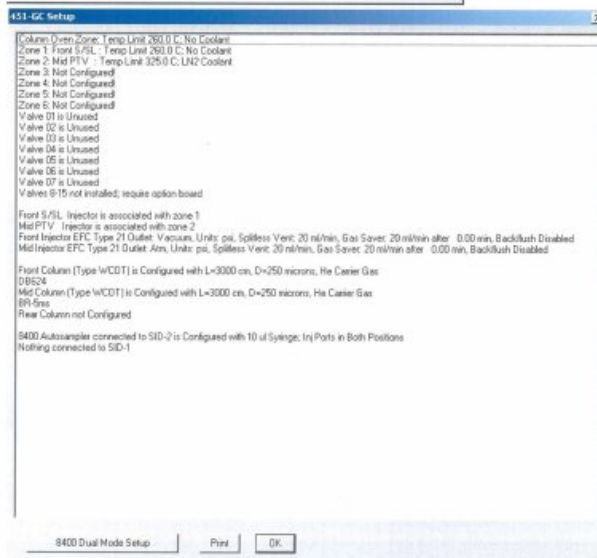
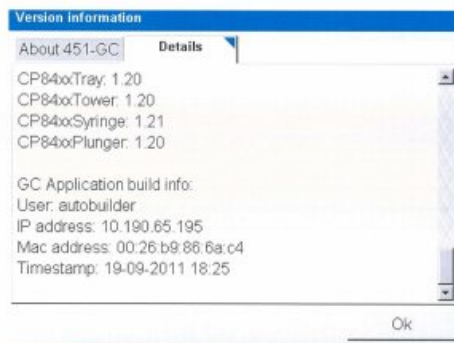
เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Addendum Procedure: 2. System description Page Number: 5

Qualification Rep. Initials	<i>Sachin P.</i>	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม



เอกสารไม่ควบคุม

Addendum Procedure: 3. Test Result Page Number: 30

Qualification Rep. Initials	<i>Sachin P.</i>	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม



เอกสารไม่ควบคุม

Main module test
5-18-2022
Passed -> LED Test
Passed -> Speaker Test
Passed -> Power supply test
Passed -> Main user analog out test
Passed -> Main module test

SCION MS system hardware test
Test date 5-18-2022

Main module test
Passed -> Power supply test
Passed -> Main user analog out test

CIDV module test

5-18-2022
vent valve can only be tested when vented
pressure sensor and pneumatics not tested in single quad system
Passed -> cidv module test

env module test

5-18-2022
Passed -> env module test
CIG Tests only performed on a CI system
EI module test

5-18-2022
Passed -> EI High voltage DC rail test
Passed -> EI Lens 1 test
Passed -> Lens 2 test
Passed -> Repeller test
Passed -> Electron energy test
Passed -> EI Source test

CI Tests only performed on a CI system
Det module test

5-18-2022

Detector module test
Passed -> Power supply test
Passed -> HV Power supply Type test
Passed -> HV Power supply Revision test
Passed -> Detector accelerator test
Passed -> Detector baseline dac test
Passed -> Detector Noise test
Passed -> Detector multiplier dac test
Passed -> Detector module test
Q0 module test

5-18-2022

Passed -> Q0 module test
Q1 module test

5-18-2022

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

CIDV module test

5-18-2022
Passed -> CIDV Power supply test
Passed -> Turbo control test
vent valve can only be tested when vented
pressure sensor and pneumatics not tested in single quad system
Passed -> cidv module test

Passed -> Q1 module test

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Det module test

5-18-2022

Passed -> Power supply test
Passed -> HV Power supply type test
Passed -> HV Power supply Revision test
Passed -> Detector accelerator test
Passed -> Detector baseline dac test
Passed -> Detector Noise test
Passed -> Detector multiplier dac test
Passed -> Detector module test

env module test

5-18-2022

Passed -> Power supply test
Passed -> temp sensor test
Passed -> Valve current test
Passed -> env fan test
Passed -> heater current test
Passed -> env module test

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Q0 module test

5-18-2022

Passed -> Power supply test
Passed -> Q0 High voltage DC rail test
Passed -> Q0 DAC test
Passed -> Quad offset test
Passed -> RF detector test
Passed -> RF modulator test
Passed -> RF current test
Passed -> heater current test
Passed -> Q0 module test

EI module test

5-18-2022

Passed -> EI Power supply test
Passed -> EI High voltage DC rail test
Passed -> EI Lens 1 test
Passed -> Lens 2 test
Passed -> Repeller test
Passed -> Electron energy test
Passed -> AMP test
Passed -> EI Filament test
Check maximum heater current and heater wattage
Max Heater Current = 1.27 Wattage = 29.66
Source heater wattage measures OK
Passed -> EI Heater test
Passed -> EI Source test

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Bruker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 12:49	Data File:	...022\ofn1pg010.xms
Calculation Date:	19/5/2565 12:55	Method:	...ds\pm2017fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

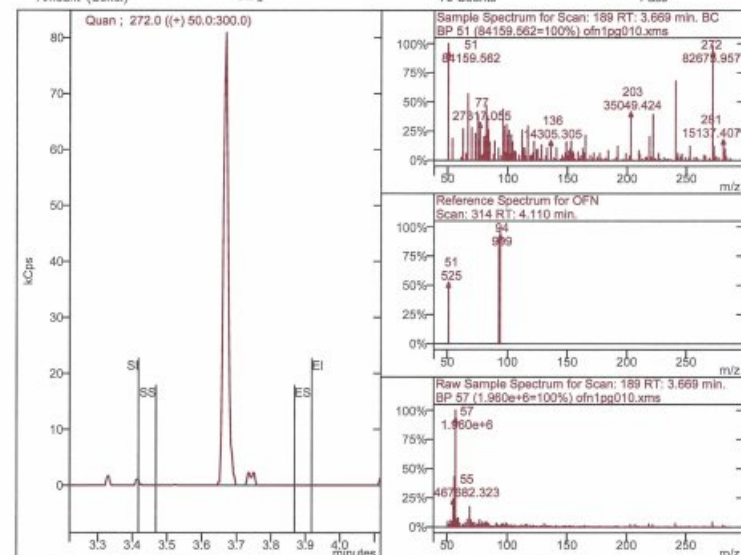
Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
Result Index:	1					

Identification

Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.669 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quan Ions	272.0		
Calibration Equation	Average		
Area	>=10	78832	Pass
Height		80862	
Amount (Conc.)	>= 0	79 Counts	Pass



เอกสารไม่ควบคุม

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Bruker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 12:23	Data File:	...022\ofn1pg008.xms
Calculation Date:	19/5/2565 12:28	Method:	...ds\pm2017fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

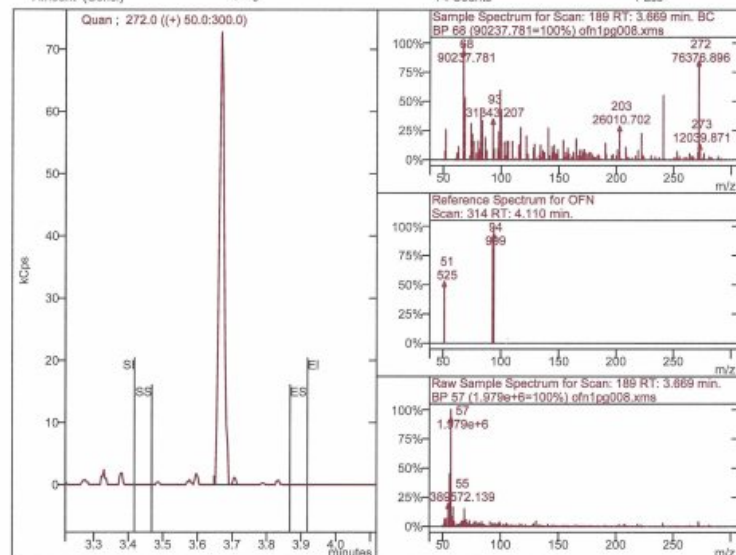
Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
Result Index:	1					

Identification

Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.670 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quan Ions	272.0		
Calibration Equation	Average		
Area	>=10	74230	Pass
Height		72761	
Amount (Conc.)	>= 0	74 Counts	Pass



เอกสารไม่ควบคุม

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Bruker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 13:03	Data File:	...022\ofn1pg011.xms
Calculation Date:	19/5/2565 13:08	Method:	...ds\pm2017fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

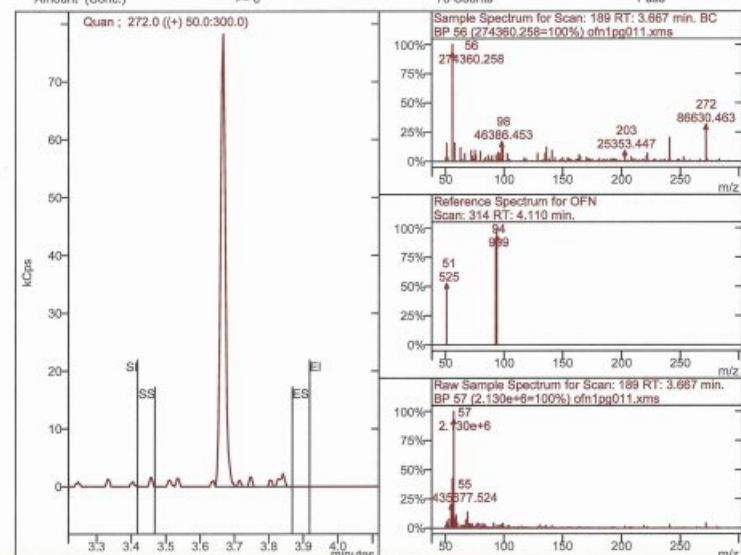
Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
Result Index:	1					

Identification

Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.667 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quan Ions	272.0		
Calibration Equation	Average		
Area	>=10	75823	Pass
Height		78279	
Amount (Conc.)	>= 0	79 Counts	Pass



เอกสารไม่ควบคุม

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Bruker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 12:36	Data File:	...022\ofn1pg009.xms
Calculation Date:	19/5/2565 12:41	Method:	...ds\pm2017fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

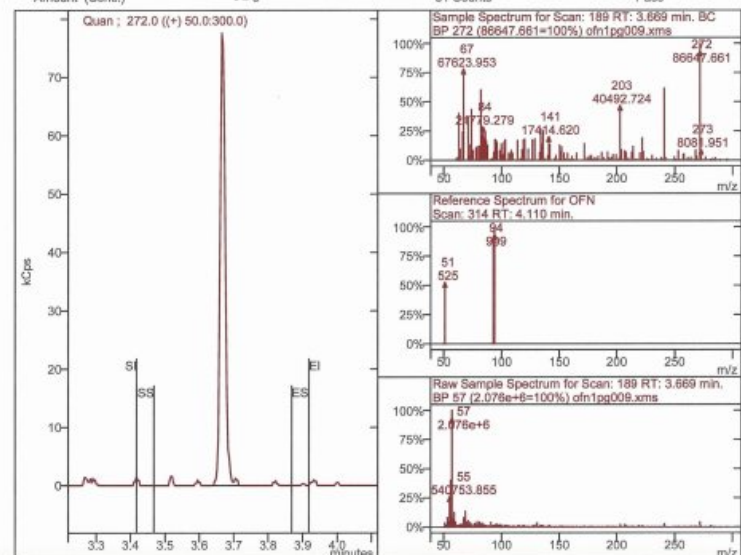
Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
Result Index:	1					

Identification

Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.668 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quan Ions	272.0		
Calibration Equation	Average		
Area	>=10	80953	Pass
Height		76589	
Amount (Conc.)	>= 0	81 Counts	Pass



เอกสารไม่ควบคุม

Sample ID:	oim1pg	Operator:	TU
Instrument ID:	Bruker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 13:56	Data File:	...022\oq\oim1pg014.xms
Calculation Date:	19/5/2565 14:06	Method:	...dsipm2017fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

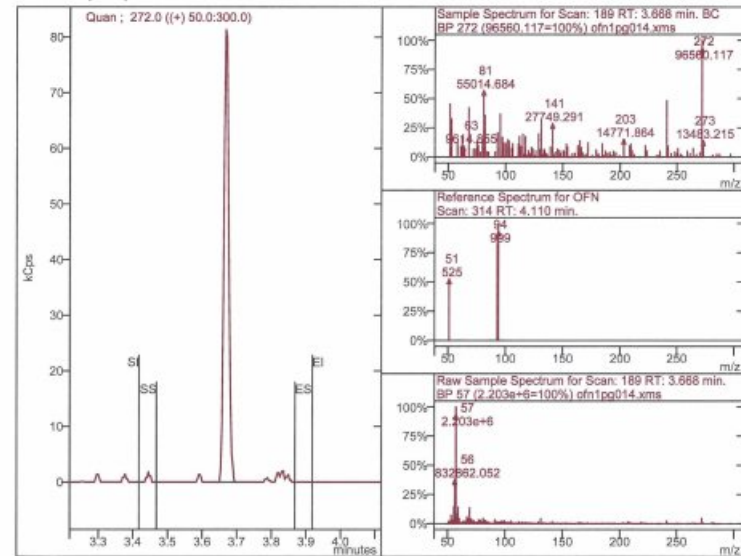
Peak Name:	OFN	Compound Number:	CAS Number:	Identified
Result Index:	1	1	None	

Identification

Parameter	Specification	Actual	Status
Search Type	Highest	3.670 min.	Pass
Retention Time	3.668 +/- 0.200	N/A	
Match Result			

Integration and Quantitation

Parameter	Specification	Actual	Status
Quant Ions	272.0		
Calibration Equation	Average	81684	Pass
Area	>=10	81381	
Height		82 Counts	Pass
Amount (Conc.)	>= 0		



เอกสารไม่ควบคุม

Sample ID:	oim1pg	Operator:	TU
Instrument ID:	Bruker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 13:16	Data File:	...022\oq\oim1pg012.xms
Calculation Date:	19/5/2565 13:21	Method:	...dsipm2017fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

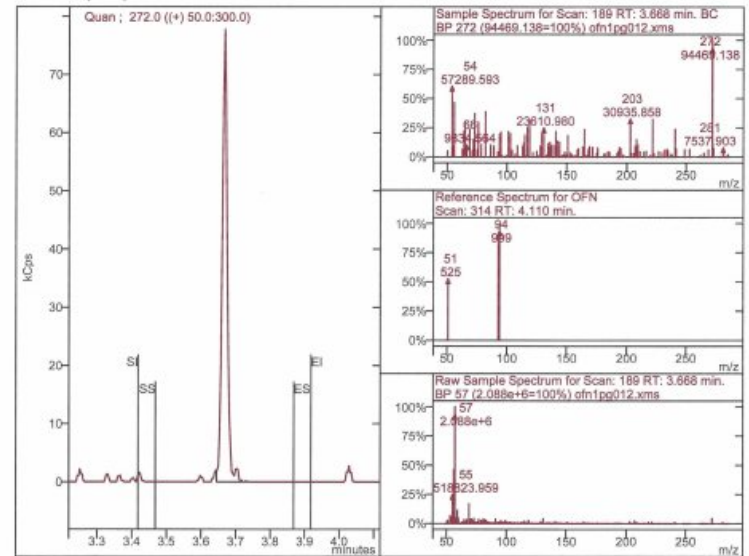
Peak Name:	OFN	Compound Number:	CAS Number:	Identified
Result Index:	1	1	None	

Identification

Parameter	Specification	Actual	Status
Search Type	Highest	3.668 min.	Pass
Retention Time	3.668 +/- 0.200	N/A	
Match Result			

Integration and Quantitation

Parameter	Specification	Actual	Status
Quant Ions	272.0		
Calibration Equation	Average	79060	Pass
Area	>=10	77781	
Height		79 Counts	Pass
Amount (Conc.)	>= 0		



เอกสารไม่ควบคุม

Sample ID:	oim1pg	Operator:	TU
Instrument ID:	Bruker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 14:09	Data File:	...022\oq\oim1pg015.xms
Calculation Date:	19/5/2565 14:14	Method:	...dsipm2017fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

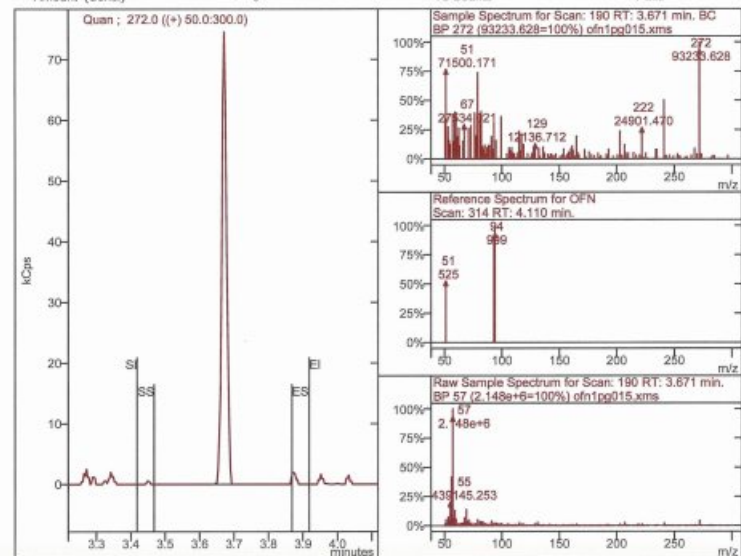
Peak Name:	OFN	Compound Number:	CAS Number:	Identified
Result Index:	1	1	None	

Identification

Parameter	Specification	Actual	Status
Search Type	Highest	3.671 min.	Pass
Retention Time	3.668 +/- 0.200	N/A	
Match Result			

Integration and Quantitation

Parameter	Specification	Actual	Status
Quant Ions	272.0		
Calibration Equation	Average	72531	Pass
Area	>=10	74597	
Height		73 Counts	Pass
Amount (Conc.)	>= 0		



Chromatogram Plots

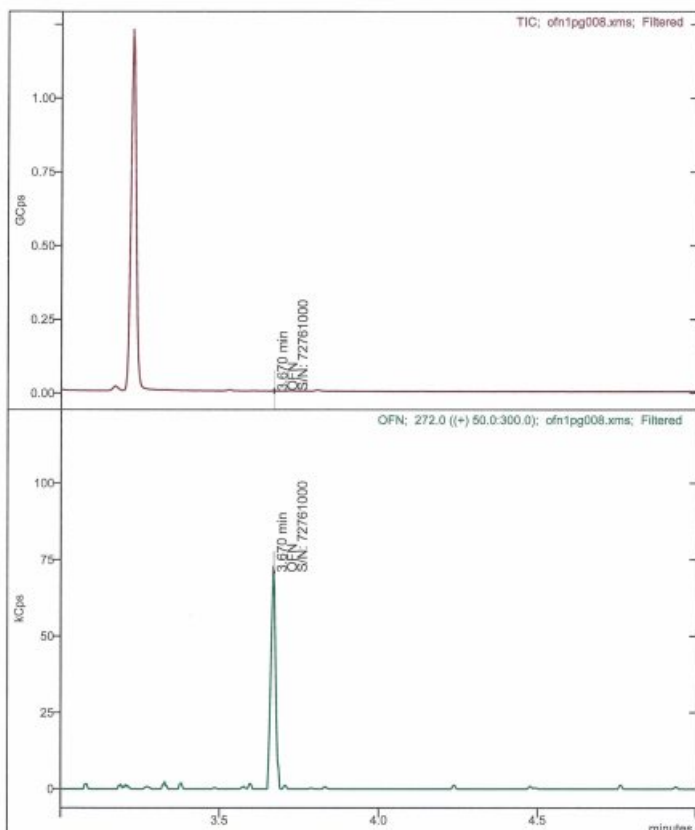
File: e:\tu\pm2022\oq\ofn1pg008.xms

Sample: ofn1pg

Scan Range: 1 - 565 Time Range: 3.00 - 5.00 min.

Operator: TU

Date: 19/5/2565 12:23



เอกสารไม่ควบคุม

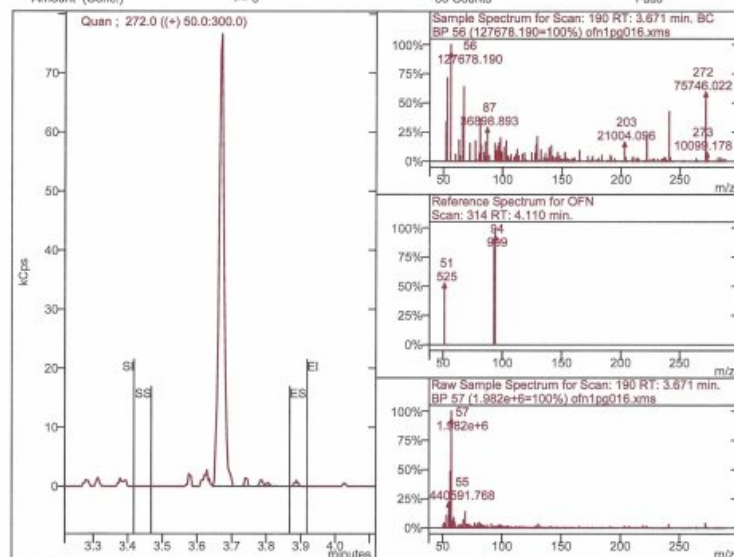
Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Bruker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 14:22	Data File:	...022\oq\ofn1pg016.xms
Calculation Date:	19/5/2565 14:27	Method:	...ds\pm2017\fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
Result Index:	1					
Parameter	Specification	Actual	Status			
Search Type	Highest	3.670 min.	Pass			
Retention Time	3.668 +/- 0.200	N/A				
Match Result						

Integration and Quantitation

Parameter	Specification	Actual	Status
Quant Ions	272.0		
Calibration Equation	Average	79852	Pass
Area	>=10	76648	
Height		80 Counts	Pass
Amount (Conc.)	>= 0		



เอกสารไม่ควบคุม

Chromatogram Plots

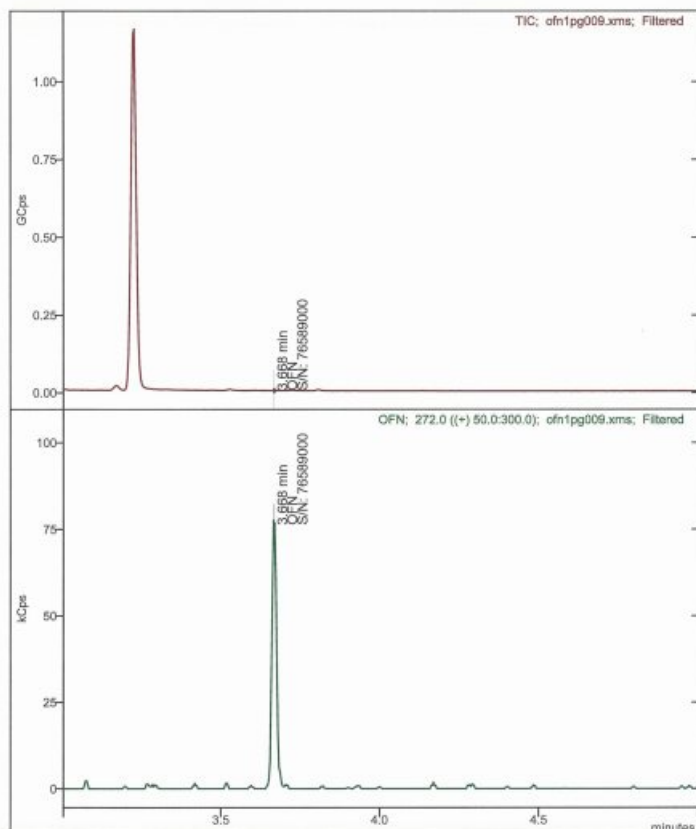
File: e:\tu\pm2022\oq\ofn1pg009.xms

Sample: ofn1pg

Scan Range: 1 - 564 Time Range: 3.00 - 5.00 min.

Operator: TU

Date: 19/5/2565 12:36



เอกสารไม่ควบคุม

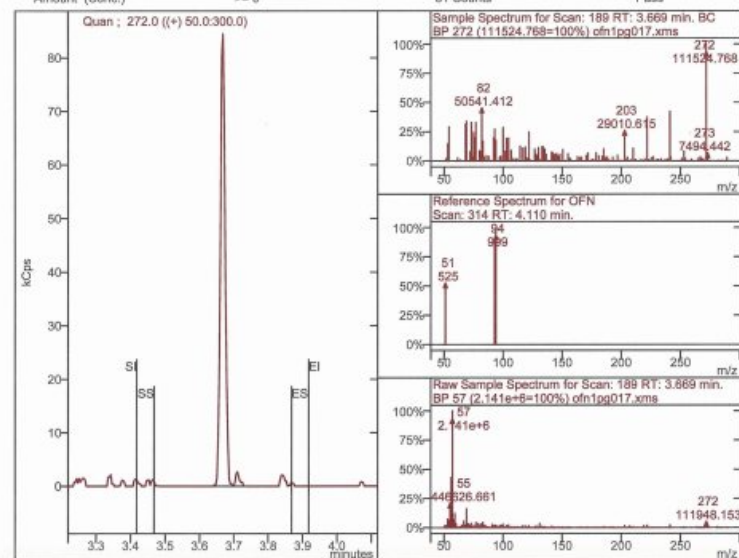
Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Bruker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 14:37	Data File:	...022\oq\ofn1pg017.xms
Calculation Date:	19/5/2565 14:42	Method:	...ds\pm2017\fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
Result Index:	1					
Parameter	Specification	Actual	Status			
Search Type	Highest	3.668 min.	Pass			
Retention Time	3.668 +/- 0.200	N/A				
Match Result						

Integration and Quantitation

Parameter	Specification	Actual	Status
Quant Ions	272.0		
Calibration Equation	Average	81366	Pass
Area	>=10	84532	
Height		81 Counts	Pass
Amount (Conc.)	>= 0		



เอกสารไม่ควบคุม

Chromatogram Plots

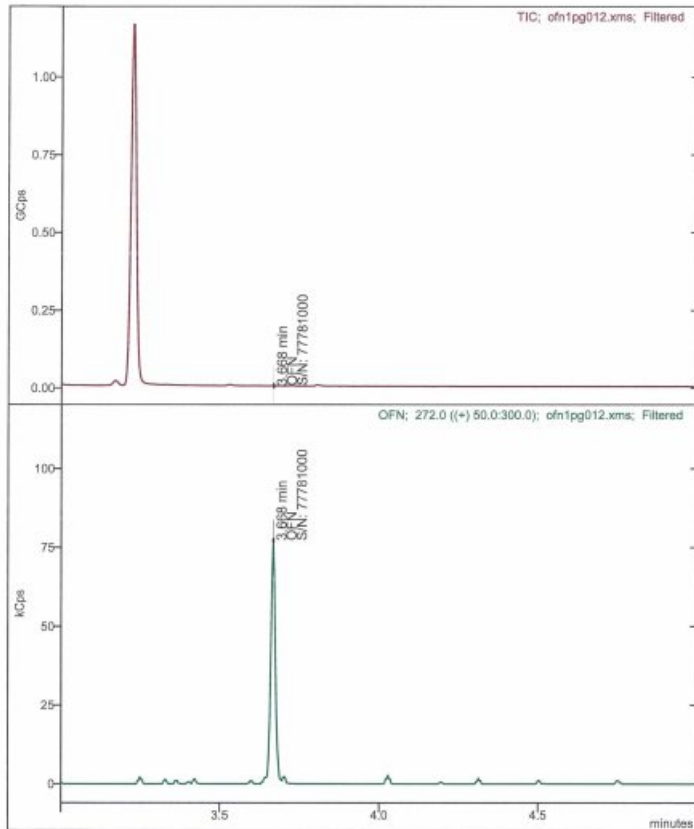
File: e:\tu\pm2022\oq\ofn1pg012.xms

Sample: ofn1pg

Scan Range: 1 - 566 Time Range: 3.00 - 5.00 min.

Operator: TU

Date: 19/5/2565 13:16



เอกสารไม่ควบคุม

Chromatogram Plots

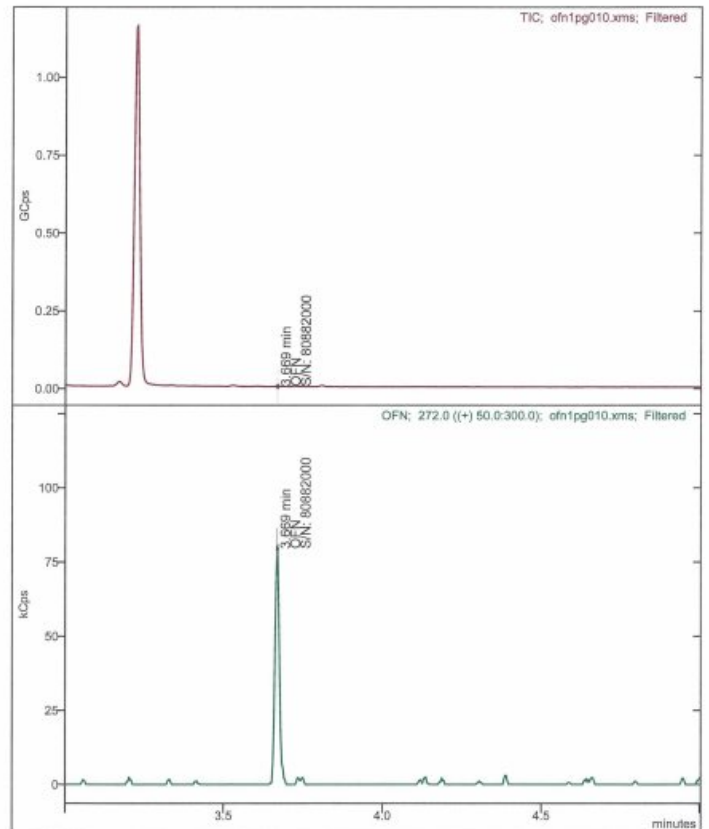
File: e:\tu\pm2022\oq\ofn1pg010.xms

Sample: ofn1pg

Scan Range: 1 - 565 Time Range: 3.00 - 5.00 min.

Operator: TU

Date: 19/5/2565 12:49



เอกสารไม่ควบคุม

Chromatogram Plots

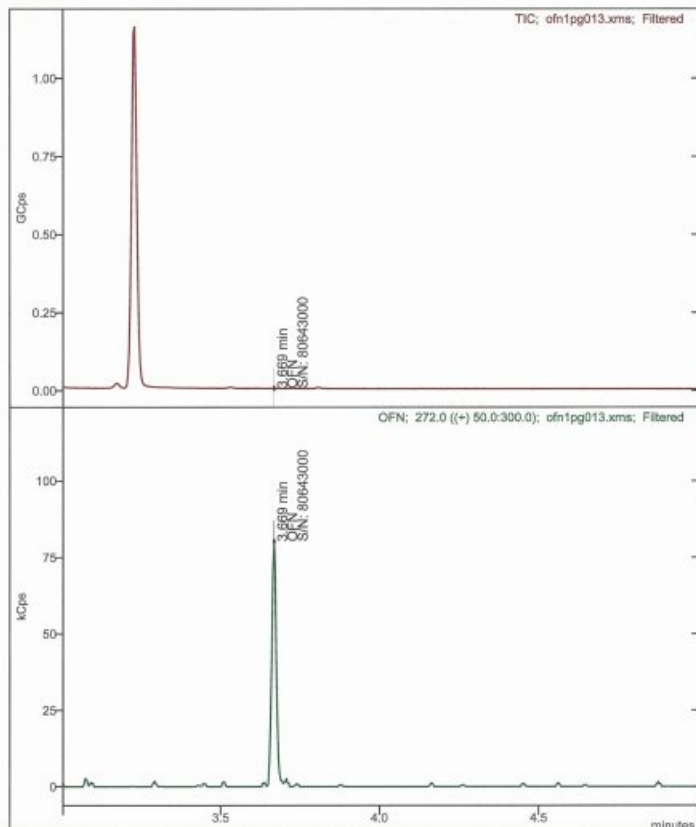
File: e:\tu\pm2022\oq\ofn1pg013.xms

Sample: ofn1pg

Scan Range: 1 - 566 Time Range: 3.00 - 5.00 min.

Operator: TU

Date: 19/5/2565 13:29



เอกสารไม่ควบคุม

Chromatogram Plots

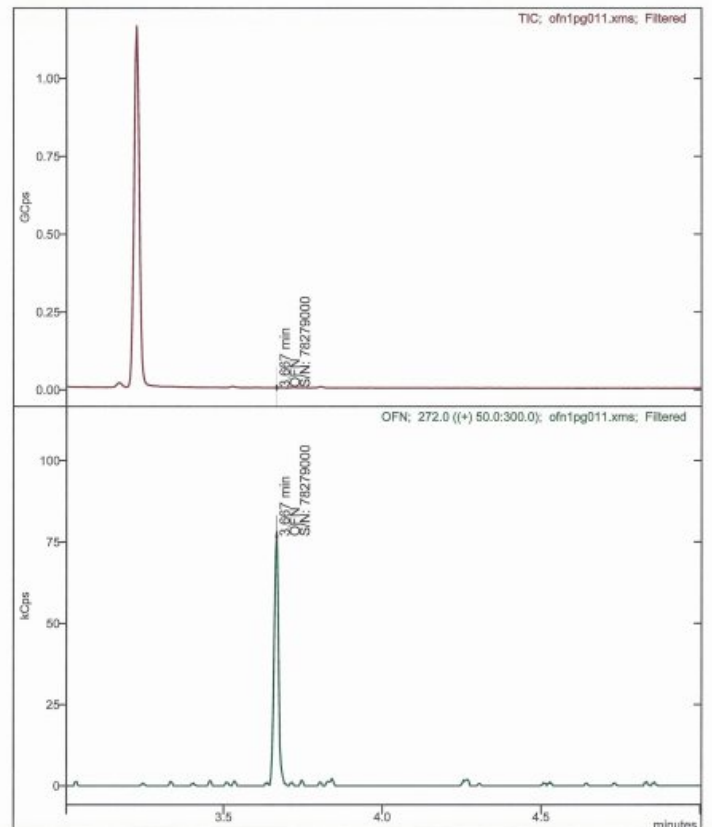
File: e:\tu\pm2022\oq\ofn1pg011.xms

Sample: ofn1pg

Scan Range: 1 - 566 Time Range: 3.00 - 5.00 min.

Operator: TU

Date: 19/5/2565 13:03



เอกสารไม่ควบคุม

Chromatogram Plots

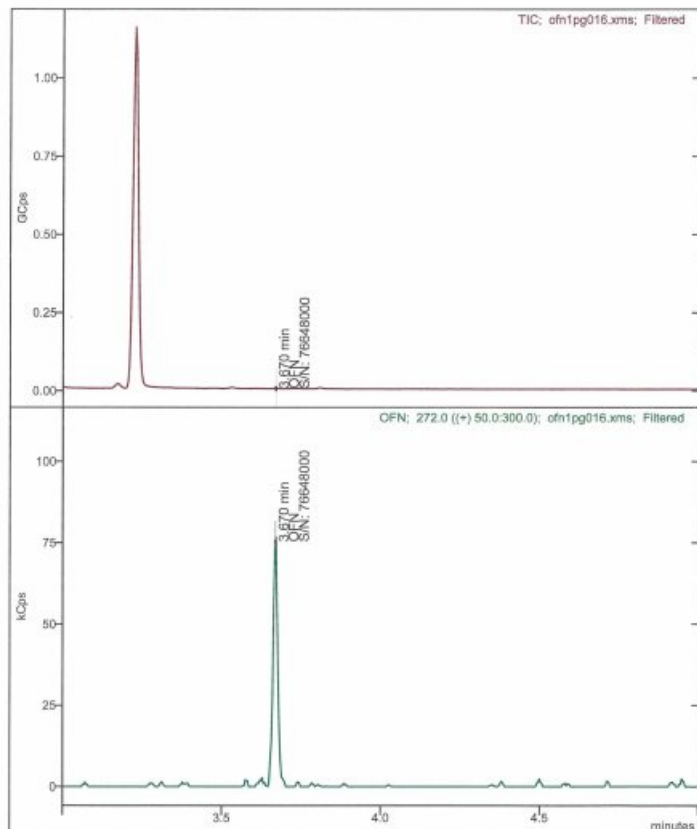
File: e:\tu\pm2022\oq\ofn1pg016.xms

Sample: ofn1pg

Scan Range: 1 - 565 Time Range: 3.00 - 5.00 min.

Operator: TU

Date: 19/5/2565 14:22



เอกสารไม่ควบคุม

Chromatogram Plots

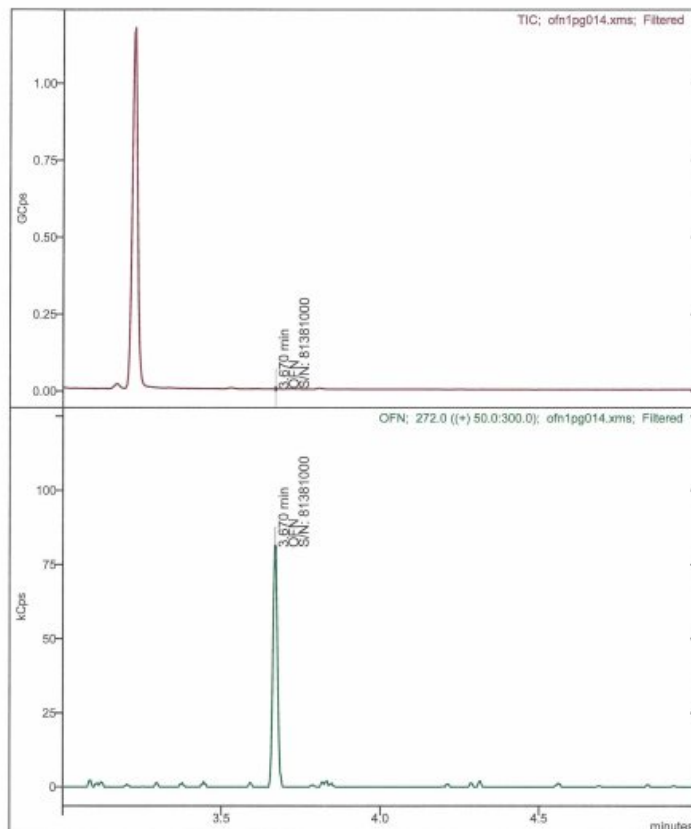
File: e:\tu\pm2022\oq\ofn1pg014.xms

Sample: ofn1pg

Scan Range: 1 - 565 Time Range: 3.00 - 5.00 min.

Operator: TU

Date: 19/5/2565 13:56



เอกสารไม่ควบคุม

Chromatogram Plots

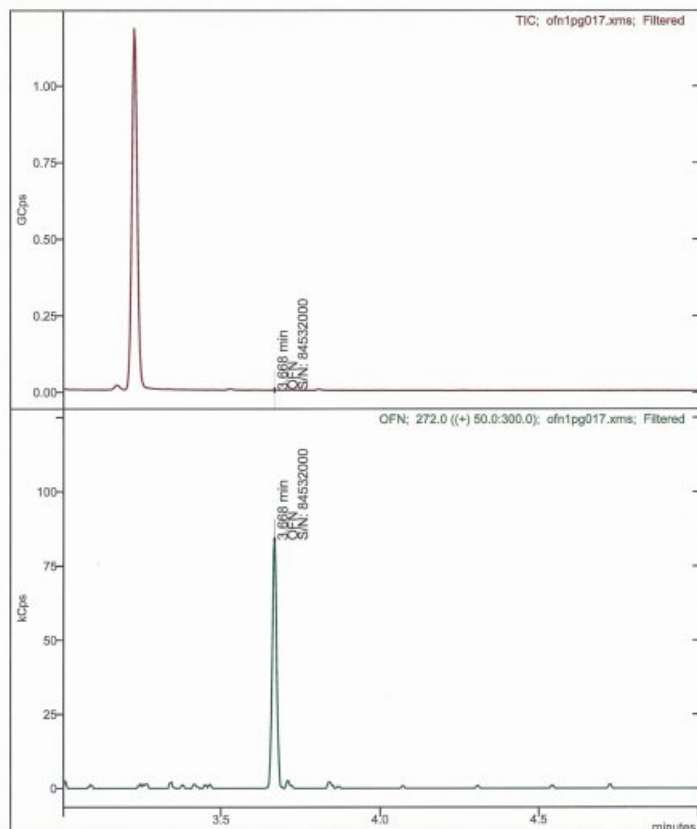
File: e:\tu\pm2022\oq\ofn1pg017.xms

Sample: ofn1pg

Scan Range: 1 - 565 Time Range: 3.00 - 5.00 min.

Operator: TU

Date: 19/5/2565 14:37



เอกสารไม่ควบคุม

Chromatogram Plots

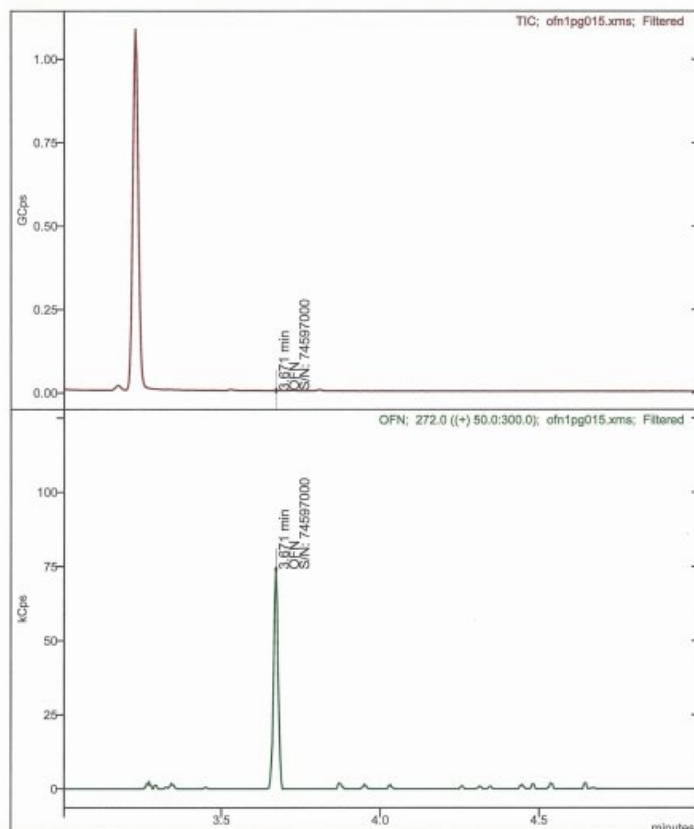
File: e:\tu\pm2022\oq\ofn1pg015.xms

Sample: ofn1pg

Scan Range: 1 - 565 Time Range: 3.00 - 5.00 min.

Operator: TU

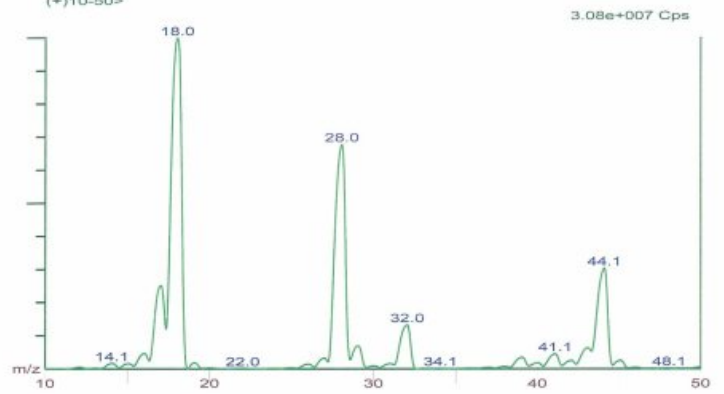
Date: 19/5/2565 14:09



เอกสารไม่ควบคุม

Addendum Procedure: A. Certificate Page Number: _____scan 267853 (15 scans) (Sparged)
Notes: EI, EDR On (1)
Compounds: OFN
(+)-10-50>

Date: 19 MAY 22 9:17 AM



28 absolute size (cps)

- Normal < 9.0e7
- Measured 2.12e7

28/32 Ratio

- Normal < 2.8:1 or > 4.2:1
- Measured 5.3:1

28/18 Ratio

- Normal < 2.0:1
- Measured 0.7:1

Qualification Rep. Initials	<u>Sorakun P.</u>	Reviewer Initials		QA/QC Initials	
Date	<u>19 MAY 22</u>	Date		Date	

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Operational Qualification Protocol Certification

for

SCION

with the serial number

GQS1203F21

has successfully completed all criteria for hardware Operational Qualification Protocol as detailed in this document.

Scion Certified Engineer

SOMCHAI POHTONGKAM

Name (please print)

Sorakun P.

Signature

19 MAY 22

Date

Authorized Customer Representative

Name / Function (please print)

Signature

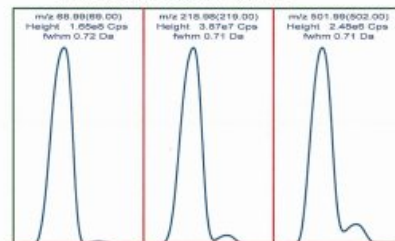
Date

Customer Address

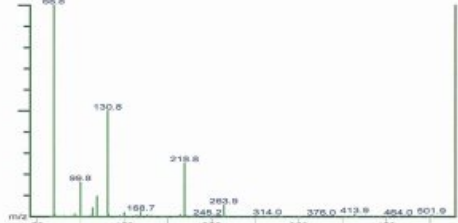
United Analyst and Engineering Consultant Co., Ltd.

เอกสารไม่ควบคุม

Tune_EI_G1_Pos_19 May 2022_ 9h30m EDR

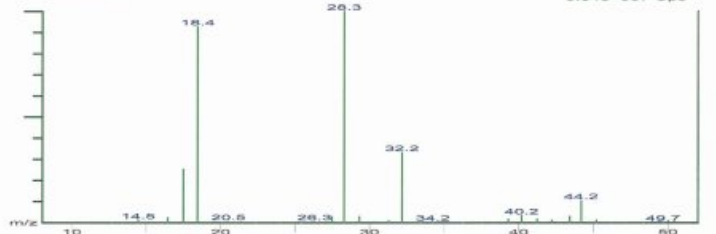
Instrument: SCION SQ
Location:
Operator:
Date/Time: 19 May 2022 9:30:53

scan 281147 Operator: Date: 19 MAY 22 9:30 AM

Notes: EI, EDR On (1)
Compounds: OFN
(+)-10-50>TIC: 2.823 e 8
1.29e+008 CpsEI
Temperature: 250C
Filament: 2
Emission: 40uA
Electron Energy: 80eV
Q0 Helium: On
Transferline: 250C
Detector Max: 1.78kV
Repeller Max: 23Vscan 281153 Notes: EI, EDR On (1)
Compounds: OFN
(+)-10-50>

Operator:

Date: 19 MAY 22 9:31 AM

TIC: 1.042 e 8
3.64e+007 Cps

เอกสารไม่ควบคุม

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

REPORT OF CALIBRATION

Certificate No. : SP22-007 Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5787	0.577	0.0017	0.0031	2.00
	1.0490	1.050	-0.0010	0.0029	2.00
	2.1900	2.183	0.0070	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.560	0.0007	0.0034	2.00
	1.0247	1.023	0.0017	0.0035	2.00
	2.1229	2.118	0.0049	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.521	0.0026	0.0030	2.00
	0.9634	0.963	0.0004	0.0029	2.00
	1.9763	1.974	0.0023	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.518	0.0011	0.0031	2.00
	1.0003	1.000	0.0003	0.0033	2.00
	1.9987	1.996	0.0027	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
	1.0809	1.082	-0.0011	0.0030	2.00
	2.0391	2.033	0.0061	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.562	-0.0019	0.0031	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.925	0.0044	0.0079	2.00

PM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

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

CERTIFICATE OF CALIBRATION

Certificate No. : SP22-007 Page 1 of 5

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

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

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064


ID No. : UAE.WAS.006/2552


Received Date : 20 January 2022

Calibration Date : 20 January 2022

Issue Date : 24 January 2022

Condition Instrument : Good

Calibrated by :  (Mr. Tanawat Rittidach)
Technical Manager

Approved by :  (Ms. Chonthicha Sangsri)
Quality Manager

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

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

PM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

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

REPORT OF CALIBRATION

Certificate No. : SP22-007 Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7478	0.746	0.0018	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8686	0.861	0.0076	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2912	0.291	0.0002	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6448	0.638	0.0068	0.0055	2.00

PM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

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

REPORT OF CALIBRATION

Certificate No. : SP22-007 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	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

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.

PM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP22-007

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.54	240.8	0.74	0.18	2.00
279.40	278.5	0.90	0.18	2.00
288.70	288.0	0.70	0.18	2.00
334.22	333.5	0.72	0.18	2.00
361.26	360.5	0.76	0.18	2.00
418.48	418.0	0.48	0.18	2.00
446.70	446.0	0.70	0.18	2.00
453.20	453.0	0.20	0.18	2.00
460.06	459.5	0.56	0.18	2.00
536.90	536.0	0.90	0.18	2.00
637.94	637.2	0.74	0.18	2.00
440.74	440.0	0.74	0.18	2.00
472.22	471.6	0.62	0.18	2.00
513.70	513.0	0.70	0.18	2.00
528.72	528.0	0.72	0.18	2.00
574.60	573.8	0.80	0.18	2.00
585.48	584.6	0.88	0.20	2.00
684.63	684.0	0.63	0.18	2.00
740.27	739.8	0.47	0.20	2.00
748.28	747.8	0.48	0.18	2.00
807.16	806.4	0.76	0.18	2.00
879.70	878.8	0.90	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 -

Calibration Certificate

Certificate No.: 2203135-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsak 41, Sukhumvit Road,
Bangchack, Prakanong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: HANNA INSTRUMENTS
Model: HI2020-02
Serial No.: C0051107
ID No.: UAE.WAQ.005/2557
Order No.: 2203135
Operation No.: 2203135-001
Date of Receipt: 7 June 2022
Date of Calibration: 8 June 2022

Calibrated by Mr.Manas Somasak Specialist
Approved by (Mr.Pheraphat Tuanjit) Manager, Division of Calibration Laboratory
Date of Issue: 13 June 2022 Responsible for the Technical Management Team

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

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

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

Calibration Report

Certificate No.: 2203135-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 0.1 mV
Manufacturer: HANNA INSTRUMENTS
Model: HI2020-02
Serial No.: C0051107
Type: Bench top
ID No.: UAE.WAQ.005/2557

Page 2 of 5

Date of Calibration: 8 June 2022
Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (23.5 ± 1.5) °C
Condition of Equipment: Good Condition
Relative Humidity: (53 ± 5) %

Condition of this Results of Calibration

1. Calibration Method: In house method: W-CC-002 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	SCL-21F-0687	24 June 2022	
2.2 Digital Thermometer	2709007	Fuke	CC-640569-01	30 October 2022	
2.3 Thermo-Hygro Meter	NPI.BTH050518	PCNPPE	QR22-0301	16 February 2023	
Certified Reference Material		Lot No.	Manufacturer	Ref No	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)		805203	CPAchem	PHQ16.L5	21 April 2024
2.5 pH buffer 6.865 (Primary pH buffer Solution)		805204	CPAchem	PHQ17.L5	21 April 2024
2.6 pH buffer 10.01 (Primary pH buffer Solution)		805205	CPAchem	PHQ25.L5	21 April 2023
2.7 pH buffer 7.00 (Standard pH buffer Solution)		805206	CPAchem	PH107.L5	21 April 2023
3. This certification is traceable to The International System of Units (SI Unit)
 - 3.1 Instruments No.2.1 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0075
 - 3.2 Instruments No.2.2 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0081
 - 3.3 Instruments No.2.3 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0292
 - 3.4 Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method: Harmed cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
 - 3.5 Certified Reference Material No.2.7 traceable to BSM RefN H-27 LotN 04.06.2021; BSM RefN H-28 LotN 28.05.2021; BSM RefN H-27 LotN 04.06.2021; BSM RefN H-28 LotN 28.05.2021, the Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2203135-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 0.1 mV
Manufacturer: HANNA INSTRUMENTS
Model: HI2020-02
Serial No.: C0051107
Type: Bench top
ID No.: UAE.WAQ.005/2557

Page 3 of 5

Date of Calibration: 8 June 2022
Calibration Results: 1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0	614.177	415.9	0.00	0.063	2.00
2	298.911	297.5	2.00	0.063	2.00
4	177.462	179.1	4.00	0.063	2.00
6	59.159	60.6	6.00	0.063	2.00
7	-0.001	1.6	7.00	0.063	2.00
8	-59.159	-57.5	8.00	0.063	2.00
10	-177.463	-175.8	10.00	0.063	2.00
12	-298.912	-294.2	12.00	0.063	2.00
14	-414.119	-412.5	14.00	0.063	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode
Type: Combined Electrode
Manufacturer: HANNA INSTRUMENTS
Model: HI11310
Serial No.: 078743
ID No.: N/A

Performance of Electrode system (Three-Point Calibration at pH4, pH7 and pH10)

Certified Value (25 °C pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	169.8	96.7	0.0071	2.00
6.865	6.87	6.2	-	0.0076	2.00
10.008	10.01	-174.0	97.0	0.0067	2.00
6.885	6.89	-2.0	-	0.0063	2.00

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

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2203135-001-01
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

Page 4 of 5

Date of Calibration: 8 June 2022
Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (23.5 ± 1.0) °C
Relative Humidity: (53 ± 3) %

Condition of this results of Calibration:

1. Calibration Method:
 - In house method: W-TB-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	PSLT 085154	24-Jun-22	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

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

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

☒ X Without adjustment

☐ After adjustment

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

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2203135-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C **Model:** H2020-02
Serial No.: C0031107 **ID No.:** UAE.WAT.0102553
Manufacturer: HANNA INSTRUMENTS
Date of Calibration: 8 June 2022 **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: 78743
- Dimension of probe: Diameter 12 mm, Length 120 mm.
- Sheath material: Glass

UUC Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.001	-0.1	0.099
20.1	20.002	-0.1	0.099
25.2	25.002	-0.2	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

เอกสารไม่ควบคุม



Calibration Certificate

Certificate No.: 2201793-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakanong, Bangkok 10260

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.0102553
Order No.: 2201793
Operation No.: 2201793-001
Date of Receipt: 21 February 2022
Date of Calibration: 1 March 2022

Calibrated by: Mr. Pheraphat Tuanjit Scientist
Approved by: (Mr. Nuttapol Niyomchart) Specialist, Division of Calibration Laboratory
Date of Issue: 1 March 2022
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-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2201793-001-01
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.0102553
Date of Calibration: 1 March 2022 **Page 2 of 5**

Location: Chemical Calibration Laboratory, NATIONAL FOOD INSTITUTE
Environment Condition: Ambient Temperature: (23.5 ± 1.5) °C Relative Humidity: (53 ± 5) %
Condition of Equipment: Good Condition

Condition of this Results of Calibration

1. Calibration Method: In house method: W-CO.002 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	2706007	Puke	SCL-21P-0607	24 June 2022
2.2 Digital Thermometer	2706007	Puke	CC-440599-01	30 October 2022
2.3 Thermo-Hygro Meter	NPL8TH00418	PONPE	QR22-0195	27 January 2023

Certified Reference Material

Lot No.	Manufacturer	Ref N	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	CPAchem	PH216.L5	19 April 2023
2.5 pH buffer 6.865 (Primary pH buffer Solution)	CPAchem	PH217.L5	19 April 2023
2.6 pH buffer 10.01 (Primary pH buffer Solution)	CPAchem	PH220.L5	19 April 2022
2.7 pH buffer 7.00 (Standard pH buffer Solution)	CPAchem	PH107.L5	16 March 2022

3. This certification is traceable to The International System of Unit (SI Unit)
3.1 Instruments No.2.1 through NSC-TIS-115 17025 Laboratory Accreditation of Calibration No.0075
3.2 Instruments No.2.2 through NSC-TIS-115 17025 Laboratory Accreditation of Calibration No.0061
3.3 Instruments No.2.3 through NSC-TIS-115 17025 Laboratory Accreditation of Calibration No.0092
3.4 Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method: Hanna cell using calibrated thermometer, barometer, and nanovisner: The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
3.5 Certified Reference Material No. 2.7 traceable to BSM RefN HI-7 Lot# 30.04.2020; BSM RefN HI-9 Lot# 28.05.2020; BSM RefN HI-8 Lot# 30.04.2020; BSM RefN HI-10 Lot# 28.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

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

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

P. Jangphairat
1 March 2022

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2201793-001-01
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.0102553
Date of Calibration: 1 March 2022 **Page 3 of 5**

Calibration Results:

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

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (mV)	Coverage Factor (k)
		mV	pH		
0.00	414.117	414	0.00	0.58	2.00
2.00	295.811	296	2.00	0.58	2.00
4.00	177.462	178	4.00	0.58	2.00
6.00	59.159	59	6.00	0.58	2.00
7.00	-0.001	0	7.00	0.58	2.00
8.00	-69.158	-69	8.00	0.58	2.00
10.00	-177.463	-177	10.00	0.58	2.00
12.00	-295.812	-296	12.00	0.58	2.00
14.00	-414.119	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)
Equipment: pH Electrode
Manufacturer: METTLER TOLEDO
Model: InLabSoda
Serial No.: 1156882
Type: Combined Electrode
ID No.: N/A

Performance of Electrode system

(Three-Point Calibration at pH4, pH7 and pH10)

Certified Value (25 °C (pH))	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.00	180	99.25	0.0078	2.00
6.865	6.88	16	-	0.0079	2.00
10.012	10.01	-162	99.19	0.0094	2.00
6.865	7.00	9	-	0.0097	2.00

P. Jangphairat
1 March 2022

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2201793-001-01
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: 1 March 2022 Page 4 of 5

Location: Chemical Calibration Laboratory, NATIONAL FOOD INSTITUTE
Environment Condition: Ambient Temperature 24 °C ± 1 °C
Relative Humidity 55 % ± 2 %

Condition of this results of Calibration:

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

2. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 0851/64	03-Jun-22	TISTR.
Platinum Resistance Thermometer (PRT)	5627A	877302			

Support Equipment: Low Temperature Bath (ISOCAL-5), Model: Europa-5 Plus Basic, SN: 341592/2

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

6. Condition of Calibrated Item:

Good ☒ Without adjustment ☐ After adjustment

7. Result of Calibration:

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2201793-001-01
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: 1 March 2022 Page 5 of 5

Calibration point: 15.0, 25.0 and 35.0 °C
Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.
- Description of probe, model: NIA SN: NIA
- Dimension of probe: Diameter 4 mm, Length 100 mm.
- Sheath material: Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.008	-0.1	0.009
25.1	25.004	-0.1	0.009
35.1	35.003	-0.1	0.009

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: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2200708-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AX 105 DR

Serial No.: 1122100406

ID No.: UAE.WAO.004/2546

Order No.: 2200708

Operation No.: 2200708-001

Date of Receipt: 24 November 2021

Date of Calibration: 24 November 2021

Calibrated by Mr.Worapob Sooktong
Scientist

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

Date of Issue: 30 November 2021

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: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200708-001-01
Equipment: Electronic Balance
Model: AX 105 DR
Serial No.: 1122100406
Capacity: 110 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g/0.0001 g
ID No.: UAE.WAO.004/2546

Date of Calibration: 24 November 2021

Page 2 of 4

Environment Condition: Ambient Temperature: 22.0 ± 0.5 °C Relative Humidity: 39 ± 1 %

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M20111955	28 November 2021
Standard Weight Class E2	1-500g	15882	TCS	M20111965	28 November 2021
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	11A1	www.ild. BTH 003/55	Quality Room	QR21-0297	15 February 2022

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:

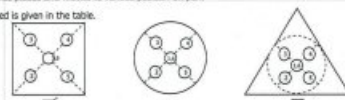
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
15	0.0000957
30	0.0000984
50	0.000053
100	0.000048

2. Off-Center Error:

A mass of 50 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)
50.0000	50.0000	49.9999	50.0000	49.9999	49.9999	0.0001

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200708-001-01
Equipment: Electronic Balance
Model: AX 105 DR
Serial No.: 1122100406
Capacity: 110 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g/ 0.0001 g
ID No.: UAE.WAO.004/2546

Date of Calibration: 24 November 2021 **Page 3 of 4**

Calibration Results: (Continued)
Calibration Range: 0-100 g
Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 30 g; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (±g)	Coverage Factor k
Unload	0.00000	0.00000	0.00000	0.0000009	2.00
0.01	0.009998	0.01000	0.00000	0.000011	2.00
0.02	0.019997	0.02000	0.00000	0.000012	2.00
0.05	0.050001	0.05000	0.00000	0.000011	2.00
0.1	0.100002	0.10000	0.00000	0.000012	2.00
0.2	0.200004	0.20000	0.00000	0.000013	2.00
0.5	0.499994	0.50000	-0.00001	0.000014	2.00
1	0.999986	1.00000	-0.00001	0.000026	2.00
2	1.999989	1.99998	0.00001	0.000019	2.00
5	4.999979	4.99998	0.00000	0.000022	2.00
10	10.000026	9.99994	0.00009	0.000074	2.00
20	20.000037	19.99991	0.00013	0.000099	2.00
30	30.000063	30.00000	0.00006	0.00013	2.00

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200708-001-01
Equipment: Electronic Balance
Model: AX 105 DR
Serial No.: 1122100406
Capacity: 110 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g/ 0.0001 g
ID No.: UAE.WAO.004/2546

Date of Calibration: 24 November 2021 **Page 4 of 4**

Calibration Results: (Continued)
Calibration Range: 0-100 g
Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 31 - 100 g; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (±g)	Coverage Factor k
40	40.00000	39.99999	0.00001	0.000014	2.00
45	44.99998	44.99999	0.00001	0.000015	2.00
50	49.99999	49.99999	0.00001	0.000016	2.00
55	54.99997	54.99998	0.00002	0.000016	2.00
60	60.00002	59.99999	0.00003	0.000018	2.00
65	65.00000	64.99999	0.00001	0.000018	2.00
70	70.00003	69.99999	0.00004	0.000019	2.00
75	75.00001	74.99999	0.00002	0.000020	2.00
80	80.00005	79.99998	0.00007	0.000021	2.00
85	85.00003	84.99998	0.00005	0.000022	2.00
90	89.99999	89.99998	0.00002	0.000021	2.00
100	99.99997	99.99998	0.00002	0.000020	2.00

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

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-0484



Cert. No.: 22TM1490
Page: 1 of 3

Certificate of Calibration

Equipment: Hot Air Oven
Manufacturer: Memmert
Model: UF 55
Serial No.: B216.1666
ID No.: UAE.WAO.027/2559
Submitted by: United Analyst and Engineering Consultant Co., Ltd.
3 Sol Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location: Lab Floor 2
Received Order: 19 October 2022
Calibration Date: 19 October 2022
Ambient Temperature: (26 ± 10) °C
Relative Humidity: (50 ± 30) %
Calibrated by: Preecha Hlaib
Approved by:
() Pomthippa Tameyakul
() Malee Butkruea
(✓) Suwit Imjai

Issue Date: 31 October 2022

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

A 0046800



Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2210-05750C-1
Cert. No.: 22TM1490
Page: 2 of 3

Procedure Used:
Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY41021843	22LM4	10 Jan 2023

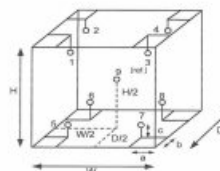
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

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 = 0.33 m
W = 0.40 m
H = 0.40 m
Capacity = 0.053 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	29	30
REL.Humid. (%)	47	40
AC Supply (Volt)	221	220

Ref. Std. ID No.: @ Calibration Point		
Position:	(104) °C	(140,180) °C
1	18-04RTD-01	21-04TC-01
2	18-04RTD-02	21-04TC-02
3	18-04RTD-03	21-04TC-03
4	18-04RTD-04	21-04TC-04
5	18-04RTD-05	21-04TC-05
6	18-04RTD-06	21-04TC-06
7	18-04RTD-07	21-04TC-07
8	18-04RTD-08	21-04TC-08
9 (ref.)	18-04RTD-09	21-04TC-09

เอกสารไม่ควบคุม

a 1133252



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2210-0575OC-1
 Result of Calibration : (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Close

Cert. No.: 22TM1490
 Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
104.0	104.0	104.0	0.061	1.3	1.7	0.42	2
140.0	140.0	140.0	0.14	2.3	2.4	1.1	2
180.0	180.0	180.0	0.21	3.5	3.6	1.3	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.076	103.876	103.777	104.124	104.667	104.426	104.012	103.928	104.370
140.0	138.199	139.189	138.808	139.550	140.266	139.622	139.293	139.385	140.369
180.0	177.930	179.267	178.643	179.753	181.011	180.093	179.496	179.743	181.278

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
 a 1133251



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



Calibration Certificate

Certificate No.: 2203120-001-01
 Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
 Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance
 Manufacturer: METTLER TOLEDO
 Model: AB204-S/FACT
 Serial No.: 1129361010
 ID No.: UAE.WAS.002/2552
 Order No.: 2203120
 Operation No.: 2203120-001
 Date of Receipt: 1 June 2022
 Date of Calibration: 1 June 2022

Calibrated by Mr.Taveesak Seilee Scientist
 Approved by (Mr.Pheraphat Tuanjit) Manager, Division of Calibration Laboratory
 Date of Issue: 7 June 2022 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



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



Calibration Report

Certificate No.: 2203120-001-01
 Equipment: Electronic Balance
 Manufacturer: METTLER TOLEDO
 Model: AB204-S/FACT
 Serial No.: 1129361010
 Capacity: 220 g
 ID No.: UAE.WAS.002/2552

Date of Calibration: 1 June 2022 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	0.0000	0.0000	0.000088	2.00
0.01	0.01000	0.0100	0.0000	0.000088	2.00
0.05	0.05000	0.0499	0.0001	0.000088	2.00
0.1	0.10000	0.1000	0.0000	0.000088	2.00
0.2	0.20000	0.2000	0.0000	0.000088	2.00
0.5	0.50000	0.5000	0.0000	0.000088	2.00
1	1.00000	0.9999	0.0001	0.000088	2.00
2	2.00000	1.9999	0.0001	0.000088	2.00
5	5.00000	5.0000	0.0000	0.000088	2.00
10	9.99998	9.9999	0.0001	0.000092	2.00
20	19.99999	19.9999	0.0001	0.000094	2.00
50	49.99990	49.9999	0.0000	0.00012	2.00
70	69.99989	69.9998	0.0001	0.00014	2.00
100	100.00001	99.9999	0.0001	0.00017	2.00
150	149.99991	149.9997	0.0002	0.00022	2.00
200	200.00007	199.9998	0.0003	0.00030	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



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



Calibration Report

Certificate No.: 2203120-001-01
 Equipment: Electronic Balance
 Manufacturer: METTLER TOLEDO
 Model: AB204-S/FACT
 Serial No.: 1129361010
 Capacity: 220 g
 ID No.: UAE.WAS.002/2552

Date of Calibration: 1 June 2022 Page 2 of 3

Environment Condition: Ambient Temperature: 19.9 ± 0.3 °C Relative Humidity: 45 ± 1.5 %
 Place of Calibration: 108, 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	1-500mg	B308068554	TCS	HQ2010205	5 January 2023
Standard Weight Class E2	1-500g	B308068128	TCS	HQ2010215	5 January 2023

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	PONPE 490	NFLBTH 010/18	Quality Reborn	QR22-0390	18 February 2023

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.

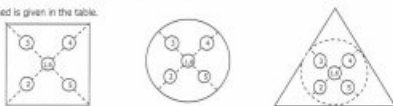
Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000048
200	0.000052

2. Off-Center Error:

A mass of 50 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)
49.9999	49.9998	49.9998	49.9999	49.9998	49.9998	0.0001

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

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มูลนิธิส่งเสริมพัฒนาอุตสาหกรรม
 ศูนย์บริการห้องปฏิบัติการอุตสาหกรรมอาหาร
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